Physical Functional Performance Tests in Pregnant Women

Rokaya AlShatti

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CANDIDATE DECLARATION

I hereby declare that:

1. I have not been enrolled for another award of the University, or other academic or professional organisation, whilst undertaking my research degree.

2. None of the material contained in the thesis has been used in any other submission for an academic award.

3. I am aware of and understand the University's policy on plagiarism and certify that this thesis is my own work. The use of all published or other sources of material consulted has been properly and fully acknowledged.

4. The work undertaken towards the thesis has been conducted in accordance with the SHU Principles of Integrity in Research and the SHU Research Ethics Policy.

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Name	*Rokaya AlShatti*
Date	*June 2024*
Award	*PhD*
Faculty	*Health, Wellbeing and Life Sciences*
Director(s) of Studies	*Dr. Rachael Spencer*

ABSTRACT

Background

Pregnancy is a time in a woman's life that is associated with considerable physiological changes, which may lead to lumbopelvic pain. Previous studies indicate a direct relationship between pain/disability and how this can affect physical functional performance. Therefore, evaluating functional status based on physical functional performance normative data can help to provide a baseline to guide clinical decision-making for both physiotherapists and policy makers. However, no data have been collected to examine the functional status of pregnant women.

Aims

To thoroughly examine the clinical application of the physical functional performance used on pregnant women with and without lumbopelvic pain in Kuwait.

Method

A mixed-method sequential exploratory design approach, consisting of three phases:

1. A scoping review to map the breadth of the literature related to the field of physical functional performance assessment in pregnant women.
2. A qualitative study: focus group semi-structured interviews with nine senior physiotherapists using thematic framework analysis.
3. A quantitative study: the normative reference values were determined by the use of timed up and go and a 10-meter walk test with 426 pregnant women with and without lumbopelvic pain based on demographic factors associated with physical functional performance.

Findings

There is a lack of studies that test physical functional performance among pregnant women, with only three valid ones currently available. This may be due to the multiple barriers related to the application of physical functional performance among physiotherapists. The normative data indicate that the median score for physical functional performance in pregnant women was lower with higher body mass index, pain, advanced in the pregnancy, and a lower level of physical activity. In general, the study's findings advance our knowledge and comprehension of pregnant women's functional status by offering thorough insights, locating predictors, analysing data, making evidence-based recommendations, and acting as a resource for stakeholders and different clinical practitioners.

Conclusion

Our study provides novel normative reference value data for two functional performance tests among pregnant women. The information acquired for this thesis provides a consistent framework for evaluating and interpreting functional performance throughout pregnancy, which bridges a large research gap. The information painted a clear picture of Kuwaiti pregnant women's functional state. Pregnant women with lumbopelvic pain or functional disorders may find this data helpful for assessment; judgments on potential early treatments can be made by

evaluating the results based on reference values. Till now, there hasn't been a lot of thorough information available on how functional performance varies during different phases of pregnancy and among women with varied body mass indices, degrees of discomfort, and physical activity. By highlighting these characteristics, it is evident that our data provide something novel and noteworthy to the knowledge of functional performance in pregnant women. It also provides insightful information and useful applications for future study as well as clinical practice.

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LIST OF ABBREVIATIONS

ADL	Active Daily Living
ASSIA	Applied Social Sciences Index and Abstracts
CS	Central Sensitisation
FABQ	Fear-Avoidance Beliefs Questionnaire
FPT	Functional Performance Tests
GA	Gestational Age
IPAC-SF	International Physical Activity Questionnaire
IPA	Interpretative Phenomenological Analysis
LBP	Lower Back Pain
LPP	Lumbopelvic Pain
ODI	Oswestry Low Back Pain Disability Index
PGP	Pelvic Girdle Pain
PA	Physical Activity
PFP	Physical Functional Performance
PICO	Population, Intervention, Comparison or Context, Outcome
PRISMA	Preferred Reporting Items for Systematic Reviews
SPSS	Statistical Package for Social Sciences
10-MWT	Ten-Meter Timed Walk
PGQ	The Pelvic Girdle Questionnaire
TUG	Timed Up and Go
VAS	Visual Analogue Scales
WCPT	World Confederation for Physical Therapy

TERMINOLOGY

Lumbopelvic Pain (LPP)	A broad term that has been used to describe lower back pain (LBP) and/or pelvic girdle pain (PGP) without differentiating between the two groups (Gutke et al., 2011).
Central sensitisation (CS)	“An amplification of neural signalling within the central nervous system that elicits pain hypersensitivity” (Sanzarello et al., 2016).
Catastrophising	“An exaggerated negative orientation toward noxious stimuli, while fear-avoidance beliefs/behaviour can result from fear of pain and fear of movement/(re)injury” (Leeuw et al., 2007).
Activities	“Activities identified by an individual as essential to support physical, social, and psychological well-being and to create a personal sense of meaningful living” (American Physical Therapy Association, 2001).
Function	“Any movement at the level of the person that is task-related, goal-oriented, environmentally-germane and involves the integration of multiple body systems and structures” (Walker et al, 2007).
Testing	Assessing ability by using a set of problems (Walker et al., 2007).
Physical Functional Performance (PFP)	Using a set of tests to determine performance ability or functional limitations OR the capability to complete tasks OR objective outcome metrics to specify function (Cooke et al., 2020; Walker et al., 2007).
Functional Limitation	An inability to perform a particular activity at a normal level (Jette, 2006).
Physical Fitness	“The ability to carry out daily tasks with vigour and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and meet unforeseen emergencies” (Romero-Gallardo et al., 2022).
Functional Activities (PA)	“Those activities identified by an individual as essential to support physical, social, and psychological well-being and to create a personal sense of meaningful living” (American Physical Therapy Association, 2001.

CHAPTER 1: Introduction to the Thesis

1.1. Introduction

My motivation to conduct this research is both personal and professional. I have always placed great emphasis on a healthy lifestyle as an essential step towards being healthy. I feel great personal sadness when I see pregnant women in my country suffering from back pain that may cause them to experience significant limitations in their daily functional movements, such as praying, dancing, or shopping. I have rarely seen pregnant women dancing at weddings or parties, as they are constantly asked to rest by older people. In my experience, they often look tired and far older during pregnancy. After I got married, I always wanted to have a positive pregnancy experience, a view that only developed further when I became a women's health physiotherapist. Furthermore, a study conducted in Kuwait discovered that 42.8% of women reported having limited activities of daily living (ADLs) and 91% of women reported having lumbopelvic discomfort (Al-Sayegh et al., 2012). I became extremely aware of the importance of adopting a more active lifestyle, and how this is linked to reducing back pain problems and enhancing physical function and performance. During this time, I became increasingly frustrated with the attitudes of some doctors who normalize back pain during pregnancy. Women had been told by doctors that: "Back pain is normal in pregnancy", "There is nothing much you can do for your pain" and "Don't worry; it'll go away after you have had the baby". Physiotherapy was not offered, yet, on a daily practical level, physiotherapy can have a significantly positive impact on their lives.

Following my extensive training in the US, UK, and Australia, I played a significant part in the development of Kuwait's women's health specialization. Instruction for medical professionals (OBS/Gyne) on women's health in physiotherapy and the services we can offer to patients. Physiotherapy is not directly accessible through Kuwait's health system; instead, individuals must receive a doctor's recommendation. Regretfully, we had trouble persuading the physicians to recommend PT for the patients. Thus, to inform women about women's health and the importance of physiotherapy, I created Kuwait Women's Health, a social media platform on Instagram. Since then, I have seen more women approach doctors to request PT referrals, and many doctors have witnessed the outcomes of our care. I think we have so much potential to improve women's quality of life.

In 2009, there were three physiotherapists in the physiotherapy department of the main maternity hospital in Kuwait. Our workload was huge, so I established the first pregnancy workout group exercise as a cost-effective way of treating more women. One of the major obstacles that I faced was the lack of any guidelines for assessing the physical functional capabilities of pregnant women, which made it difficult for me to allocate the pregnant women to the appropriate exercise group because we were unable to determine their baseline physical functional performance (PFP). In addition, I used manual muscle testing to evaluate the effect of the intervention on my patients, and therefore we had no common language through which to describe their functional improvements. Many of the pregnant women subjectively mentioned positive functional improvements but we could not measure these changes.

There is very little data presently available on PFP regarding pregnant women, especially in Kuwait. This created a crucial problem for me: I did not know which protocol to follow to assess and understand pregnant women's baseline PFP levels as there was no standard measure for PFP among pregnant women, with or without lumbopelvic pain. This was compounded by the second key challenge I faced during my work, which was that we did not know the functional status of pregnant women in Kuwait. This meant that there was no simple way of scoring or classifying pregnant women's PFP based on identifying the confounding variables or demographic measures factors affecting their functional performance.

This provided the central motivation for the current research, which seeks to establish normative data for assessing PFP based on demographic measures. This was achieved by exploring the field of PFP assessment in pregnant women. Additionally, through my analysis of the data gathered for this study, I was able to develop my further goal of understanding the cultural acceptance, feasibility, and barriers related to undertaking PFP measures among pregnant women. Having developed these, I conclude my thesis with several recommendations that aim to guide clinical practitioners working with pregnant women in a way that meets Kuwaiti's specific cultural and environmental characteristics.

As such, this thesis answered three main questions:

1. What is the significance and extent of the use of functional performance tests on pregnant women?

2. What is the physiotherapist's opinion regarding the application, feasibility and barriers of PFP among pregnant women?

3. What is the functional status of pregnant women?

1.2. Thesis outline

This thesis contains seven chapters. A brief overview of each chapter is presented below:

Chapter [1] provides the background information that supports the subject of interest as well as the motivation and reasoning for the research. Subsequently, the issue identification process and the formulation of the research questions.

Chapter [2] offers an overview of the theoretical framework. It explains the ICF framework that conceptualises and measures the links between body function, disability, pain, and the body system with environmental or task factors, and how ICF can be applied to pregnant women's functional disability and pain.

Chapter [3] presents a mapping of the literature to contextualize the use of physical functional performance tests among pregnant women. This chapter helps both to identify the best possible tools for evaluating the physical performance of pregnant women with LPP, and determine the possible risk factors that may affect their performance.

Chapter [4] comprises a qualitative study that was designed to clarify physical functional performance's scope. This chapter discusses the barriers and facilitators associated with performing physical functional tests on pregnant women among the participating physiotherapists. This helped to clarify the cultural and other factors that limited the use of these tests.

Chapter [5] offers a prospective normative reference value of the physical functional performance tests, making it possible to determine the functional status performance in pregnant women with and without LPP, while considering the effects of potential risk factors.

Chapter [6] presents a discussion of the results in detail, comparing them with and contrasting them to those in the literature. In addition, it outlines the implications for policy and practice, as well as the strengths and limitations of the study. Finally, suggestions for future research and the study's contribution to knowledge in this field are presented.

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CHAPTER 2: Background and Rationale

2.1. Introduction

2.1.1. Lower Back Pain (LBP)

As per Hartvigsen et al. (2018), lower back pain is a symptom that can arise from several known or undiscovered pathologies or disorders. It is generally felt between the buttock ridges and lower rib borders. The term "pain between the posterior iliac crest and the gluteal fold, particularly in the vicinity of the sacroiliac joints" (PGP) is also frequently used to describe it in the literature. It further specifies that "pain may extend to the posterior thigh and can also occur in conjunction with/or separately in the symphysis." (Wuytack & O’Donovan, 2019).

According to the research, LBP is uncommon among people under the age of ten, as it has a high correlation with pregnancy (Hartvigsen et al., 2018). Early in their pregnancy, around 50% of pregnant women report having lower back discomfort. The pain typically lasts during the first year after giving birth, and in 20% of cases, it lasts for three years (Wadephul et al., 2021).

2.1.2. Pregnancy-related Lumbopelvic Pain

According to the place in which pain is situated, Berber & Satılmış (2020) identify the features of back pain in pregnancy, dividing it into three primary categories: lumbar pain, posterior pelvic pain, and a mix of the two (Peterson et al., 2014). Pregnancy-related recurring pain in the lumbopelvic area that lasts longer than a week is known as lumbo-pelvic pain (LPP), which is especially common (Shad et al., 2018). Yet, it is important to remember that the word "LPP" is used more widely in the literature, referring to both LBP and PGP without making a clear distinction between the two occurrences (Wuytack & O’Donovan, 2019).

According to the cross-sectional study by Gutke et al. (2018), pregnancy-related LPP is a prevalent and noteworthy musculoskeletal issue in the US, Norway, Sweden, and the UK. Frequency of LPP during pregnancy has been recorded for the United States and Norway, ranging from 76% to 86%, respectively. Likewise, Al-Sayegh et al. (2012) reported that 91% of pregnant women in Kuwait have reported having LPP. According to their study, the compounded prevalence of obesity among pregnant women and inactive lifestyle patterns in Kuwait might account for the greater prevalence reported, highlighting the possibility that PR-LPP could be particularly hazardous for women in Kuwait.

2.1.3. Pregnancy-related LPP and Functional Limitation

Pregnancy-related lumbo-pelvic discomfort is believed to be caused by changes in hormones, blood flow, and mechanics (Fatmarizka et al., 2021). The musculoskeletal system's properties are affected by these pregnancy-induced changes, which include weight distribution, muscle imbalances, and static, biomechanical changes in the lower limbs. These changes have a negative effect on the overall quality of life, which includes the ability to perform activities of daily living (ADLs) (C. Olsson et al., 2009; Ribeiro et al., 2013).

A narrative analysis of the literature examined the connection between back discomfort brought on by pregnancy and pregnant women's quality of life (Fatmarizka et al., 2021). According to several studies (Ibanez et al., 2017; Khan et al., 2017; C. Olsson & Nilsson-Wikmar, 2004), pregnant women with LPP had a larger decline in their physical, social, and psychological health ratings as well as their overall quality of life. This happens because of modifications to physical elements, such as motor and physical fitness components, that are connected to the capacity to do Activities of Daily Living (ADLs) (Lima et al., 2017; Wong & McGregor, 2018). Pregnant women, for instance, have complained of discomfort during the following activities: sitting, standing, walking, and rolling over in bed. This pain might prevent them from achieving their intended functional goals (Coban et al., 2011; Skaggs et al., 2007). The relationship between PR-LPP and functional constraints has been shown in other research (Flores et al., 2018; Michoński et al., 2016; Wong & McGregor, 2018). Wong & McGregor's (2018) systematic review concluded that impaired physical function may play a role in the development of pain in pregnant women. Because this adaptation continued into the three to four-month postpartum period, it was very noteworthy. In a more recent study, Akselim et al. (2023) discovered a strong relationship between severe tiredness, health-related quality of life (QOL), disability, functional exercise capacity, and balance on the one hand, and the severity and duration of pain experienced by women with pregnancy-related lower back pain on the other hand. Thus, pregnant women with LPP may benefit from seeing treatment for severe or chronic pain to maintain overall quality of life and functional abilities (pierce, 2010).

2.1.4. Management of LPP During Pregnancy

Based on the literature, clinical practitioners need to be aware of this problem and produce effective management for pregnancy-related LPP (Fatmarizka et al., 2021). Non-invasive and non-pharmacological approaches (including physiotherapy) are preferred to avoid medication during pregnancy, and surgery is not an option during pregnancy (Chou et al., 2017). As a component of a multimodal plan to reduce LPP, physical therapy could provide pregnant women with a practical, self-management advantage. Systematic reviews and meta-analyses of pregnancy-related LPP management have explored different physiotherapy interventions and concluded that prenatal exercise decreased the difficulty of LBP, PGP, and LPP during both pregnancy and the postpartum period (Davenport et al., 2019; Shiri et al., 2017; Stuge et al., 2003; van Benten et al., 2014). Another systematic review suggests that lumbar stabilization is effective in reducing the musculoskeletal impairments, activity limitations, and participation restrictions associated with LPP (Wang et al., 2012). These findings are further supported by Ostelo et al. (2008), who showed that prenatal exercise substantially decreased the intensity of LBP, PGP, or LBPP-related symptoms during pregnancy when conducted anywhere between once per week and once per day by at least 15-20%.

In an unfortunate contrast with the literature, however, physicians in Kuwait appear unaware of the role physical therapy can play in pain management, inappropriately recommending rest, and thus contributing to deconditioning at a time when women need to maintain a reasonable level of physical endurance and strength through exercise (Al-Sayegh et al., 2012). This underlying misapprehension is compounded by a lack of a common model or reference frame for functionality, which presents a fundamental challenge for understanding and interpretation of back-related functional limitations (Grotle et al., 2012). Providing coherent and generalizable assessments of functional status has become a crucial task in understanding and documenting the impact of LBP symptoms on a patient’s life (Grotle et al., 2012). Effective plans for treatment, management, and rehabilitation of PR-LPP depend in turn upon making effective assessments of pregnant women’s functional status, which would likely add crucial information in both research and clinical settings.

2.2. Theoretical Framework for Physical Function and Pain

Theories provide a framework for understanding complex phenomena, for instance, the relationship between physical function and pain (Hayek, 2018). Thus, they can assist in guiding the research design and interpreting the results of research studies by providing a context for understanding the meaning of the results and contributing to the development of interventions (Block et al., 2010). In addition, they could offer the groundwork for improving interventions to address specific issues and/or problems (O'Cathain et al., 2019)). Several key concepts underpin the theoretical framework for functional testing, which are summarised below.

2.2.1. Biopsychosocial Model (Catastrophising and Fear-avoidance Beliefs)

There are crucial indications from the existing literature that pain is not solely linked to biological factors, with psychological and social factors also contributing to the experience of LPP (Chang et al., 2012). Therefore, attempts are often made to explain back pain as well as the emergence of functional limitation and pain using the biopsychosocial model, which incorporates catastrophising and fear-avoidance beliefs, such as the 'cognitive model of fear of movement/(re)injury' and the 'fear-avoidance model of exaggerated pain perception' (Buer & Linton, 2002; Dieppe et al., 2001).

Acute phases of an individual's experience of pain may give rise to avoidance behaviour, such as resting, limping, or the use of supportive equipment (Leeuw et al., 2007). These types of protective behaviour may persist in anticipation of pain, which in turn can give rise to a long-lasting avoidance of motor activities. Accordingly, this may result in some physical detriment, including the loss of mobility and muscle strength, and result in muscle stiffness, possibly leading to 'disuse syndrome' (Bortz II, 1984).

Catastrophising is proposed to be a sign of pain-related fear but is also linked to dysfunction and exaggerated pain (Swinkels-Meewisse et al., 2006). Cross-sectional studies show that a link exists between catastrophising and heightened dysfunction in various populations with pain (Lynall et al., 2018; Sullivan et al., 2002; Swinkels-Meewisse et al., 2006). Catastrophising, in particular, is a key component of the psychological dimensions of PR-LPP in pregnant women. Catastrophising represents a complex phenomenon, varying in how it presents between both individual pregnancies and wider populations, and is always dependent on wider contexts. In this respect pregnancy represents a highly distinct condition, in that it has a clear timeframe, and delivery and motherhood constitute a clear, definite end-state to the condition (Rondung et al., 2019). In particular, the reported levels of catastrophising may be a response to women's worries about giving birth, anxieties over their capacity to care for a newborn, or fears for the baby's health and wellbeing (Doğru et al., 2018).

Women with LPP during pregnancy reported greater levels of catastrophising and functional limitation than women without LPP (C. Olsson et al., 2009). Furthermore, pregnant women with LPP and higher levels of catastrophising had double the risk of postpartum LPP (Ferber et al., 2005). Pregnancy-related pain intensely affects the performance of daily activities and has an undesirable effect on physical functional performance (Gutke et al., 2006; Mogren, 2006; C. Olsson & Nilsson-Wikmar, 2004). Crucially, Flink et al. (2009) reported that catastrophising about labour pain was linked to both increased expectations of pain and experiencing more intense pain during delivery. This phenomenon also gave rise to poorer postpartum recovery in terms of daily physical activities, and higher levels of catastrophising doubled the risk for LPP at 6 months postpartum in pregnant women with LPP in weeks 19 to 21 of pregnancy (Ferber et al., 2005).

The cross-sectional study of (C. B. Olsson et al., 2012) found further associations between catastrophising about pregnancy, LPP, and postpartum physical ability. They found that women who catastrophised at one or more of the test occasions reported a higher proportion of LPP and lower levels of physical ability than women who did not. Doğru et al. (2017) added further details to this understanding, showing that levels of catastrophising about LPP also fluctuate during pregnancy, with levels at their highest in the third trimester, especially the 9th month. Doğru et al. (2017) further revealed that individuals scoring higher in their metric for catastrophisation showed decreased physical function, while other factors, such as consultations with medical experts like physical therapists and midwives, may have had a role in the reported alterations in catastrophising. Particularly, patients with high levels of catastrophising seem to benefit from physiotherapy treatment, with a decrease in catastrophising and an improvement in physical capacity. Measuring catastrophising and fear may thus be critical in helping physical therapists make informed decisions on treatment and clinical practice.

2.2.2. The Conceptual Framework of Physical Functional Performance

In the mid-twentieth century, the conceptual framework surrounding research and clinical practice on functional limitations was shaped by distinctions among the concepts of disability, pathology, impairment, and levels of performance of the organism (Nagi, 1976). However, in the last quarter of that century, two conceptual frameworks were developed; the International Classification of Impairments, Disabilities, and Handicaps (ICIDH), and the Nagi scheme, which continue to inform research and scholarly debate on the relationship between pathology and disability (Nagi, 1976; WHO, 1980). Both schemes ascribe the same scope to concepts of functional limitation and disability, with functional limitation conceptualized as “limitation in performance at the label of the whole organism or person” and disability as the “restriction or lack of ability to perform an activity in a normal manner”. The central focus in the development of the Nagi and ICIDH schemes was to set out pathways from pathology to functional outcomes. On the other hand, the Disablement Process model was developed to consider disability from both medical and social perspectives (Verbrugge & Jette, 1994). Within this concept, "disability" refers to the effects of both acute and chronic diseases on the way certain physical systems operate, as well as people's capacity to behave in ways that are essential, customary, expected, and individually desired within their community.

In this context, Stewart (2003) represents a crucial contribution to the literature. They argue that the assessment of functional performance should precede any assessment of functional limitations, constituting an additional step in the assessment process. They also point out that functional performance testing provides insight into a broad spectrum of functions in ways that provide more nuance and variation than self-reported functional limitations. These tests can even provide insight into subtle changes in basic physical function that manifest before an individual is directly aware of the change. Nonetheless, the focus on concepts of pathology and impairment within these frameworks remains a crucial consideration in adapting them for the present research. The contributions made by these concepts are indicated by the number of health conditions reported and the respondents’ evaluations of their health status, to the levels of physical and emotional performance. However, when considering the use of these frameworks in the context of pregnancy, it is crucial to bear in mind that pregnancy constitutes a health condition rather than a pathology or an impairment.

Previous studies of LPP have employed the International Classification of Functioning, Disability, and Health (ICF) framework to provide criteria for evaluation and the application of recommendations for therapy and rehabilitation (Aartun et al., 2021; Fehrmann et al., 2018; Ibsen et al., 2021; Selb et al., 2021). The ICF represents an internationally accepted standard for the assessment and description of functioning, having attained the status of a ‘common language’ in both research and clinical practice on rehabilitation, with a marked recent increase in reporting on the ICF in clinical rehabilitation (Cerniauskaite et al., 2010; Ibsen et al., 2021; Maribo et al., 2016; D. Wade, 2015). The ICF provides an exclusive set of categories that serve as reference units for standardizing reporting on functioning, developing, and refining a biopsychosocial model of health and disability (Ibsen et al., 2021).

2.2.2.1. ICF Classification and the Measurement of Functioning

The World Health Organization defines health as one's physical, mental, and social well-being; this definition is compatible with the link between pain, function, and disability (WHO, 2001). The ICF places functioning within the framework of a biopsychosocial model, being brought into practice through the categories of Body Structures, Body Functions, and Activity and Participation (Riis-Djernæs et al., 2021). Functioning is furthermore the result of a dynamic interaction between Health Condition and Environmental and Personal Factors (Björklund et al., 2007). Two qualifiers—performance and capacity—are used to characterize activity and participation, a specific focus of this research. Performance refers to an individual's actions in their real environment, whereas capacity describes an individual's potential actions in scenarios where the environment can be effectively ignored.

The first part of the ICF framework, functioning and disability, comprises three main components. The first two of these are related directly to functioning and disability, including any physiological and anatomical changes, and impairments, such as issues with body function and structure (Schroder, 2021). In the case of low back pain during pregnancy, healthcare providers can consider the woman's pain intensity, pain duration, and the presence of any underlying conditions that may be contributing to her pain (Watanabe et al., 2020). They can also consider the impact of the pain on the woman's mobility, strength, and flexibility, as well as any changes to her posture or gait (Bagwell et al., 2022).

The third component, activities/activity limitations, and participation/participation restrictions, seeks to explain and evaluate how patients with specific health conditions engage with the world (Schroder, 2021). This component concerns which activities are limited for a given individual, and the defined difficulties they experience when performing these activities. Clinical practitioners can consider pregnant women's ability to perform ADL activities such as dressing, bathing, and cooking, as well as her ability to engage in leisure activities and participate in social and community life, and the impact of LBP on her work and other occupational activities (Berber & Satılmış, 2020).

The second part of the ICF framework focuses on contextual factors, including environmental and personal factors, that can be described as either barriers or facilitators (Schroder, 2021). This contextualisation of an individual's disability experience aims to draw focus towards the changes that are necessary for assisting individuals to achieve their highest functioning potential and understand their right to take an active role in society. Healthcare professionals can consider a woman's job and home circumstances, as well as any social or cultural elements that can have an impact on her disability and capacity to function (M. Mitra et al., 2015). They can also consider the individual features of women, like their age, weight, and health-related behaviours, and how these could affect their capacity to function and their disability.

2.2.2.2. Justification for Selection of the ICF

An evident advantage of the ICF is that it does not require a disease label to describe a person's condition or situation, allowing its use in a much broader range of contexts (Sykes et al., 2021). Its comprehensive, holistic approach makes the ICF framework particularly useful for understanding and addressing the health and well-being of pregnant women. The five key factors that justify its use in this research are outlined as follows.

a. Holistic Approach

The ICF provides a coherent view of health, personal, and environmental domains through its holistic synthesis of concepts of health and well-being (S. Mitra & Shakespeare, 2019). It takes a patient’s mental, social, and environmental well-being into consideration alongside the context of their physical health (Esson et al., 2020). This holistic perspective is crucial within the present research context as it acknowledges the effects of pregnancy on the different aspects of a woman's life. The use of the ICF facilitates a systematic approach to classification, assessment, and support procedures, alongside goal setting and the identification of interventions (Allet et al., 2008; Kristensen et al., 2015; Pettersson et al., 2011).

The ICF is thus invaluable for understanding processes of assessment and rehabilitation concerning functionality in pregnant women. Its integrative model synthesizes the medical and social models of human functioning (Solli & Barbosa da Silva, 2012). This model integration serves as the foundation for the ICF's holistic approach, which is best understood from the standpoint of systems theory, in which the relationships between the many components are determined by their intricate interactions with one another.

The use of the ICF framework by Aartun et al. (2021) provides a key example of its utility: in a study of three separate countries, the ICF was crucial in helping to determine what constructs of functioning were important in each context. The ICF does not treat disability due to disease, instead constructing an integrative model of health, presenting related outcomes from the interaction between a person’s health condition and relevant contextual factors. The ICF framework provides a common language to describe functioning across health professions, aiming to apply to all people regardless of sex, age, culture, or health condition. Thus, the findings of Aartun et al. (2021), which gave a relatively high ranking to psychosocial factors, highlight that for patients these factors can take precedence over and above factors of biological origin, which is consistent with the existing literature of qualitative studies exploring the lived experiences of patients with LBP.

This trend in the literature is confirmed by the recent systematic review of Mackenzie et al. (2018). This review provided a meta-synthesis of women’s experiences of PR-LPP reported in qualitative studies, wherein all included studies demonstrated that the cumulative result of pain and dysfunction, when combined with the changing roles and identity of the pregnant women, gave rise to many negative emotional and psychological effects. The evaluation played a critical role in highlighting the significant psychological and emotional effects of LPP on the lives of all women and their families.

As such, the personal and environmental domains that influence or are influenced by health remain a central concern when considering functionality in the context of any health condition, pregnancy included. Taking factors such as employment, community life, and education into account forms part of a wider, more coherent view of a person’s health that is not restricted by a narrower focus on health domains (S. Mitra & Shakespeare, 2019).

b. Environmental Factors

The recognition of environmental factors is crucial in this research context: pregnancy is influenced by numerous factors, including social support, workplace conditions, and access to healthcare (Bakilan & Zelveci, 2020). These environmental factors are included as a key component within the ICF, improving the outcomes of rehabilitation and treatment by enabling healthcare professionals to identify and address them (Cerniauskaite et al., 2010). As noted above concerning the findings of Aartun et al. (2021), their work confirmed the contextual nature of the lived experience of back pain, wherein environmental factors accounted for nearly one-fifth of the concepts mentioned. Key environmental factors reported as facilitators for participants’ functioning included health systems and family support, personal health system experiences and expectations, family and social relationships, and patient perspectives on employment and work environments. Crucially, Aartun et al. (2021) underlined the need to support and emphasize the biopsychosocial foundation of the ICF framework by connecting patients’ experiences with the relevant ICF domains.

c. Patient-Centered Care

The ICF framework's capacity to emphasize a patient-centered approach to care brings about several additional benefits. It can take into account external elements including cultural attitudes and beliefs, the physical environment, and health policy, and places physical and psychological traits within the context of an individual's living status and social position (Goljar et al., 2011). The complexities of lumbopelvic pain are far more readily comprehensible from such a perspective. The contribution of the multiple, interacting factors that affect this symptom, which include psychological, social, physical, lifestyle, and personal factors, can be unique to any given patient (Selb et al., 2021). As such, Ibsen et al. (2021) recommend that the assessment and management of LPP adopt a biopsychosocial and patient-centered approach more able to account for this heterogeneity. Their findings underline the critical importance of a holistic approach to understanding LPP symptoms and emphasize the importance of patients being actively involved in their own care.

Patient-centered treatment must specifically take into consideration personal aspects, or traits that are unique to an individual and do not relate to a health issue but rather make up that person's life and way of living (Kristensen et al., 2015). In the context of this research, such factors would include race, gender, age, lifestyle, social background, coping styles, and other characteristics relevant to the evaluation and assessment of functional performance (Geyh et al., 2011). D. T. Wade (2005) suggests that the success of rehabilitation services may be founded on the use of problem-solving processes that focus on an individual patient’s specific situation. This suggests that every intervention should be evaluated from a patient-centered perspective and should be multifunctional, and flexible enough to adjust over time to a patient's changing surroundings and circumstances (Kristensen et al., 2015). The existing literature indicates that patients benefit from active involvement in assessment, goal setting, and treatment planning processes, and from engaging in rehabilitation programs, especially when these processes are founded in patient-centered practice (Parker, 2013).

The use of the ICF framework in the context of this research thus emphasizes patient-centered care, particularly when it is possible to ensure the involvement of pregnant women in the assessment and planning of their own care. This approach promotes a more patient-centered and empowering healthcare experience by respecting the individuality and preferences of each pregnant woman.

d. Interdisciplinary Collaboration

Pregnancy care requires the involvement of multiple healthcare providers, including obstetricians, physiotherapists, psychologists, social workers, and nurses. The ICF framework is thus a vital tool in this process, as it provides a common framework and language for collaboration across healthcare disciplines, facilitating communication and coordination throughout (Kinoshita et al., 2020). The current literature strongly supports the ICF's utility as a framework for facilitating communication between stakeholders, with particular emphasis being placed on its importance for goal setting, establishing roles within multidisciplinary teams, and structuring rehabilitation plans. The findings of (Finger et al., 2014), for example, highlight that ICF tools assisted in defining long and short-term goals and formulating action points, and were crucial facilitators in documenting improvements in patients' activity limitations, participation restrictions, and impairments. They also found that using ICF-based tools in multidisciplinary rehabilitation contexts allowed for coordinated planning of interventions, a more comprehensive approach to assessment, and the setting of common goals. These tools enhance transparency in setting goals and planning interventions across disciplines, providing crucial support to physiotherapists' roles within rehabilitation teams.

e. Research and Policy Relevance

In the fields of pregnancy research and policy development, where individual contexts can vary greatly among countries, regions, and healthcare systems, the use of the ICF framework is evidently an essential tool for facilitating standardization, comparison of data collection, and policy implementation across healthcare contexts. The adoption and exchange of best practices are facilitated by this standardization, which also offers data to assist decisions that are relevant across healthcare settings. Cerniauskaite et al. (2010) identified the critical need for definitions of functional limitation broader than simple recourse to activity problems, or body functions and structures. Comprehensive definitions of this nature are key to decision-making processes when planning services and their implementation pathways and allocating funding and resources as part of wider healthcare planning strategies. Cerniauskaite et al. (2010) thus recommend the use of the ICF as the most comprehensive classification system currently available, offering the ability to describe functioning from wider frames of reference, at the societal level in terms of participation restrictions, at the level of the person in terms of activity limitations, right down to the level of the body when looking at specific impairments. The use of the ICF also facilitates reporting on the presence and effect of environmental factors. The ICF thus provides a common language critical in evidence-based policy development through operationalizing a biopsychosocial model of functioning, health, and disability.

2.2.2.3. Recent Critiques of the ICF Framework

Although the ICF is widely recognized as a global standard language and framework for characterizing human functioning, new developments in the literature point to a reconsideration of its significance. Journal editors (McDermott & Turk, 2019), and (S. Mitra & Shakespeare, 2019), further investigated whether, or not, to redesign the ICF in light of the changes in research and the clinical setting brought about by two decades of usage (Sykes et al., 2021). Three key suggestions have emerged from this recent commentary and critique on the ICF's application: Firstly, the concept of a 'health condition' could usefully be broadened to encompass both its biological and socio-economic aspects. This suggestion would address the socioeconomic determinants of health conditions, such as depression and anxiety arising from participation restrictions like isolation; this would necessitate shifting personal and environmental factors to the top of the graph, rendering them central within the ICF's model. However, Sykes et al. (2021) asserted that no direct link could be established between contextual factors and health conditions.

Secondly, they suggest that more holistic concepts, preferably either 'quality of life' or 'wellbeing', should replace or, at a minimum, supplement the existing concepts of activities and participation. Mitra & Shakespeare's suggestion of connecting the ICF with Amartya Sen's Capability Approach (CA) is already supported in the existing literature, mostly notably in (Welch Saleeby, 2006) and (Bickenbach et al., 2012).

Finally, these critiques note that, in practice, the uses of the ICF can show marked variation, including such diverse usage contexts as program and survey measurement, classification, or policy. They underline that the ICF model is normative rather than neutral, requiring a selection by those applying it regarding the relevant dimensions or aspects of the lives of those to whom the metric is being applied. As such, the ICF demands the exercise of significant caution when applied in classification, policy, and intervention. An individual's lived experience of health deprivations cannot be fully described by any implementation of the ICF model, even if it is only used for classification, as there is no guarantee that all aspects of a person's life are sufficiently specified and classified within it. Thus, to determine what limitations or outcomes in life should serve as a suitable bar for what qualifies as a disability, the ICF model requires practitioners to make normative decisions. Certain implementation efforts may necessitate a variable threshold due to cultural contexts and values.

2.2.2.4. Implementing the ICF Framework to Test PFP in A Clinical Setting

The ICF framework remains crucially relevant to physiotherapy in clinical settings, with the World Physiotherapy Organisation adopting a motion assisting the application of the ICF in physiotherapy in 2003 (Escorpizo et al., 2010). Within a physiotherapy context, the ICF adopts the functional measurement of capacity and performance as the two main key practices related to the functional measurement of activities and participation. The functional measurement of capacity is what a person can do in a standardised environment, for example, during a clinical assessment (Schroder, 2021). It indicates the extent of activity limitation as a direct consequence of a patient's functional status, and any need for assistance, whether through equipment or environmental modification.

Performance measurement aims to quantify what pregnant women can do both at home and, more generally, in their daily lives. In this respect, the hot climate of Kuwait profoundly shapes this activity: Kuwaiti lifestyles are oriented around family and home, with the bulk of activities and social events taking place at home rather than outside. Kuwaiti cultural norms also emphasize that a wife’s role is to manage the home and family, with the husband, along with domestic servants or assistants, responsible for running errands and other tasks outside the home. The Kuwait Ministry of Health’s November 2023 approval of a ministerial decision granting pregnant women the right to sick leave from 30 weeks until the end of their pregnancy can thus be treated as a legislative manifestation of this cultural trend (Alsanad, 2023). This decision underscores the Kuwaiti government’s responsibility to provide care for pregnant women, following the principles outlined in Article 22 of Law No. 21 of 2015, encompassing healthcare and treatment throughout pregnancy, childbirth, and beyond.

Therefore, by describing all potential factors—physical, social, and environmental—assessing pregnant women's functionality in their daily lives and at home may help determine the extent of potential barriers, either physical, social, or environmental, that may affect performance and a woman's "lived experience" (Bakilan & Zelveci, 2020). Additionally, it assesses how tough it is for expectant mothers to perform tasks, presuming that these are things they want to complete (Grotle et al., 2012). Accordingly, the ICF core sets were developed as a helpful tool to support the rigorous and comprehensive assessment of functioning in therapeutic practice, enabling medical practitioners to better understand the needs of their patients (Maribo et al., 2016). Core sets for lower back pain have been developed, containing 78 ICF categories. Movement, self-care, rest, motivation, and energy, as well as mental function, are only a few of these categories. The capacity to maintain or switch positions, dress, and use the restroom, together with mobility skills, like walking and even running, are additional categories. A thorough understanding of the issues that pregnant women are experiencing with their function, health, as well as life circumstances can be obtained by evaluating such categories regarding pregnant women with LPP.

Therefore, to understand the conceptual framework of functioning in pregnant women with LPP, it is important to adopt a holistic approach to evaluate and determine the functional status of pregnant women and understand the feasibility, barriers, and culture related to applying the PFP measures on pregnant women with LPP.

2.3. Clinical Reasoning

2.3.1. Definition of Physical Functional Performance

“Functional” can be defined in various ways. Functional activities are defined as “those activities identified by an individual as essential to support physical, social, and psychological well-being and to create a personal sense of meaningful living” (Jette, 2006). Walker et al. (2007) define Function as “any movement at the level of the person that is task-related, goal-oriented, environmentally-germane and involves the integration of multiple body systems and structures.”

“Testing” is defined as assessing abilities by using a set of problems. Therefore, “physical functional performance testing” means using a set of tests to determine performance abilities or functional limitations. A functional limitation is the inability to perform a particular activity at a normal level (Jette, 2006). “Normal” must be grounded on factors such as the patient’s age, gender, physique, and profession.

2.3.2. Clinical Methods for Measuring Physical Functional Performance

Several tools and methods can be used to measure functional performance in pregnant women, including self-report measures, physical performance-based tests, and objective measures, such as wearable technology. Self-report measures, such as questionnaires or interviews, can provide valuable information about women's perceived functional abilities and limitations during pregnancy (Aletaha et al., 2006). However, self-report measures may be subject to response bias and may not accurately reflect a woman's actual functional abilities (Denteneer et al., 2018). Response bias is a widely discussed phenomenon in behavioural and healthcare research where self-reported data are used; it occurs when individuals offer self-assessed measures of some phenomenon (Rosenman et al., 2011). There are 13 valid self-report tools available that evaluate pain and measure physical function or disability, which are pertinent to the assessment of patients with LBP, such as the Oswestry Disability Rating Index DRI, Pain Disability Index, and Roland-Morris Disability Questionnaire RDQ (Ramasamy et al., 2017). Dagenais et al. (2010) recommend additional guidance and proper assessment and management tools that allow the consistent measure of improvements at appropriate time intervals, to provide better support for both clinicians and patients.

Several systematic evaluations conducted between 2003 and 2015 evaluated the efficacy of physical therapy treatments for the prevention and treatment of pregnancy-related LPP (Liddle & Pennick, 2015; Pennick & Liddle, 2013; Richards et al., 2012; Stuge et al., 2003). These reviews all based their assessments of pregnant women’s functional status on DRI measurements, levels of sick leave taken, and RDQ. The studies included in the reviews further highlighted the lack of agreement within the existing literature on what is the most reliable and valid measures of outcomes for LPP in pregnancy. In particular, the limited validity of these measures for populations of pregnant women and a reliance on self-reporting measures raise serious questions regarding research methodologies prevalent in this field.

These findings are corroborated by the more recent systematic review of Romero-Gallardo et al. (2022). This review showed that most tests used to assess physical fitness, where a physical functional performance test was included, lacked validity and data reliability. Only limited confidence can presently be placed in data on physical function during pregnancy, and the review highlighted the need to develop and validate a battery of fitness tests specific to pregnant women. Collecting normative data would give crucial meaning to the results of such tests (see section 2.4).

2.3.3. Clinical Use of Physical Functional Performance

Measuring PFP in pregnant women is an important aspect of pregnancy outcomes for promoting overall health and well-being and can help to identify areas for improvement and develop interventions to address functional impairments or limitations that may arise during pregnancy (Karlsen et al., 2017; Manske & Reiman, 2013).

Latham et al. (2008) stressed that measures used in clinical trials are sensitive to change. This is one of the key theoretical advantages of performance-based physical function measures over self-report measures: these advantages also included improved reproducibility, and reduced vulnerability to external influences such as cognition, language, culture, and education.

A thorough assessment of a woman's general health and well-being as well as any difficulties that might need to be addressed to support her physical well-being can be obtained by measuring her functional performance during pregnancy. Women's capacity to walk a certain distance in a certain amount of time, for instance, can be assessed using the Six-Minute Walk Test. According to Hulens et al. (2003), this test can detect any functional restrictions or impairments that may influence a patient's health and well-being during pregnancy. It can also give information regarding the patient's cardiovascular fitness and mobility. The use of PFP would address this issue, using clustered physical performance movements to help capture the multiple dimensions of function (Reiman & Manske, 2011). Reiman & Manske (2011) argue strongly for such a comprehensive approach to functional measurement, outlining a conceptual model for their approach that facilitates multi-directional flow along the assessment continuum. Thus, for example, limitations in hip mobility might prevent a patient from performing a proper deep squat; to understand the reasons for this impairment, a clinician would need to undertake this assessment early in the examination process to complete the necessary impairment assessments. A single unsuccessful attempt at a test component might not provide complete insight into the limitations a patient is experiencing but would allow the diagnostic process to focus on identifiable areas of interest such as impaired joint mobility or decreased muscle performance.

Assessments that use FPTs consider a person’s ability to complete a task safely and efficiently by putting together a series of movements, as opposed to assessing isolated single joint and planar movements (Reiman & Manske, 2011). Such assessments examine the overall functioning of the person rather than the function of any given part: they put into practice the fundamental truth that a person with a full range of movement in their hips, knees, and ankles might still fail to make a successful return to basketball. However, they also lead to a more nuanced assessment of that function, with many FPTs making close approximations of activities people might need or wish to undertake. In the same scenario as described above, a safe return to basketball could be much more confidently anticipated if that same person was to achieve an excellent score on jumping, hopping, and anaerobic endurance tests without adverse symptoms, and were to have normal joint play, full neuromuscular control, and full strength.

PFP testing during pregnancy can assist in identifying possible risk factors, such as lower back discomfort, that may result in difficulties. Healthcare professionals can detect impairments or limitations in the performance of tasks by monitoring functional performance during pregnancy. This allows us to take appropriate action to address the difficulties and lower the chance of complications developing (Karlsen et al., 2017).

Pregnancy can cause a variety of physical changes that may affect women's functional ability, such as changes in posture, balance, and mobility. By measuring functional performance during pregnancy, healthcare providers can identify any impairments or limitations that may need to be addressed and can develop targeted interventions to support pregnant women's functional ability

(Davies & Matheson, 2002). For example, a woman who experiences significant back pain during pregnancy may benefit from exercises to improve her core stability and strengthen her back muscles. This is supported by Barten et al. (2012), who stated that it is imperative to assess and evaluate patients' PFP to differentiate between patients with musculoskeletal pain. They affirmed that patients' PFP is an essential element in determining dysfunction, a relationship that remains common across musculoskeletal disorders and applies to pregnant women with LPP in particular.

One of the advantages of using the PFP in clinical assessment is to determine the ability to participate at the desired level of function (Reiman & Manske, 2011). Testing physical functional performance during pregnancy can provide a baseline measurement, based on which progress can be monitored and treatment adjusted as needed (Davies & Matheson, 2002). Shnayderman & Katz-Leurer (2012) used the PFP to assess the effect of different types of training on functional capabilities within patients experiencing chronic lower back pain. Pregnancy is a dynamic process, and women's functional ability may be shown to change over time by regularly measuring their PFP during pregnancy (Stuge et al., 2011). To preserve or enhance a pregnant woman's functional capacity, healthcare professionals can keep an eye on her development and modify the therapy as necessary. This can guarantee that a woman's functional capacity is preserved or enhanced during her pregnancy and can help avoid the emergence of new restrictions or impairments.

Wong & McGregor (2018) are not alone in highlighting the pressing need for further systematic reviews on the clinical understanding of the effect of physical therapy interventions, especially concerning their effect in terms of improving PFP among pregnant women with LPP (Richards et al., 2012). The functional performance tests, as analysed in four related studies, were represented by using questionnaires that were considered valid, reliable self-reported outcome measurement tools. These tools, specifically the Disability Rating Index, Patient-Specific Functional Scale, and Roland Morris Questionnaire, were used to assess functional improvements in these studies.

Like all research studies, there are limitations relevant to the measurement methods outlined above; some level of direct clinical assessment can give details about patients that would not otherwise be available. Grotle et al. (2012) found that the Pelvic Girdle Questionnaire (PGQ), which was developed to assess activity limitations and symptoms related to pelvic girdle pain, proved to have a good level of construct validity and reliability when used within its intended patient group. Stuge et al. (2011) argued that the measurement properties for these instruments, when used to assess activity limitations, offered a satisfactory discriminative ability for pain, but not specifically for pregnant patients. This is a crucial gap in the existing knowledge regarding these tools: the capacity for differentiation between different population measures, pregnant and non-pregnant, is critical for functional assessment. According to a recent Norwegian study, early pregnancy pain areas in the pelvis were highly correlated with late pregnancy pain severity and impairment. In a study indicating that pregnant women should become more cautious about physical activities compared to non-pregnant women, the fear-avoidance beliefs questionnaire (FABQ) activity subscale was found to offer good discriminative ability for pregnant and non-pregnant patients (Sullivan et al., 1995). This result emphasizes even more how important it is to back up the comparative performance measurements of the tools used to evaluate pregnant women's health issues.

2.4. Overview of the Thesis

This thesis helps to determine the functional status of pregnant women, which provides an important tool for healthcare practitioners, and researchers regarding the evaluation and management of pregnancy and promotion of optimal health and wellbeing. This can be achieved by establishing normative data using PFP measures, which involve the use of standardised tools and procedures to assess the characteristics of functioning in pregnant women. The normative data in pregnant women were separated according to demographic measures and each set of data classified the participants into functional groups (low, normal, fit). These classifications also depended on other factors, like gestational age (GA), physical activity (PA), Body mass index (BMI), and pain.

According to Ibrahim et al. (2017), the normative data may be utilized as a benchmark or reference for comparison. They can aid in the early detection and management of any possible issues as well as the identification of any variations of normal physical functioning performance throughout pregnancy. They may also be used to track changes in physical functioning performance during pregnancy, which can aid in the early detection of any possible problems and enable prompt intervention. Finding the PFP tests that are accessible throughout pregnancy is a prerequisite to assessing the functional condition of expectant mothers. This would give objective data on PFP during pregnancy and present therapies or suggestions for pregnant women. It will also educate researchers and healthcare practitioners about the many alternatives available for PFP testing, which may be utilized in research studies or clinical practice. To effectively utilize PFP testing in clinical settings, it is vital to comprehend the cultural acceptability of these tests by identifying the barriers that hinder pregnant women in Kuwait from using PFP tests. Thus, the creation of assessment and evaluation procedures that take these aspects into consideration and aid in identifying areas for improvement can be aided by physiotherapists' understanding of the factors that may impact the use of functional performance tests among pregnant women. A mixed-methods sequential exploratory design approach was used to examine the clinical application of PFP among pregnant women with and without LPP. This methodology was used to address the study’s objectives and answer the research questions outlined below. Quantitative research is the main research approach, conducted to determine the functional status of pregnant women by establishing the normative data, and considering demographic factors. For the quantitative part of the research, a descriptive study was used, focusing on the use of two physical functional performance tests (timed up and go, and 10 meter walk test). The 426 pregnant women included in this study were selected when they attended a routine clinic check-up. Their completion time, in seconds, was recorded for both tasks. The IBM Statistical Package for Social Sciences (SPSS) 22 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, 6 Version 22.0. Armonk, NY: IBM Corp) was used to sort the data, test the normality of the data, and conduct the required tests and analysis.

The secondary qualitative research helped me to gain some insights into the perceptions of the participating physiotherapists regarding their clinical practice. The qualitative element of the study used a semi-structured focus group technique to explore physiotherapists’ perceptions and experiences of the barriers and facilitators related to using PFP with pregnant women. This technique was also used to gather data on their thoughts and opinions regarding the social and cultural restrictions and contributions within a Kuwaiti context. Qualitative framework analysis was used to interrogate the qualitative data.

2.5. Aim of the Thesis

The aim of this thesis is to thoroughly examine the clinical application of the physical functional performance used with pregnant women with and without LPP in Kuwait.

2.6. Objectives of the Thesis

1. To map the breadth of the literature related to the field of physical functional performance assessment in pregnant women, linking it to the literature on pain during pregnancy.

1.1 To explore the existing evidence base related to the field and nature of physical functional performance testing on pregnant women.

1.2 To identify the best possible tools for evaluating the physical functional performance of pregnant women, based on their reliability and validity.

1.3 To identify which demographic factors may potentially contribute to physical functional performance testing in pregnant women.

2. To identify the barriers and facilitators that affect the use of functional performance tests among pregnant women with LPP.

2.1 To measure and report physiotherapists' knowledge and perceptions regarding the feasibility of applying/implementing the tests in clinical practice.

3. To determine the status of functional physical performance in pregnant women with and without LPP while considering the potential risk factors.

3.1 To provide normative data about pregnant women, stratified based on possible potential factors.

3.2 To set three cut-off points: low, normal, and high, so as to divide expectant mothers into functional groups.

2.7. Thesis Outputs

Study 1

Title	Physical Functional Performance Assessment in Pregnant Women: Scoping Review (Chapter 3)
Acknowledgement	This study has been submitted for publication in PLOC ONE Journal (see Appendix 1 for submission confirmation).

Study 2

Title:	Physiotherapists' Perceptions of the Barriers, Facilitators, and Acceptance of Functional Performance Tests for Pregnant Women with Lumbopelvic Pain in Kuwait (Chapter 4)
Acknowledgement	This study has been accepted for presentation at the third Kuwait International Physiotherapy Conference (See Appendix 7). This study has been submitted for publication in the Frontiers in Global Women's Health journal, (see Appendix 7 for submission confirmation).

Study 3

Title	Assessing Physical Performance Tests for Pregnant Women With and Without Lumbopelvic Pain: Normative Study (Chapter 5).
Acknowledgement	This study's abstract has been accepted to participate in the World Physiotherapy Congress 2023 as a poster presentation (Appendix 13).

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CHAPTER 3: PHYSICAL FUNCTIONAL PERFORMANCE ASSESSMENT IN PREGNANT WOMEN: SCOPING REVIEW

3.1. Introduction

3.1.1. Pregnancy/Pain/Dysfunction

Pregnancy is a time in women's lives associated with the significant physiological and psychological alterations in their bodies and minds that occur during pregnancy (Atkinson & Teychenne, 2022). According to Bryndal et al. (2020), around 70% of pregnant women develop back pain difficulties as a result of these changes, which makes it difficult for them to do daily tasks. This is because of the relationship between reduced trunk coordination, strength, and flexibility on the one hand, and lumbopelvic pain (LPP) that occurs during pregnancy on the other hand (Haddox et al., 2020).

3.1.1.1. Pregnancy and Pain

A critical change to the musculoskeletal system occurs between weeks 16-32 of a woman's pregnancy (Haddox et al., 2020). The resulting changes in lumbar curvature create adjustments in the loading patterns of the lumbar spine, which in turn significantly affect the prevalence of LPP. Yoo et al. (2015) investigated the changes in pain intensity, spinal curvature, balance, and gait ability in pregnant women, compared to non-pregnant women. They concluded that the pain scores for the lower back and pelvic region increased significantly in the third trimester of pregnancy, compared with the second trimester, and that there was a statistically significant difference in lumbar spine curvature between pregnant women in their third trimester (9.98°) and nonpregnant women (7.27°). Indeed, pregnant women were frequently reported as experiencing a substantial repertoire of pregnancy-related symptoms, including LPP (Daneau et al., 2021).

3.1.1.2. Pregnancy and Dysfunction

The structural changes that occur to the musculoskeletal system during pregnancy can affect many aspects of functional performance, particularly postural stability and gait (Desgagnés et al., 2022). The postural stability changes during pregnancy, being associated with increased postural sway in the anterior and posterior directions and resulting in a decline in dynamic stability, are particularly prevalent in the advanced stages of pregnancy (Jang et al., 2008; Lira et al., 2019; Oliveira et al., 2009). The shift of the center of gravity towards the abdomen results in increased lumbar lordosis and changes in gait pattern, which are characterised by a decreased step width and an increased double support phase; these are known strategies for maintaining balance (Bertuit et al., 2015). The spinal posture adapts, leading to an increased thoracic kyphosis or lumbar lordosis (Betsch et al., 2014; Michoński et al., 2016). However, pelvic joint laxity is also discussed in this context, as it decreases the stability of the pelvis and influences the gradual decrease in postural stability during pregnancy, lasting up to 6-8 weeks after childbirth (Biviá-Roig et al., 2018; Butler et al., 2006). This, in turn, leads to static and biomechanical changes in the lower limbs and gait pattern due to the reduced support and decrease of static postural control (Desgagnés et al., 2022; Oliveira et al., 2009; Ribeiro et al., 2013). As noted above, the overall impacts of these changes, including pain, reduced mobility, and increased difficulty in performing the activities of daily life constitute a decrease in the quality of life for pregnant women.

3.1.2. Measuring and Clinical Implications of the PFP in Pregnant Women

A systematic review of 107 studies demonstrated that pain intensity was the most frequently reported result in LPP studies, followed by results about function and disability (using self-reported measures) (Wuytack & O'Donovan, 2019). Romero-Gallardo et al. (2022) conducted a similar systematic review and stated that walking—a weight-bearing activity—is the main handicap experienced by pregnant women with pelvic girdle pain (PGP) (Stuge et al., 2011). As physical function is the ability to perform daily activities, which would include walking, this is a core issue in the clinical evaluation of these women (Terwee et al., 2006). Commonly, self-reported and performance-based instruments capture complementary aspects of physical function (Guildford et al., 2017).

It is advised to use objective performance tests to assess physical function thoroughly since they supplement patient-reported findings with additional data (Chiarotto et al., 2018). A test must be minimise of measurement error, assess the intended construct, be capable of identifying variations over time, and offer the basis for evaluating the efficacy of the therapy to guide rehabilitation progression as well as the assessment of treatment success (Mokkink et al., 2010b).

Policymakers may find it useful to evaluate pregnant women's functional capacities using non-instrumented clinical assessments such as PFP for a range of purposes relevant to research, policy creation, healthcare quality, and budget allocation (Papanicolas et al., 2022). Determining where resources are most required, such as in rehabilitation programs, can be influenced by knowledge about the frequency and severity of functional limitations (de Souza Macêdo et al., 2021). To differentiate LBP patients from healthy participants and provide objective criteria for LBP functional evaluation, a study employed a classification and functional assessment methodology (Sánchez-Zuriaga et al., 2011). They found out that the information gathered would be helpful for therapeutic activities like guiding a functional rehabilitation process or evaluating the outcome of a surgical operation.

Furthermore, PFP may facilitate the early detection of individuals at risk for functional impairment and facilitate the development of efficient preventative strategies (Patterson et al., 2020). The PFP was utilized by Pfingsten et al. (2014) to determine the physical functional characteristics linked to low back pain. The findings indicated that physical performance assessments may be a significant predictor of a patient's degree of impairment and may possibly have an intrinsic shortcoming in their capacity to distinguish back pain sufferers from healthy controls. They proposed that further PFP evaluation in clinical research might advance our knowledge of the intricate connections between the psychological, functional, and physical components of LBP (Ishak et al., 2016). Thus, nationwide screening of participants to determine the likelihood of developing LPP in pregnant women should occur earlier in GP practice through evaluation and prior to referral to physiotherapists. If functional limitations among pregnant women with LPP are on the rise, PPF testing can be used to identify this trend. Based on the results, policymakers can create policies targeted at controlling or avoiding these limitations.

Initiatives for healthcare quality and safety may also include PFP assessment. According to Fuentes-Abolafio et al. (2020), this may be accomplished by offering patients high-quality treatment that includes an evaluation of their physical functioning skills. Particularly in groups who are more susceptible, this can aid in reducing falls, injuries, and other problems. Kear et al. (2017) found that primary care physicians view PFP as an objective means of tracking a patient's physical development and that it can be used as an entry point for evaluating a patient's progress in exercise, physiotherapy, and other rehabilitation services. Health care providers can also monitor their patients' progress toward their treatment goals with the use of a PFP objective measure. If the results do not meet expectations, they can also alert patients to possible issues with their compliance or enthusiasm (Kear et al., 2017). This might support the creation of clinical recommendations and allow for the monitoring of PFP assessment guidelines' effects to evaluate their accuracy and make necessary adjustments to enhance patient outcomes (Daley et al., 2021). As a result, the clinical performance data are used to classify patients to create suitable interventions and forecast the severity of performance declines over time as a result of increasing discomfort during pregnancy.

Such Physical Functional Performance PFPs, like Timed-up and Go TUG and Ten-meter Walk Test 10MWT, offer the advantage of being affordable, simple to administer, and available in clinical as well as field contexts. Shared decision-making (SDM) and evidence-based patient care have, at least theoretically, been recognized as examples of excellent clinical practice (Robertson et al., 2017). One of the essential components of embedding decision-making within clinical practice is the necessity of rendering apparent patients' needs concerning medical care choices and clinical outcomes. Creating systems that support decisions is challenging (Musen et al., 2021). These systems need to provide physicians with information regarding the health problems associated with a patient's condition, as well as the benefits and drawbacks of certain interventions and therapies. They also need to include techniques for eliciting patients' needs, as well as channels that enable healthcare professionals to share this information. These systems must be agreeable to physicians, conveniently implementable in clinical practice, and show improvement in clinical decision-making as well as patient outcomes from the point of view of the patients in order to be meaningfully beneficial (Cranley et al., 2020).

3.1.3. ICF Framework

Functional performance tests (FPT) are unbiased outcome metrics used to define functionality (Cooke et al., 2020). A person's ability to create, absorb, and adapt to the multiplanar forces occurring in movement patterns that mimic or are similar to those required for the activities of daily living (ADL) is assessed using FPT. Several additional names for this kind of assessment exist, including field expedient tests, functional outcome measures, and physical functional performance (Lynall et al., 2018). Physical functional performance (PFP) is commonly understood as the capability to complete tasks, e.g., rising from a chair (Cress et al., 1996). The WHO's International Classification of Functioning, Disability, and Health (ICF) addresses the concept of functioning despite the absence of a universal definition of physical function (WHO, 2007). According to the ICF model, examining physical function is essential for assessing many elements of health in addition to the progression toward disability (Bennell et al., 2011).

The evaluation of various physiological categories that lead to a total score is referred to as PFP (Freiberger et al., 2012). This score can help to identify persons at risk, preferably during the preliminary phases of functional loss, since this is simple to evaluate in clinical settings. This score may be used to create preventative actions based on different functional domains and is, additionally, more reliable than a single-item assessment. The current primary care recommendations recognize the value of a multidimensional assessment of PFP among different MSK conditions, hence the need to investigate the psychometric characteristics of such instruments (Beswick et al., 2008; Rydwik et al., 2011).

Many issues, which may all be classified under the ICF, are experienced by pregnant women, with and without LPP (Glocker et al., 2012). In terms of the ICF framework, body functions, including structures, activities, and participation, are the three health factors that can be used to explain functioning and disability.

The Body Functions and Structure component comprises the physiological and/or psychological functions of body systems and their anatomical parts. For pregnant women, physiological and musculoskeletal adaptations are common, including pain, weakness and muscle imbalance, muscle spasms, decreased muscle flexibility, and decreased joint mobility. These types of decline usually reduce the functional performance of pregnant women concerning maintaining an adequate posture without discomfort (Ribeiro et al., 2013). This is said to be the main cause of the high frequency of LPP in expectant mothers, which affects how well they manage their everyday tasks. Furthermore, LPP during pregnancy affects the participation factor. Under these situations, it is typical to observe a decline in sports participation, increased days absent from employment, and a reduced social lifestyle (Bennell et al., 2011). These more complex sociocultural impacts are nonetheless the result of the negative or adverse effect of pregnancy on the body in terms of musculoskeletal pain.

3.1.4. The Psychometric Properties of Outcome Measures

Many tools, some specifically designed for that purpose, are presently in use to measure both general and particular functional performance during pregnancy. Through statistical and psychometric analysis, the appropriateness of these instruments for the intended audience must be determined, carefully examining their dimensions, constructions, ideas, and content (de Vet et al., 2011; Fayers & Machin, 2015; Mokkink et al., 2018). Importantly, the Consensus based Standards for the selection of health measuring Instruments, or COSMIN, offer a taxonomy for the assessment of psychometric qualities of measuring instruments (Mokkink et al., 2010b). Psychometric qualities are arranged into three separate domains and nine suggested properties are listed by COSMIN. As a result, the dependability domain includes the characteristics of measurement inaccuracy, internal consistency, and reliability. Likewise, the validity domain includes criteria validity, content validity, and the three parts of construct validity (structural validity, cross-cultural validity, and hypothesis testing). The psychometric trait of responsiveness is the sole thing included in the responsiveness domain, which makes it unique. COSMIN also includes interpretability, or the ability to deduce meaning from an instrument's results; however, this is not a psychometric attribute in and of itself because it has nothing to do with an instrument's quality (de Vet et al., 2011; Mokkink et al., 2010a). The psychometric qualities of an instrument must be demonstrated to be sufficient for the intended use to prevent the potential of inaccurate or biased results, and thus, incorrect conclusions (Mokkink et al., 2010a). An instrument's utility and applicability for a particular purpose can be demonstrated by the collection of reliable information from several studies, but the validity of the instrument itself can never be confirmed (Fayers & Machin, 2015).

Using the search approach defined by PubMed, a search was conducted of the electronic databases MEDLINE (PubMed) and Psych INFO to find studies that reflected the psychometric qualities of each particular assessment instrument. Using diagnosis-specific MeSH keywords and key phrases found in the search technique, an initial search was conducted using the names of the assessment instruments. In order to find research that addressed a particular psychometric property of an instrument that is related to functional performance during pregnancy—reliability, test/retest procedure, or evaluator reliability—headline screening was employed. Content, criteria, and construct validity are examples of validity. The search was rerun with diagnosis-specific MeSH keywords removed, thereby expanding the search to include studies covering additional conditions, in cases where psychometric features for the selected assessment instruments could not be found. The next step was using headline screening to find studies that represented the psychometric qualities of a certain instrument for a range of conditions.

Two systematic reviews that examined the psychometric qualities of PFP in LBP patients offered a thorough summary of PFP in these individuals (Denteneer et al., 2018; Jakobsson et al., 2019). Nevertheless, none of the included studies explicitly examined pregnant women, though these evaluations concentrated on LBP populations. Therefore, of the twenty-nine studies that were part of the study, six of them expressly excluded pregnancy, according to Denteneer et al. (2018) (Durand et al., 2004; Hodselmans et al., 2007; Kahraman et al., 2016; Paatelma et al., 2010; Spratt et al., 1990; Teixeira da Cunha-Filho et al., 2010). Furthermore, Jakobsson et al. (2019) focused on target groups who had had LBP for six weeks or longer and were at least eighteen years old, particularly excluding trials with pregnant individuals. Systematic studies that did take pregnant patients into account especially concentrated on diseases other than low back pain (LBP) or on people whose LBP did not predominantly arise from the lumbar spine. Therefore, this scoping analysis may be quite helpful in answering problems with a wide scope (Tricco et al., 2018).

In addition, there is a pressing need to map the depth of the literature related to the field of physical performance functional assessments in pregnant women to determine the prevalence and extent of their disability, and the subsequent build-up of fitness level as a result of interventions or care (Christensen et al., 2019).

Based on the above discussion, the overarching aim of this scoping review was to map the breadth of the literature related to the field of physical performance assessment in pregnant women, linking it to the literature on pain during pregnancy. This mapping will provide a deeper understanding of the significance and extent of the use of functional tests on pregnant women, by addressing the physical and functional performance tests developed or discussed in the existing literature, particularly their reliability and their relationship to pregnant women’s experience and reporting of pain. It will also allow a more thorough tabulation of the number and nature of the tests already developed. Such a discussion of the key aspects of the physical and functional performance tests aims to be sensitive to the pain experienced or other demographic factors related to pregnant women, identifying key works and discussions in the field to inform current clinical practice. This review seeks to establish the groundwork for a meaningful reconsideration of the use of such tests on pregnant women with LPP by identifying the most effective instruments for assessing the physical performance of these women.

3.2. Method

The scoping review design proposed by Peters et al. (2015) is used in this study, which is additionally enhanced by supplementary advice (Daudt et al., 2013). Scoping reviews are a systematic, transparent method for describing the academic focus of the research and identifying gaps in the existing literature (Munn et al., 2018). Due to the increasing necessity for efficient, up-to-date summaries of primary research, such evaluations are especially helpful whenever the nature and scope of the evidence presented are unknown (Peters et al., 2015). The review adhered to earlier scoping reviews' methodological principles (Levac et al., 2010; Shafizadeh et al., 2021). The framework involved the following five steps: (a) research aims, (b) a literature search, (c) the screening and selection of studies, (d) the extraction and charting of the data, and (e) the results and findings.

3.2.1. Scope of the Review/Research Aim

Several questions served as the foundation for this review: how widespread and important is the use of functional testing on expectant mothers? The review's two main goals were to: (a) examine the body of research on the subject, as well as the nature of PFP testing on expectant mothers; and (b) determine which instruments would be most useful for assessing the reliability and validity of the PFP of expectant mothers. The Cochrane Database for Systematic Reviews devised a structure known as population, intervention, comparison or context, and outcome (PICO) that served as a guide for the literature search (Amir-Behghadami & Janati, 2020):

Population: Pregnancy, Pregnant Women, Antenatal, Ante-natal, Antepartum, OR Prenatal.

Intervention: N/A

Comparison or context: Physical functional performance or physical functional tests during pregnancy.

Design: Published literature of any research design

Outcome: PFP test Name, geographic data, participant's characteristic, area of testing, aim, psychometric property testing

A panel of supervisory team members, including experts in physiotherapy, physical activity/exercise, midwifery, and movement science, designed and improved the search approach. The evaluation process was purposefully expanded to encompass findings with publication dates ranging from conception to 2024, to encompass papers that specifically reference research on the physical performance of expectant mothers. Regardless of the study's form, the goal is to locate research on the therapies stated by mentioning specific participant groups and outcomes.

3.2.2. Literature Search Strategy

The time span employed for the investigation was from inception to 2024, and it was conducted in December 2023. Boolean operators were utilized to integrate the search phrases and search important databases, especially electronic ones:

Web of Science, Applied Social Sciences Index and Abstracts (ASSIA), Medline, PsychINFO, and CINAHL Complete. For completeness, and to avoid any potential oversights regarding the list of databases consulted, by employing key search phrases in Google Scholar, a concurrent search was conducted. The authors carefully examined lists of pertinent articles, verified the reference lists of the corresponding articles, and hand-searched several articles. The author was already aware of relevant literature from the National Library of Medicine, but also examined other sources to identify the most appropriate search phrases. (**Table 3.1** lists the search parameters).

Table 3.1: Search strategy

	Search Terms	**MeSH terms**	**Limited to**	**Date (inception-2024)**
Concepts of Physical Performance	Pregnancy OR Pregnant women OR Antenatal OR ante-natal OR antepartum OR prenatal (title)	Physical Performance (any field)	Title	762
	Pregnancy OR Pregnant women OR Antenatal OR ante-natal OR antepartum OR prenatal (title)	Physical functional test (any field)	Title	110
			Total	872

3.2.3. Screening

The selected studies that were identified by the above search process were imported into RefWorks software; all duplicates were removed, and the remaining studies were screened according to the eligibility criteria, as described below. This process consisted of three stages, the first being the title screening, followed by abstract screening, and then finally full-text screening. The title screening was carried out by the researcher. A co-investigator was invited to examine the selection process of all the studies related to the titles and abstracts to ensure that relevant studies were selected. Full-text screening was performed by the researcher and then revised by the co-investigator and the researcher jointly. The author then created a search syntax by separating the search into two distinct steps. The first step involved searching for material related to the concept of ‘physical performance’ in pregnancy. The next step was to expand the search terms to include ‘physical functional test in pregnant women’ (**Table 3.1**). A brief pilot test of such inclusion and exclusion criteria was carried out by the reviewers, but it took numerous revisions before agreement could be achieved. The researcher as well as her mentor then separately assessed each abstract, reached a consensus, and then applied the finalized inclusion and exclusion criteria to all of the submissions.

3.2.4. Study Selection (Inclusion and Exclusion Criteria)

Studies that met the following criteria were included in the review: a) studies whose outcome measures were related to physical performance assessment and the participants were pregnant women, with and without LPP; b) studies published in English that reported quasi-experimental study designs; c) studies published between inception-2024 (inclusive), whose publication type was a peer-reviewed article.

The exclusion criteria were: a) the physiological outcome measures (e.g., insulin level, blood pressure, hormonal response, O2 consumption); b) pregnancy in animal studies and physical assessment in post-partum women; c) studies that presented conference proceedings, dissertations/theses, and short reports as abstracts; e) studies that used laboratory outcome measures for gait (kinematics, kinetics and EMG) and balance (Biodex) and single-joint dynometry and goniometry; and f) subjective outcome measures (self-report questionnaires) on ADL and QOL.

3.2.5. Data Extraction and Charting of the Data

All of the articles that met the aforementioned requirements were reviewed. The data taken from the complete texts of the selected studies were plotted with the help of two separate reviewers. Information was carried out by the main researcher (R. Alshatti) and verified by the supervisory team. All discrepancies were discussed by the researcher and the supervisory team until a consensus was reached. A Preferred Reporting Items for Systematic Reviews (PRISMA) four-phase flow diagram was followed; that is, the search process moved through the phases of identification, screening, eligibility, and inclusion, in sequence. The PRISMA statement was created to improve authors' reporting of systematic reviews, scoping reviews, and meta-analyses (Page et al., 2021). The process of this review complied with the PRISMA guidance and is represented in (**Figure 3.1**).

3.2.6. Collation and Synthesis

The researcher compiled the data extraction, and the supervisory team confirmed it. To facilitate description and analysis, the research was structured according to themes. The initial order of studies was determined by their titles and outcome measures. As can be seen in **Table 3.2**, when patterns were discovered, the publications were grouped according to their main research goals, study area, participant demographics, and other crucial data derived from investigations (criteria), study type, measurement area, and outcome measures.

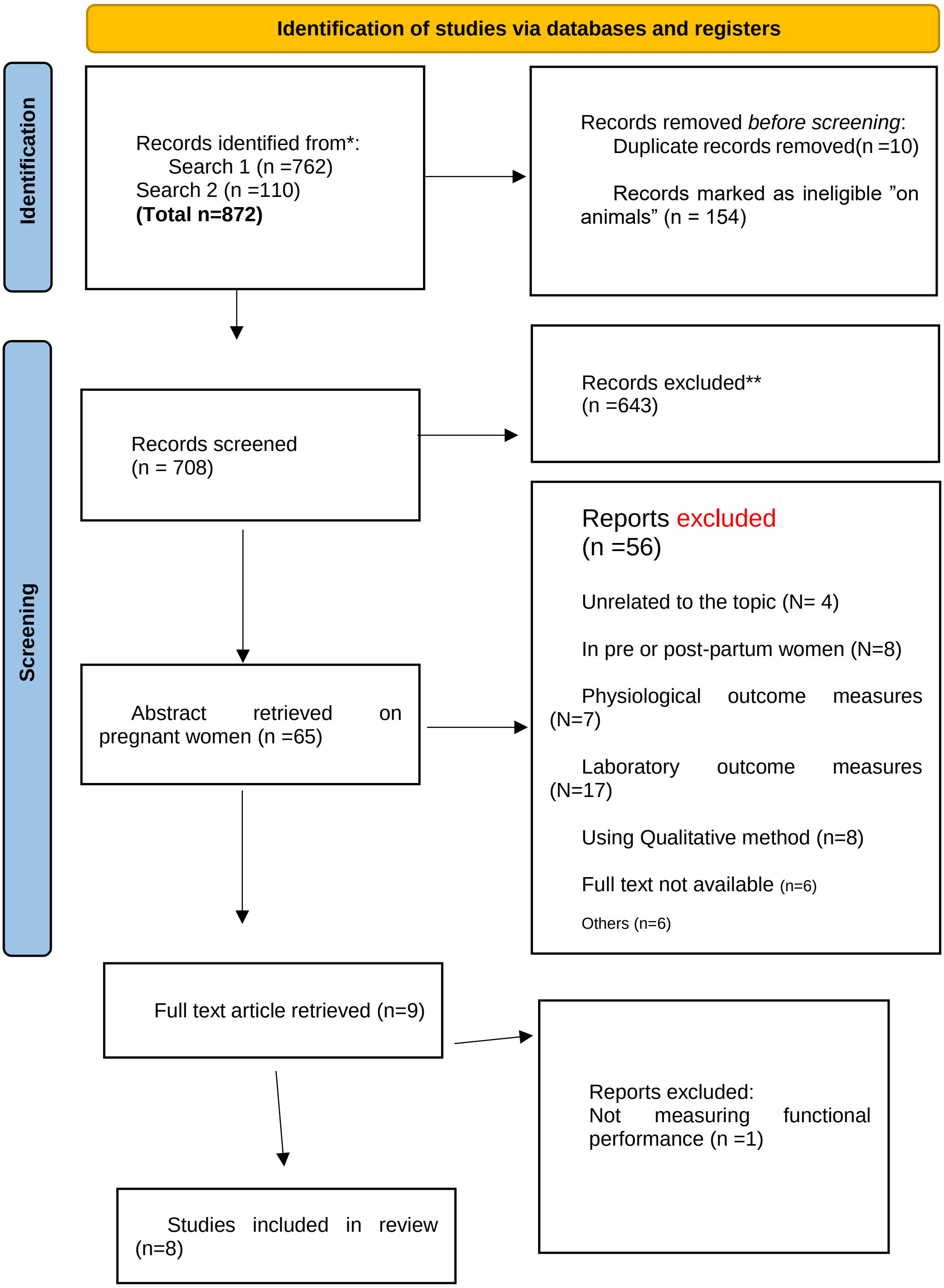

Figure 3.1: PRISMA Flow Chart of the Study Selection Process

Table 3.2: The Main Characteristics of the Participants, Outcomes Measures, Research Design, Psychometric Properties and Findings

	Study	Country	Participant Sample size	Gestational weeks	Pain condition	Aim of using functional test	Functional tests	Methods of psychometric property	Findings of test measurements
1	*Gutke et al. (2008)*	Sweden/ Europe	308 Pregnant women. Age (year) 29 (17–44).	Gestational weeks 12 to 18 and 3 months postpartum.	LBP PGP Combined (LPP) No Pain	To investigate the association of muscle function and subgroups of low back pain in relation to pregnancy.	Gait test (modified by Ljungquist et al)	None	There is an association between muscle dysfunction and women who develop or have persistent PGP. The women with PGP walked at a slower speed compared with the women without LBP both in pregnancy (mean difference 0.09 m/sec, p = 0.008).

2	*Evensen et al. (2015)*	Norway/ Europe	17 pregnant women. Age (year) 31.1 (28–35).	Gestation weeks 28.7 (SD =7.4)	PGP	To establish test-retest and intertester reliability of the TUG test and 10-MWT in pregnant women with PGP	Timed Up and Go (TUG) test. Ten-Meter Walk Test (10-MWT)	1) Reliability testing by calculating the intraclass correlation coefficient (ICC): a) Test-retest reliability b) Inter-tester reliability 2) Standard error of measurement (SEM) 3) Minimal detectable change scores at the 95% confidence level (MDC95)	**a) Test-retest reliability:** -For TUG: excellent (ICC=0.88), (SEM=0.42 seconds), MDC95= 1.16 seconds) -For 10-MWT: good (ICC=0.74), (SEM=0.17ms-1), MDC95= 0.47 ms-1) **b)Inter-tester reliability** Excellent ICC values being found for both tests 10mTWT: For TUG: Excellent ICC= (0.95), SEM= 0.36 seconds, MDC95= 1.00 seconds For 10-MWT: Excellent ICC= (0.94), SEM= 0.09 ms-1, MDC95= 0.25 ms-1

3	*Evensen et al. (2016)*	Norway/ Europe	18 pregnant women. Age (year) 31.4 (28-37)	Gestational weeks 15.3 (SD=5.30)	PGP	To evaluate the convergent validity of the TUG and 10-MWT by comparing performances on these two walking tests with scores achieved on the Active Straight Leg Raise (ASLR) test and the Pelvic Girdle Questionnaire (PGQ).	Timed Up and Go (TUG) test. Ten-Meter Walk Test (10-MWT)	convergent validity by using spearman rank correlation coefficient (rs):	**Convergent validity** a) correlation with ASLR: Strong correlations between the TUG and ASLR (rs = 0.73, p=0.001), and the 10-MWT and ASLR (rs = 0.65, p=0.003). b) correlation with PGQ: -Moderate relationships between the TUG and PGQ (rs = 0.41 to 0.52) -low to moderate between the 10-MWT and PGQ (rs = 0.25 to 0.56).
4	*Wadhwa et al., (2016)*	India/Asia	90 Pregnant women Age (year) (18-28)	Gestational weeks (wk 5, week 18, week 32) of pregnancy.	No pain	The relationship between balance during the three different trimesters of pregnancy	The Timed Up and Go (TUG) test	None	There are statistically significant differences between TUG scores among the three trimesters.

5	*Carvalho et al., (2019)*	Canada/ North America	30 pregnant women (16 with LBP and 14 without pain) 14 non-pregnant women. Age (year) 30 (SD=7)	Gestational weeks 23 (SD=5)	LBP No pain	To compare the static and dynamic postural balance of pregnant women with and without LBP compared to non-pregnant women.	Timed Up and Go (TUG) test	None	In dynamic balance (TUG test), statistical difference was found between the groups (P 0.038) and the effect size was moderate to strong in the comparison between the three groups, indicating that LBP is a factor for decreasing balance in pregnant women
6	*Christensen et al. (2019)*	Norway/ Europe	49 pregnant women (25 with PGP, 24 no pain) 25 non-pregnant women.	Not mentioned	PGP No pain	To investigate physical function by the use of TUG in pregnant women with PGP compared to asymptomatic pregnant and non-pregnant women, and to identify factors	The Timed Up and Go (TUG) test	None	The time on TUG varied among pregnant women with PGP, and was significantly higher (mean (95% CI) 6.9 (6.5, 7.3) seconds) than for asymptomatic pregnant (5.8 (5.5, 6.0), p < 0.001) and non-pregnant (5.5 (5.4,5.6), p < 0.001) women. Increased pain, BMI, and sick leave were significantly associated with increased TUG (p-values≤0.02).

						associated with increased TUG.			
7	*Mazzarino et al. (2021)*	Australia / Oceania	30 low risk pregnant women. Age (Not mentioned)	Gestational week 18-25	No pain	To test the effect of intervention on lower limb strength and endurance.	Sit to stand test (STS)	None	The result shows there were no significant differences between groups for change in lower extremity performance (p= 0.57).

8	*Yenişehir et al. (2020)*	Turkey / Europe, Asia	167 pregnant women in Age (year) (28.43 SD=4.59)	Gestational age (the second or third trimester)	PGP	To investigate the reliability and validity of the Five Times Sit-to-Stand (5TSS) test in pregnant women with and without PGP.	Five times sit-to-stand test (5TSS) The Timed Up and Go (TUG) test	**1) Reliability** a) relative reliability by using intraclass correlation coefficient (ICC) b) Absolute reliability by using interclass correlation coefficient (ICC) and Bland-Altman plot. SEM and minimal detectable change scores at the 95% confidence level (MDC95) **2) Validity**	**1) Reliability tests:** **a) Relative reliability** -**Test-retest reliability:** For 5TSS: excellent in subject with PGP (ICC= 0.986, 95% CI =0.959–0.995); and without PGP (ICC= 0.828, 95% CI=0.632–0.920) For TUG: excellent In subjects with PGP (ICC=0.978, 95% CI= 0.941–0.992), without PGP (ICC= 0.552, 95% CI=0.031–0.793) -**Inter-rater reliability:** For 5TSS: excellent for pregnant women with PGP (ICC=0.999, 95% CI=0.999–1.000) and without PGP (ICC = 0.999, 95% CI = 0.999–0.999). For TUG: excellent for pregnant women with PGP (ICC= 0.999, 95% CI= 0.998–0.999) and without PGP (ICC=0.984, 95% CI=0.977–0.989) **b) Absolute reliability:** **-Intra-rater** For 5TSS: (MDC95 = 1.54s, SEM 0.56 sec.) in pregnant women with PGP and (MDC95=2.67 sec., SEM= 0.96 sec.) in pregnant women without PGP. For TUG: (MDC95 =1.87 sec., SEM= 0.67 second) with PGP, without PGP (MDC95= 1.90 seconds, SEM 0.69 seconds) **-Inter-rater**

	tests a) Convergent validity by using Pearson correlation coefficient. b) The known-group validity by using a t-test.	For 5TSS: Pregnant with PGP (MDC95= 0.42 sec, SEM 0.15 sec.) and without PGP (MDC95= 0.27 sec., SEM= 0.10 sec.) For TUG: Pregnant with PGP (MDC95= 0.30 sec, SEM 0.11 sec.) and without PGP (MDC95= 0.41 sec., SEM=0.15 sec.) **2) Validity tests** **a) Convergent validity** moderate positive correlation between the 5TSS and TUG tests for both women with and without PGP (r = 0.420, p = 0.006 and r = 0.404, p = 0.000). **b) Known-group validity** The subjects reported higher pain (95% CI = 0.322–0.824) and difficulty (95%CI = 0.500–1.042) during 5TSS than the TUG test.

3.3. Main Findings

3.3.1. Literature Search

According to the inclusion and exclusion criteria, 708 potential papers were retrieved from the searched databases. The selection process of the studies and the reasons for withdrawal of articles are shown in the PRISMA flow chart (**Figure 3.1**). After screening the studies, 9 studies were selected and met the criteria for full-text review (Carvalho et al., 2019; Christensen et al., 2019; Evensen et al., 2015, 2016; Gutke et al., 2008; Kristiansson et al., 1996; Mazzarino et al., 2021; Wadhwa et al., 2016; Yenişehir et al., 2020).

One study was excluded because they tested the mobility by using the range of motion, not PFP (Kristiansson et al., 1996). Only eight studies were included in the review as either they were directly testing the PFP by measuring the psychometric properties of the tests such as testing the validity or reliability of PFP on pregnant women or used the PFP to test the functionality of the pregnant women **(Table 3.2)**.

Only 8 studies were included in this scoping review because they met the inclusion criteria (tested the PFP on pregnant women). A huge number of the studies were withdrawn due to many reasons, some articles were not related to the topic (N= 4), for instance, Leźnicka et al. (2022) assessed psychological characteristics such as anxiety and fear of movement, while Felder & Robra (2006) used different medical tests for testing the performance with an application to prenatal diagnostics.

Another reason the studies were excluded is that they used physiological outcome measures to investigate the relation between PR-LPP and fitness performance (N=7) such as O2MAX (Carpenter et al., 1990; Thorell & Kristiansson, 2012; Treuth et al., 2005), measuring the β-subunit human chorionic gonadotropin (Clapp, 1989), blood circulation parameters and the vital capacity of pregnant women (Nesheva, 2019) or measuring the fetus outcomes using the echocardiogram and ultrasound scan (Boardman et al., 2015).

In addition, 17 studies used a laboratory outcome measure such as force platform, electromyography, force plate, gait analysis system, motion analysis system, sagittal plane motions & three-dimensional motion, and GAITRite system

(Bey et al., 2018; Catena et al., 2019; Fontana Carvalho et al., 2020; Hesse et al., 2018; Marshall et al., 2021; Tella et al., 2020).

Furthermore, 8 studies used some quantitative methods to test functional performance such as interviews, Oswestry Disability Index score, Disability Rating Index (DRI), and self-rated functional health (SF-36) (Nicholls & Grieve, 1992; Ozdemir et al., 2015; Rinaldi et al., 2022; Sihvonen et al., 1998; Torstensson et al., 2013).

Some studies were excluded due to measuring something else other than the PFP, for example testing the functional parameters such as Max. grip strength and not testing the functional performance (Kalliokoski et al., 2016), measure the ROM to test the flexibility (Delshad et al., 2020; Paula et al., 2017) or measuring the distance or speed in running during pregnancy (Amola et al., 2019; DARROCH et al., 2022). Some studies used Mental and Physical State Energy and Fatigue Scales (Ward-Ritacco et al., 2016). Likewise, some articles did not include pregnant women, either pre or postpartum (DeGroot et al., 2021; Miller et al., 2017) or in old age (Eriksson et al., 2015).

3.3.2. Geographical Distribution of Functional Tests

The studies that were considered were published between 2008 and 2020. The majority of research participants were Europeans (3 studies from Norway and 1 from Sweden). The other four investigations were conducted in various continents: Australia/Australia, Canada/North America, India/Asia, and Turkey. The research was spread around the globe, except South America and Africa. Furthermore, no research was done in the Middle Eastern and West Asian nations.

3.3.3. Population Representation

The minimum and maximum ages of the participants were 17 and 44 years old. The average age of the pregnant women was 29 (SD=6 years).

The sample size in five studies was less than 50 participants, one study (Wadhwa et al., 2016) included 90 pregnant women, and only two studies (Gutke et al., 2008; Yenişehir et al., 2020) exceeded 150 pregnant women. The largest sample size was 308 pregnant women (Gutke et al., 2008). Of all studies, six studies collected data from pregnant women with pain (LBP n=48, PGP n=210, LPP n=54), and two studies (Wadhwa et al., 2016; Yenişehir et al., 2020) included only the No-pain group (n=120).

In terms of gestational age, all pregnant women were in the second trimester, and in three studies the third trimester was included. Three studies also included the first trimester of pregnancy. Only one study included all gestational periods to examine balance during the three different trimesters of pregnancy (Wadhwa et al., 2016).

3.3.4. Pain-related Relevancy

The pregnant women were divided into four groups according to their pain condition. This includes pelvic girdle pain, Low back pain, lumbopelvic pain, and no pain group. Pelvic girdle pain was the most commonly studied type of pain. It was mentioned in 60% (5 studies) of the included studies. Followed by low back pain in two studies.

One study (Gutke et al., 2008) involved all the pain groups as it aimed to investigate the association of muscle function and subgroups of low back pain in relation to pregnancy (No pain n=116, LBP n=32, PGP n=99, LPP n=54). Two studies (Mazzarino et al., 2021; Wadhwa et al., 2016) included asymptomatic pregnant women only (n=220) to test the effect of the intervention on lower limb strength and to investigate the relationship between balance during the three different trimesters of pregnancy.

In regards to the pain-related studies, three studies (Evensen et al., 2015, 2016; Yenişehir et al., 2020) included only pregnant with PGP to test the psychometric properties of the PFP tests (n=17, n=18, and n=167). The remaining two studies (Carvalho et al., 2019; Christensen et al., 2019) used a group of PGP or LBP and a comparative group of asymptomatic pregnant women to compare the functionality between the groups (25 pregnant women with PGP and 16 with LBP, respectively).

3.3.5. Scope of Functional Tests

Out of the eight studies analysed, four different used TUG, 10-MWT, modified gait test, and 5STS for measuring the different components of physical performances (agility, strength, and balance). All of the tests were performed during pregnancy. In the selected studies, only three studies (Evensen et al., 2015, 2016; Yenişehir et al., 2020) used these tests for psychometric properties in pregnant women with PGP: The Timed Up and Go (TUG), Ten-Meter Timed Walk (10-MWT) and Five Times Sit-to-Stand (5TSS) tests. The aims of other studies were not relevant to testing the validity or reliability of the functional tests and mainly focused on changes in physical performance (e.g. strength, endurance, balance, and walking) in different gestational ages or due to local pain in pregnant women. For example, Gutke et al. (2008) used the Timed Up and Go (TUG) test to explore whether an association exists between muscular dysfunction and pregnancy-related LBP. Carvalho et al. (2019) and Christensen et al. (2019) used the TUG test on pregnant women with and without LBP and non-pregnant women to compare the static and dynamic balance in three groups. Christensen et al. (2019) used the TUG test among pregnant women with PGP. Mazzarino et al. (2021) used the sit-to-stand test (STS), and other tests to assess the lower extremity performance, strength, and endurance of pregnant women.

3.3.6. Psychometric Properties Methods

Three studies that calculated the psychometric properties of TUG, 10MWT, and 5STS used different methods. Relative reliability was a form of test-retest and inter-tester through calculating the intraclass correlation coefficient (ICC), Standard error of measurement (SEM), and Minimal detectable change scores at the 95% confidence level (MDC95) in 2 studies (Evensen et al., 2015; Yenişehir et al., 2020). In addition, the Bland-Altman plot used the absolute reliability of 5STT in one study (Yenişehir et al., 2020).

For the validity testing, the two studies tested the convergent validity either by using the Spearman rank correlation coefficient (rs) or by using the Pearson correlation coefficient (Evensen et al., 2016; Yenişehir et al., 2020). Yenişehir et al. (2020) also tested the known-group validity by using a t-test.

3.3.7. Findings of Psychometric Measures in Pregnant Women

3.3.7.1. Reliability Testing

Reliability of TUG and 10-MWT

Evensen et al. (2015) stated good to excellent relative reliability was found for all test-retest and intertester reliability analyses with the ICC (1,1) ranging from 0.74 to 0.95. Test-retest reliability excellent for the TUG (ICC=0.88), (SEM=0.42 seconds), MDC95= 1.16 seconds) and good for the 10mTWT (ICC=0.74), (SEM=0.17ms-1), MDC95= 0.47 ms-1).

Inter-tester reliability was determined excellent ICC values being found for both tests (TUG: Excellent ICC= (0.95), SEM= 0.36 seconds, MDC95= 1.00 seconds, and 10-MWT: Excellent ICC= (0.94), SEM= 0.09 ms-1, MDC95= 0.25 ms-1).

Reliability of 5TT

Yenişehir et al. (2020) measured the inter-rater reliability of 5TSS which was excellent for pregnant with PGP (ICC=0.999, 95% CI=0.999–1.000, MDC95= 0.42 sec, SEM 0.15 sec.) and without PGP (ICC = 0.999, 95% CI = 0.999–0.999, MDC95= 0.27 sec., SEM= 0.10 sec.). For TUG: excellent in subjects with PGP (ICC= 0.999, 95% CI= 0.998–0.999, MDC95= 0.30 sec, SEM 0.11 sec.) and without PGP (ICC=0.984, 95% CI=0.977–0.989, MDC95= 0.41 sec., SEM=0.15 sec.)

In addition, Yenişehir et al. (2020) measured the test-retest reliability of 5TSS was also very high for pregnant women with and without PGP (ICC= 0.986, 95% CI =0.959–0.995, MDC95 = 1.54s, SEM 0.56 sec.; ICC= 0.828, 95% CI=0.632–0.920, MDC95=2.67 sec., SEM= 0.96 sec., respectively). In addition, test-retest was excellent for TUG for TUG in pregnant women with PGP (ICC=0.978, 95% CI= 0.941–0.992, MDC95 =1.87 sec., SEM= 0.67 second), without PGP (ICC= 0.552, 95% CI=0.031–0.793, MDC95= 1.90 seconds, SEM 0.69 seconds).

3.3.7.2. Validity Testing

Convergent Validity of the TUG and 10MWT

Spearman rank correlation coefficient (rs) showed a strong correlation between the TUG and Active Straight Leg Raise test (ASLR) (rs = 0.73, p=0.001), and the 10-MWT and ASLR (rs = 0.65, p=0.003) (Evensen et al., 2016). Relationships between the TUG and Pelvic Girdle Questionnaire (PGQ) were moderate (rs = 0.41 to 0.52) and between the 10MWt and PGQ low to moderate (rs = 0.25 to 0.56).

Convergent Validity of the 5STT

Pearson correlation analysis showed a moderate positive correlation between the 5TSS and TUG tests for both women with and without PGP (r = 0.420 and r = 0.404) (Yenişehir et al., 2020).

Known-Group Validity for 5STT

Intergroup comparison of time of completing functional mobility tests showed that women with PGP completed 5TSS and TUG tests in a longer duration (t-value for 5STT= -3.229, and TUG t= -3.572) (Yenişehir et al., 2020). In addition, the subjects reported higher pain (95% CI = 0.322–0.824) and difficulty (95%CI = 0.500–1.042) during the 5TSS than the TUG test.

3.4. Discussion

3.4.1. Aim and Main Findings

This scoping review aimed to map the literature associated with the field of physical performance assessments in pregnant women and identify valid and reliable assessments for evaluating the physical performance in pregnant women.

The Main Findings of this Study are:

1. The majority of excluded studies (56 studies out of 65 studies) did not use PFT, which indicates that the definition and implication of this term are vague and maybe other terms should be considered to reflect the physical capacity demands of pain-related pregnancy.

2. The psychomotor properties of selected tests (TUG, 10MWT) for the first time reported in 2015 indicates that major areas of physical assessments before or after 2015 were physical fitness components, physiological capacity, and biomechanical analysis rather than performance-oriented assessments by time score.

3. The 3 studies that tested the psychometric properties of selected tests showed good validity and reliability in pregnant women with pain.

4. The selected psychometric metrics were inter-rater reliability, intra-rater reliability, and validity.

5. The scope of the remaining studies (5 studies) mainly focused on changes in physical performance (e.g. strength, endurance, balance, and walking) in different gestational ages or due to local pain in pregnant women.

6. In terms of geographical distribution, only two countries in Europe (Norway and Türkiye) reported psychometric properties of the selected tests. These results further reflect the limited application of selected tests for clinical decision-making

and the need for a more comprehensive assessment of pain-related dysfunctions in pregnant women.

3.4.2. Definition of Performance Term

The definition of the performance tests varied among the studies, either on pregnancies or in pain management. For example, (Evensen et al., 2015, 2016) validated the TUG and 10MWT as "walking performance tests"; in addition, Yenişehir et al. (2020) validated the 5STS as a "functional mobility test". However, a recent systematic review included all the previous three tests and categorized them as "fitness tests" and their results did not identify any tests of agility, balance, and coordination (Romero-Gallardo et al., 2022). They classify the TUG and 10MWT as skill-related components "multidimensional and speed" respectively, while the 5STS as health-related components to test "muscular fitness". In addition, another systematic review defines the functional outcome measure as the "functional capacity" to perform activities of daily living (Richards et al., 2012). Therefore, the definition of physical functional performance is still vague and the classification and the context of those tests are still not clear as it could vary from performance-oriented tests, biomechanical analysis, physical capacity tests, fitness tests, or others. Defining and utilizing the PFP as a clinical assessment tool is challenging and a better consistent language is needed to use in clinical practice or future research.

Additionally, from the few included studies there was no consistency in the procedure in using these tests. For example, the TUG test was the most commonly used test, previous studies have employed different protocols with regard to the setup and instructions. Most of the studies used the same setup for the TUG test; However, Carvalho et al. (2019) used a different setup by positioning a cone and asking the patient to turn around it. In addition, with regard to the instructions, all of the studies asked the pregnant women to walk as fast as they could, except for Wadhwa et al. (2016), who asked the participants to perform the test without considering their walking speed. This confusion was addressed previously in past studies used different instructions and protocols for timing the tests either to walk as fast as they could, walk at a 'comfortable', 'normal' or 'self-selected' pace (Botolfsen & Helbostad, 2010; Kristensen et al., 2010; Nordin et al., 2006). However, using the maximum pace was found to be the method used with pregnant women with LPP patients and the more reliable than when undertaking timed walking test at a comfortable pace (Lexell et al., 2005; Romero-Gallardo et al., 2022).

In addition to the lack of homogeneity, the lack of a clear protocol makes it difficult to compare results across different studies and identify areas where more research is needed. Having clear protocols and proper setup are essential for the accurate, reliable testing of physical functional performance. A well-defined protocol ensures that the test is conducted consistently and that the results can be replicated and compared to those of previous studies. Without clear protocols, the results of a PFP test may be unreliable and difficult to interpret. Therefore, policy-making plays a crucial role in the development and implementation of physical functional performance testing protocols (Torres et al., 2004).

3.4.3. Psychometric Properties of Tests

Test-retest reliability in particular is an essential requirement for any test as it determines the consistency of the same subject's performances on two different occasions (Weir, 2005). Performances on the walking tests are more likely to be affected by the subject being tested than by the assessor timing the performance or the stopwatch itself; thus, this form of intratester reliability is considered particularly important. The findings of this scoping review showed that there were three studies related to the reliability and validity of three PFP tests (TUG, 10-MWT, and 5STT) on pregnant women with PGP. However, only the study by Yenişehir et al. (2020) used a large sample size (n=167), while the other two studies used less than 20 participants which doubts the power of the test in the reported validity and reliability.

The findings of good-excellent test-retest relative reliability results for the 10MWT, TUG, and 5STT indicate that subject performances on the three functional performance tests were highly repeatable between the two testing sessions. All three tests demonstrated ICC values above 0.70 generally which is considered to be acceptable (Bernstein, 2000). However, the previous study included only pregnant women with PGP; therefore, the differences in psychometric properties of the tests between asymptomatic and LPP pregnant women in terms of ICC and other metrics have not been published yet. In addition, there is a need to examine other psychometric properties such as responsiveness, sensitivity, and normative scores to offer additional insights into the measure's effectiveness and appropriateness to provide a comprehensive picture of a psychological measure's utility. For instance, monitoring the development of symptoms, functional skills, or health-related outcomes can be facilitated by measuring responsiveness (Jakobsson et al., 2019; Yao et al., 2020). Likewise, comparing the normative results to a reference group might offer context for evaluating a person's performance on a psychological test (Zouita Ben Moussa et al., 2020). "Is this score typical or atypical for someone of this age, gender, or cultural background?" is one of the questions these scores address. Interpreting an individual's position in relation to peers or demographic norms improves the therapeutic value and interpretation of assessment results.

The results show that testing the psychometric properties started in 2015 for TUG and 10MWT as valid walking tests (Evensen et al., 2015, 2016). However, before the PFP test became validated, agility was tested by using a non-validated modified gait test (modified Ljungquist et al. (1999)) (Gutke et al., 2008). Concerning the 5STT, which was validated on pregnant women in 2020 by Yenişehir et al., Previous studies (before 2020) used the STT to evaluate the biomechanical changes to stand-to-sit during pregnancy. For example, Catena et al. (2019) used a 60-second STT test, while Lou et al. (2001) used a one-time STT. Even after the validation of TUG, 10MWT, and 5STT, Mazzarino et al. (2021) used a different protocol of STT to test the effect of an intervention on pregnant women. This might mean that, despite the validation of a small number of PFP tests in LPP women after 2015, examining the psychometric qualities of PFP was not taken into account for this group and was instead utilized in earlier research without raising any concerns about the validity and reliability of such measures.

3.4.4. Application of the Findings

Difficulties with PFP are a significant issue for pregnant women with LPP and quantifying functional performance is essential when assessing functional status (Evensen et al., 2015). Therefore, the result of this scoping review identified three valid and reliable performance-related outcome measures among pregnant women with PGP. Considering the limited resources in the clinical setting (including space, equipment, and time constraints), all three tests are feasible in clinical settings and also, they are inexpensive and require little equipment and instructions for administration in patient screening.

These findings imply that clinicians, researchers, and decision-makers may feel certain that the outcomes of each of these tests are highly reliable and probably reflect the components that they are intended to evaluate (de Vet et al., 2011). Having a reliable, valid PFP to employ as an acceptable decision-making tool provides evidence of improved clinical decision-making as well as better outcomes from the viewpoint of the patients, as well as being accessible to clinical practitioners and easily implementable in clinical practice (Holmes-Rovner et al., 2001). Finally, the results open a window for further studies, first to generalize and standardise the categories or criteria of PFP.

3.5. Conclusion

The results of this scoping review showed that only three of the studies analysed provided distinct tests for measuring different components of physical performance (agility, strength, and balance) to evaluate the effect of pregnancy on the functional performance outcome measures. It is necessary to consider additional psychometric properties like responsiveness, sensitivity, and normative scores to enhance the interpretability and utility of physical measures in various contexts. In addition, a standardized language for defining and categorizing PFP is essential for improving clarity, consistency, and comparability in pregnant women.

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CHAPTER 4: PHYSIOTHERAPISTS' PERCEPTIONS OF THE BARRIERS, FACILITATORS, AND ACCEPTANCE OF FUNCTIONAL PERFORMANCE TESTS FOR PREGNANT WOMEN WITH LUMBOPELVIC PAIN IN KUWAIT

4.1. Background

Functional performance evaluation is fundamental to the epidemiological study of the relationship between functional performance and musculoskeletal conditions (Pesenti et al., 2021; Shephard, 2003). Evaluations of functional performance are thus a key component of any such avenue of study, offering a crucial path toward understanding the healthcare needs of both individual patients and populations at large (Meander et al., 2021).

Functional performance assessments are essential when it comes to addressing the subject of the current study. It is suggested that almost 70% of pregnant women experience back pain, which causes functional difficulties in performing the activities of daily living (Daneau et al., 2021; Gutke et al., 2018; Olsson et al., 2009). This is underscored by the positive correlation between lumbopelvic pain (LPP) during pregnancy and musculoskeletal adaptations, which results in a decrease in trunk coordination, strength, and flexibility (Backhausen et al., 2019; Hegaard et al., 2011). Functional performance tests are thus essential for the assessment or evaluation of pregnant women with LPP. However, physiotherapists' use of functional performance tests in evaluating pregnant women with LPP remains limited.

Most research on functional performance testing has focused on self-reporting measures, such as questionnaires, rather than on physical functional performance (PFP) tests. Crucially, it remains unclear whether the limited use of physical functional performance tests among pregnant women is due to individual, environmental, or task-related barriers.

This study explores the barriers, facilitators, and acceptance of the PFP by seeking to answer the following questions:

1. What are the reasons behind the limited use of PFP tests among pregnant women?

2. What are the barriers and facilitators to adoption of PFP tests uptake in clinical settings?

The main objectives of this research are to identify the barriers and facilitators that affect the use of PFP among pregnant women with LPP. This study employs qualitative methods to investigate physiotherapists' experiences with the PFP through conducting focus group interviews. Framework analysis, which strives to identify patterns of themes in interview data (barriers, facilitators, and cultural acceptance), was used to analyse the semi-structured interviews. The empirical analysis is based on conducting focus groups among expert physiotherapists in Kuwait. Given its strong commitment to culture and traditions, Kuwait represents a unique test case for understanding the effect of cultural factors on the use of the PFP.

4.1.1. Previous Research on Functional Performance Tests

A previous scoping review provided a comprehensive overview of PFP in patients with lower back pain (LBP) (Denteneer et al., 2018). For LBP patients, thirty-eight clinical tests have been verified to be effective. The validity of the tests was further systematically reviewed by Jakobsson et al. (2019). They analysed the evidence for the reliability, validity, and responsiveness of physical function tasks designed to assess functioning in patients with LBP, and included 16 physical functional performance tests in LBP patients. By comparing the findings of the previous study (see chapter 3: scoping review), only 3 tests (timed up and go, or TUG, five sit to stand, or 5STS, and the ten minutes-walk test, 10MWT) were found to be valid and reliable for use with pregnant women with pelvic girdle pain. This indicates a key deficiency in the use of physical functional tests among pregnant women with LPP, given the many studies utilizing physical functional measures in LBP patients. However, at the time of the empirical study, no validation data were available for the 5STS, which influenced the selection process (See Appendix 15).

Although inaccuracies caused by recall bias, social desirability bias, and simple errors are considered to be a common limitation with self-reported questionnaires, this remains the most commonly used method for assessing functional performance (Denteneer et al., 2018). However, there is a lack of qualitative research that explores the experiences of physiotherapists and the feasibility of using the PFP with pregnant women suffering from LPP.

Identifying the barriers to the use of such tests is a key step towards explaining the lack of use of the PFP with pregnant women suffering from LPP in the existing literature as well as in clinical practice. In addition, identifying the possible facilitators for its use may lead to the development of better strategies for assessing PFP in pregnant women with LPP (Bragaru et al., 2013). However, to facilitate the comprehension of these functional tests, physiotherapists must be aware of which barriers, facilitators, and cultural attitudes are relevant to a specific pregnant patient, in their particular healthcare context. This awareness, particularly when encountering novel combinations of these factors, is crucial in effectively motivating the use of these functional tests in the field. This study aims to provide the foundations for developing such awareness.

4.1.2. Task Constraints

Because research suggests that distinct adaptations occur in terms of muscular strength, endurance, balance, and flexibility, clinical specialists employed a variety of functional tests to highlight functional deficits throughout pregnancy that result in LPP. During pregnancy, the dynamic stability of the pelvis may be affected due to hormonally-induced ligament laxity, which leads to decreases in muscle strength. Thus, improving muscle function will reduce pain and enhance functioning in women with pelvic girdle pain (PGP) (van Wingerden et al., 2004). Back extensors, abdominals, and hip extensors are important muscles related to stabilizing the lumbopelvic area. Low endurance in the back and hip muscles has been reported in postpartum women with longstanding LPP (Fitzgerald & Segal, 2015).

In addition, it was noted that muscular dysfunction is a critical factor concerning persistent problems. In addition, the results of the research conducted by Fitzgerald & Segal (2015) reinforce the hypothesis that there exists a positive correlation between muscle dysfunction and women who develop or already have persistent LPP. The research highlighted that women with LPP had lower muscle function in the trunk and less hip muscle strength as well as slower preferred gait speed compared to women without lower back pain (LBP). These findings were seen in the early stages of pregnancy as well as postpartum. Moreover, the results of the PFP among LBP workers that included reduced mobility of the spine, as well as low performance concerning muscle balance, strength, and flexibility, are considered positive clinical signs for predicting future lower back pain (Ferguson et al., 2012).

The importance of testing mobility and muscle strength as an objective PFP measure has been previously emphasized (Smeets et al., 2006). It is important to assess the influence of pain on physical performance in a rehabilitation population that experiences chronic lower back pain. To assess aerobic endurance, a 5-minute walk is a useful test for conducting this PFP measure. This test is useful for measuring walking distances, stair climbing, and shopping ability. Therefore, the World Confederation for Physical Therapy (WCPT) stated that these physical functional performance outcome measures should reflect the patient's main concerns (Sykes, 2008). Elsewhere, walking has been documented to be a concern for almost 73% of pregnant women who experience pelvic girdle pain (Hansen et al., 1999; Mei et al., 2018; Stuge et al., 2011). The only suitable tests to use for this group of pregnant women are defined as the "Timed Up and Go (TUG)" test, and the "Ten-Meter Walk (10MWT)" test (Evensen et al., 2015, 2016). Both tests have been proven to be reliable and valid among various populations of patients with lower back pain (Flansbjer & Lexell, 2010; Isles et al., 2004; Podsiadlo & Richardson, 1991; Schenkman et al., 1997).

Other research has suggested that the assessment of postural balance under multi-task conditions is considered an indicator of balance issues and falls. Likewise, it has been confirmed by researchers that the ability to maintain stability may affect the performance of daily tasks (Cakmak et al., 2016). The TUG test reflects the balance and gait manoeuvres used in everyday life to evaluate alterations in functional mobility while performing tasks to prevent potential falls. TUG comprises many daily activities, such as getting in and out of a chair, walking, and turning (Nicolini-Panisson & Donadio, 2014). The advantage of the TUG test lies in its simplicity and usefulness for evaluating the functional mobility of patients before, during, and after treatment, even though it has been shown that the time it takes to complete the TUG test is strongly correlated with lower muscle balance and strength.

The main aim of a physiotherapy rehabilitation program concerning musculoskeletal conditions, including pregnant women, is either to prevent or delay the onset of physical disabilities or improve functional performance. Unfortunately, a limiting factor in evaluating and managing physical decline during pregnancy has been the lack of suitable measurement tools for assessing the underlying parameters associated with functional mobility (strength, endurance, flexibility, balance, and agility). Using functional performance tests is essential to obtain a general picture of a patient's ability and provide a means of assessing the major underlying physical parameters associated with LPP that support functional mobility in pregnant women.

4.1.3. Implementing the ICF Framework to Test PFP in a Clinical Setting

By gathering, recording, and disseminating data on health-related functioning, the World Health Organization (WHO) created the International Classification of Functioning, impairment, and Health (ICF) framework, which aims to represent the wide-ranging nature of patient experiences of impairment (Ustün et al., 2003). The ICF avoids the conceptual pitfalls of viewing disability as only a result of illness by beginning with an integrated assessment of health. Rather, the ICF examines the relationship between an individual's setting and their health state (Selb et al., 2015), providing a common language for characterizing function across health professionals and seeking to stay appropriate to all people regardless of sex, age, culture, or health condition.

The WHO has outlined the fundamental ideas of the ICF and provided a hierarchical classification system of its chapters, components, and categories to aid in the creation of a common language (WHO, 2001). Their conceptions of function—Body Functions and Structure, either by Body Region or by System; Activities and Participation, from both individual and broader societal perspectives; and Environmental Factors, ranging from the specific to the general—are crucial to the current research (WHO, 2001). Personal variables are excluded from the categorization because of their considerable cultural and societal diversity (WHO, 2001), they are crucial for the ICF in general (Geyh et al., 2019).

More than 1,400 categories of human function are used by the ICF as a framework for organizing data (WHO, 2001). The creation of the ICF Core Sets, which comprise category selections representing typical spectra of functional issues for patients with certain diseases, has further improved this (Cieza et al., 2004). A substantial amount of expert surveys, qualitative and quantitative clinical research, and literature evaluations served as the foundation for the development of these Core Sets (Stucki et al., 2002).

The World Physiotherapy Organization acknowledged the value of the ICF framework for clinical physiotherapy in 2003 with an effort to support its use in physiotherapy (Escorpizo et al., 2010), and it is still vitally important for field practice today. The ICF uses the functional measurement of capacity and performance to approach the functional assessment of activities and participation in the context of clinical physiotherapy. The functional measurement of capacity, which is central to the current study, is concerned with how well a person performs (functionally) in standardized settings, such as a clinical assessment (Schroder, 2021). Measuring a patient's functional status allows for the assessment of the constraints their condition places on their activities, including the requirement for support through equipment use or environment alterations.

The WHO's definition of health, which encompasses mental, emotional, and social well-being, is still aligned with this method of comprehending the connections between pain, function, and impairment (WHO, 2001). By providing a model of impairment for illnesses and disorders that takes into account their effects on the body, mind, and society, the ICF contributes to this wider perspective. It offers a tool that is still in use today for characterizing, documenting, and assessing function and impairment (WHO, 2001).

The ICF views an individual's level of function as the result of a dynamic process including their health, environment, and personal characteristics (Björklund et al., 2007). To provide insight into how the important relationship between internal and external influences affects a person's health, it offers two complimentary classification systems.

The primary determinants of function in the ICF's approach to this biopsychosocial model are body functions, body structures, and activity and participation (Riis-Djernæs et al., 2021), maintaining its comprehensive understanding of the dynamic relationship between personal, environmental, and health-related aspects (Björklund et al., 2007). The key idea of the current study, activity, and participation, is explained in terms of performance and capacity. Performance refers to an individual's actions in their natural environment, whereas Capacity describes an individual's potential actions in a context in which the environment may be ignored.

The primary objective of this study is to determine which patient function constructs apply to and are utilized by practicing physiotherapists. Additionally, the study sought to understand the views of physiotherapists on the obstacles, enablers, and acceptability of the use of PFP testing for pregnant women with LPP. The research data was analysed using the ICF framework, which highlights the significance of the biopsychosocial model and the relationships between personal, environmental, and health-related components in describing health-related functioning.

4.1.4. Barriers and Facilitators to Using Functional Performance Tests in Clinical Settings

This section outlines the barriers, facilitators, and preferences related to using PFP among pregnant women with LPP.

4.1.4.1. Lifestyle and Obesity

Previous qualitative studies provide data on the attitudes and perceptions regarding the barriers and facilitators to physical performance among pregnant women (Coll et al., 2017; Evenson et al., 2009; Harrison et al., 2018). However, these studies did not consider the perceptions of the PFP. Different barriers to the PFP in pregnancy were cited, such as fatigue and discomfort (nausea, pain), back pain, and awkwardness (due to weight gain and increasing size as the pregnancy progresses), which are all pregnancy-related symptoms (K P Subramanian et al., 2022; Mbada et al., 2022). These barriers may limit the use of the PFP among pregnant women (Harrison et al., 2018). Other studies that examined overweight and obese pregnant women reported additional barriers, such as a lack of confidence, motivation, and knowledge (Harrison et al., 2018).

The expectation is that this may limit the cultural acceptance regarding the usage of the PFP among pregnant women in Kuwait. Furthermore, Al-Sayegh et al. (2012) argued that the reasons for obesity in Kuwait are related to the environment, culture, eating habits, and limited amount of physical activity. 80% of pregnant women in Kuwait were categorized as being overweight or obese, which is a major serious chronic health issue among pregnant women (Al-Sayegh et al., 2012). Again, an inactive lifestyle with a limited amount of physical activity increases the risk of weight gain and obesity.

Moreover, cultural limitations may play a strong role in terms of reducing the functional performance of outdoor daily living activities among women, such as exercising, walking, and engaging in various fitness activities in public (Al-Sayegh et al., 2012). The environmental barriers were a lack of access and (unfavourable) weather, while the less frequent safety concerns included the type and intensity of physical activity that is considered safe during pregnancy and fears for the self, the pregnancy, and the baby (Harrison et al., 2018).

A study by (Smuck et al., 2014) found that reduced physical activity (PA) was an independent risk factor for LPP. Moreover, this study, which examined the relationship between physical activity, obesity, and LPP patients proved that physical activity can help to mitigate back pain risk, which is shown to have greater consequences for the overweight population. Moreover, de Sousa et al. (2019) claimed that inactive pregnant women have a 30% higher chance of experiencing higher pain intensity compared to active women. Due to these implications and risks related to pregnancy, Al-Sayegh et al. (2012) emphasized the need for more study on elements like inactive lifestyle to better understand the connection between pelvic discomfort and lower back pain, as well as the negative effects on pregnant women.

Due to the physiological adaptation in women during pregnancy and the fact that women with LPP experience detrimental effects concerning the quality of their life in many domains, including their physical activities and emotional health, qualitative research is needed in this area to build on the current literature by providing an in-depth analysis of the unique barriers and facilitators related to the usage of functional performance tests, especially with pregnant women in the sedentary population.

4.1.4.2. Cultural Factors

Cultural factors play an important role in the acceptance by society of using the PFP with pregnant women suffering from LPP. Qualitative evaluations in different societies are essential to allow health care providers and policy makers to design assessments and interventions around the specific cultural norms, community factors, and individual motivations that can affect health-related behaviour (Krans & Chang, 2011).

This was supported by Harrison et al.'s (2018) systematic review, which found that different ethnic backgrounds face unique barriers and socio-economic factors to health-related behaviour that limits physical activity in pregnant women. The most-frequently reported barriers to leisure-time physical activity during pregnancy were work-related factors (Connelly et al., 2015). The review identified a lack of time due to work commitments, a lack of energy because of work, and perceiving that their job was already physically demanding, which they felt contributed to them meeting the PA guidelines. This may not be a problem in Kuwait because the government supports employed pregnant women and grants them fewer working hours and paid leaves in the last few months of their pregnancy if needed. Another common point that is often considered a barrier in other countries but is unrelated to Kuwait is the educational level (Coll et al., 2017). Following the literature review, we will identify the conceptual framework to assess the feasibility of using the PFP (Brod et al., 2009).

4.1.4.3. Educational Level, Knowledge, and Awareness

Knowledge (e.g., how functional movements are safe during pregnancy) is another important factor that needs to be considered to promote the use of the PFP during pregnancy (Connelly et al., 2015). A lack of awareness regarding the importance of functional performance may be a major barrier to the application of the PFP among pregnant women. Physiotherapists and midwives have been identified as an ideal avenue through which to provide information regarding healthy lifestyle behaviour for pregnant women, as this may be the key to enhancing pregnant women's knowledge of the safety of the PFP and benefits of engaging in activity during pregnancy (Evenson et al., 2009; Forbes et al., 2017; Gustavsson & Eriksson-Crommert, 2020).

In a previous qualitative study, pregnant women mentioned receiving a lack of advice from health providers regarding PA, with some reporting having received none (Coll et al., 2017). Due to the traditional nature of Kuwaiti society, such as following elderly people's advice, I expect to find some lack of support from older health care professionals concerning encouraging functional performance among women, especially in the first three months of pregnancy. Thompson et al. (2017) claimed that social support is considered one of the "interpersonal factors" that influence PA patterns. They emphasised the need to understand the potentially modifiable factors for PA during pregnancy. However, no qualitative study has assessed the opinions of physiotherapists regarding this issue.

On the other hand, what is seen as a barrier in some countries may be a facilitator in other contexts. A lack of free time for working pregnant women, for instance, is considered one of the barriers that limit functional performance. However, in other countries, such as Kuwait, the working hours are 7:30 am to 1:45 pm in most institutions, which gives pregnant women plenty of time to engage in physical activities after working hours. Another factor is the lack of social and familial support for engaging in physical activities during pregnancy (Harrison et al., 2018). Nonetheless, the levels of social and familial support differ across cultures and contexts. Hence, I expect to find this to be a facilitator in contexts where the levels of support for pregnant women are high because they receive more attention and help from their community and family.

4.1.5. Study Context

The analysis centres on Kuwait, an Arab Gulf country located in the Middle East. The assessment of pregnant women with LPP in Kuwait remains limited. Furthermore, the barriers and facilitators mentioned in previous studies were based on other contexts that cannot be generalized or extrapolated to the Kuwaiti case. There are no studies that identify the barriers and facilitators in a county with a sedentary lifestyle and high standard of living, which may contribute directly to an increased risk of lumbopelvic pain (LPP) among pregnant women. Therefore, this study will explore these factors, which are expected to influence the PFP among pregnant women with LPP from an expert physiotherapist’s perspective.

To begin with, in Kuwait, pregnant women with LPP are assessed using an ante-natal assessment sheet that covers demographic information, the patient’s history (obstetrics, past and present), observations of body build, posture, gait, and a physical examination to assess muscle strength, tightness, oedema, tenderness, and subjective pain (see appendix 2). At the end of the assessment sheet, there is a small space to mention special tests (if any), which reflects the importance of using some tests while assessing these conditions. However, it is unclear from this assessment sheet what kind of special tests are used with pregnant women in Kuwait nor the current practice regarding testing the PFP. This is why we conducted the focus group, to further understand how patients are assessed, what special tests are usually used, whether these are used in combination, and whether they think that it is important to combine these tests.

Kuwait is known for it is sedentary lifestyle and high standard of living combined with a high rate of obesity (Aburezq et al., 2020). Kuwait is a high-income country. According to Trading Economics Global, the official estimate for Kuwait's Gross Domestic Product (GDP) was $210 billion at the end of 2022 in purchasing power parity terms. World Economics estimates that Kuwait's GDP is

$290 billion, which is 38% larger than the official estimates (World Bank Open Data, n.d.), with 80% of governmental earnings coming from the petroleum trade. Crude oil reserves in Kuwait ranked seventh in the world's oil reserves (Kuwait 7th in global oil reserves, 2022). These factors may contribute to reduced PFP among pregnant women. As for the sedentary lifestyle there, this is related to various factors that enhance indoor gatherings and contribute to reduced functional performance, such as the culture, traditions, hot weather, social life, and abundance of resources. Even if they work outside the home, moms receive a lot of assistance at home. The majority of families employ a home maid to assist with cooking and cleaning duties. This promotes an inactive lifestyle. In addition to the heat restricting outdoor activities like strolling, working out, and other fitness pursuits in public, Culture has a significant impact on how few outdoor activities women engage in. Due to family norms, the majority of women choose to stay indoors (Al-Sayegh et al., 2012).

The social life of Kuwait encourages the high consumption of food especially at gatherings and among their social circle, discouraging movement or physical activity, which thus affects the quality of their functional performance. The luxurious lifestyle in Kuwait also reinforces this sedentary lifestyle. The Kuwaiti government provides citizens with extensive social welfare services, employment, education, and health. Kuwait has a reputable public healthcare system that provides free healthcare to all residents, which may decrease the responsibility for promoting a healthy lifestyle and improving one's functional performance (Kuwait Healthcare, 2023).

All these mentioned factors contribute to increasing the already high percentages of obesity in the country (Aburezq et al., 2020; Al-Sayegh et al., 2012). Obesity is seen as a major issue for pregnant women, that contributes to several musculoskeletal conditions including lower back pain (LBP) (Heuch et al., 2010; Kostova & Koleva, 2001; Shiri et al., 2010). Within Kuwait, obesity is prevalent among the general population, as 37.9% of adults are obese (Obesity Rates by Country, 2020). Al-Sayegh et al. (2012) identified 80% of pregnant women as being in the overweight or obese categories. This shows that this alarming health issue facing pregnant women in Kuwait is increasing. Furthermore, culture and traditions are an essential part of life in Kuwait, and sometimes they submerge all other factors. For instance, education is mandatory and free for all citizens, which is expected to have a positive effect on increasing the awareness of what constitutes a healthy lifestyle for pregnant women. However, there exists a tradition whereby resting during the first and last three months of pregnancy is very common in Kuwait (El-Haddad, 2003). This may be an important factor that affects the functional performance of pregnant women.

4.2. Methodology for the Qualitative Study

4.2.1. Introduction

This section describes the methodology underpinning the qualitative study and offers a detailed overview of the methods used in the study. The first section discusses the qualitative methodology, stating both the rationale for using certain qualitative methods and the implications of the findings arising from using these methods. The second section explains the data collection procedure and analysis method.

4.2.2. The Study Rationale and Design

4.2.2.1. Rationale

This study's rationale is grounded on three main points, drawn from the existing literature. First, the bulk of the literature on functional performance tests has focused on testing functional performance through self-reported measures, primarily questionnaires, rather than physical functional performance tests. No coherent rationale has been advanced for the limited use of PFP tests among pregnant women and, currently, the literature offers no specific strategies to address the barriers, facilitators, and acceptance of the PFP.

Second, there exists a positive correlation between LPP during pregnancy and musculoskeletal adaptation, which results in decreased trunk coordination, strength, and flexibility (Hegaard et al., 2011). Detailed knowledge of the correct use of PFP tests is essential when assessing or evaluating pregnant women with LPP. However, the literature still has a significant gap about the proper applications of PFP testing in pregnant women.

Finally, there is only a limited understanding of the effectiveness of the interventions found within the investigated literature. Further research is crucial to informing the continued development of such tests to improve the assessment of LPP during pregnancy, allowing this gap in the existing knowledge to be adequately addressed.

4.2.2.2. Ontological and Epistemological Underpinning

The researcher's main perspective within a qualitative framework is that people's experiences, knowledge, opinions, and comprehension are significant aspects of social reality. Research questions are therefore created with this basic notion in mind, investigating these occurrences and considering them in light of the researcher's prior ontological perspective. Realists emphasize the importance of macro-level forces and social processes that are outside of human control, according to (Blumberg et al., 2011). These have a significant impact on people's ideas and behaviours. However, gaining complete knowledge of these events requires an appreciation of subjective individual perceptions of reality at the individual human, i.e. the micro level. As a result, the realism approach taken by this study in explaining the broad forces and affecting processes, identifying the external aspects, and examining how individuals perceive and give meaning to their circumstances is necessary.

However, if the researcher adheres to a completely subjectivist ontological perspective and, on the other hand, an interpretivist or constructionist (strong or weak) approach concerning epistemology, then such a study may have quite different consequences. According to Lincoln et al. (1985), social science research entails the creation of many, socially produced realities, which demand a comprehensive analysis from an interpretivist and subjectivist ontological and epistemological perspective. Additionally, they argue that individuals should be the primary data-gathering tool for this kind of research. In addition, to reduce the challenges of using non-human instruments or statistical tools to interact with human subjects, this human-centric approach to data collection can also show how participants have constructed the various realities of the phenomenon they are studying. One of the main ideas of this perspective is that "the knower and the known are inseparable" (Lincoln et al., 1985). As a result, the researcher's viewpoint has to be anchored in the research context and value-bound, with participants being in their natural environments. This is necessary because, to fully understand participants' reality, their context must be taken into account.

The term "LPP" refers to chronic illnesses and back pain that afflict pregnant women and make it difficult for them to carry out everyday tasks. These can be diagnosed, and there is a wealth of evidence supporting this (Olsson et al., 2009;

Olsson & Nilsson-Wikmar, 2004). There is a lot of evidence to show the favourable relationship between LPP and the musculoskeletal adaptations made during pregnancy, which often lead to a decline in trunk strength, flexibility, and coordination (Hegaard et al., 2011). Thus, functional performance tests—which are still crucial for diagnosing and treating pregnant women with LPP—can help a single pregnant woman with LPP lower her chance of developing LPP. Nevertheless, LPP is a genuine phenomenon, and pregnant women are still at risk of suffering from LPP during their pregnancy, regardless of their thoughts about it.

Social variables, such as social media and encounters with other patients who have LPP, can moderate pregnant women's perceptions regarding LPP (A. M. Clark et al., 2007). These ideas can therefore affect how LPP pain is perceived and how related health behaviours are affected (A. D. Clark & Reid, 2002; Emslie et al., 2001). When it comes to encouraging functional performance during pregnancy, knowledge (such as whether functional motions are safe) is equally crucial (Connelly et al., 2015). It has been determined that professional health experts are an essential source of information for pregnant women seeking advice on healthy lifestyle choices. Enhancing pregnant women's safe functional performance throughout their pregnancy and motivating them to continue their active lifestyles may be possible with the help of this information transfer (Evenson et al., 2009). Qualitative research has shown that health professionals advised pregnant women on physical exercise only when necessary, with some claiming to have gotten no guidance at all (Shum et al., 2022). Consequently, to properly describe the nature of these occurrences, it is necessary to understand physiotherapists' perceptions, attitudes, and beliefs regarding LPP.

In this study, two groups of senior physiotherapists with expertise participated. Although both groups were in the same environment, their varying responsibilities and backgrounds in the industry eventually led to variations in their views and experiences both within and between these groups. Through the interviews, the participants were able to share their perspectives on the obstacles they encountered when assessing pregnant women. In addition, the interviews aimed to find out whether any task-related, environmental, or human facilitators may aid in achieving functional performance. Respondents acknowledged in their statements that contacts with other colleagues might have an impact on their knowledge, attitudes, and behaviours. The interviews' knowledge and impressions may thus be seen to be very context-specific due to the various social factors present in this situation.

The idea that a phenomenon exists but cannot be completely quantified or understood is indicative of a critical realism stance from an ontological standpoint. According to critical realism, "our beliefs and expectations play an important role in how we perceive facts, particularly in the social realm" (Bunge, 1993). Consequently, critical realists believe that reality exists apart from human views and can only be comprehended via the perspectives and interpretations of certain individuals (Ritchie et al., 2003). In this study, it is important to comprehend how LPP is viewed, how the risk associated with it is recognized, and what factors may affect how well the functional test is performed in the context of skilled senior physiotherapists and their surroundings. It is, therefore, necessary to adopt a critical viewpoint that permits a more comprehensive understanding of the intricate and highly context-specific phenomena at work to comprehend the expert physiotherapists' perceptions of the obstacles, enablers, and acceptability of utilizing these functional performance tests on pregnant women. Thus, I adopted a critical realism viewpoint while conducting this study.

4.2.2.3. Study Design

The study's rationale was to develop research methodologies to comprehend participants' perspectives on two major phenomena: the causes of the limited use of physical functional performance tests by the physiotherapists, and the obstacles, enablers, and acceptance that impact this use. The study also looked at how these perspectives may be applied to direct future therapies that use a mix of specific physical performance measures on pregnant women with and without LPP.

Qualitative analysis deals with significance and interpretation and aims to explain various phenomena within social and organizational contexts (Lapan et al., 2012; Silverman, 2014). The exploration focuses on the multiple perspectives of the physiotherapists, constructing knowledge from their responses, and therefore the qualitative approach was considered to be the most appropriate approach for this study. Following the recommendations of Saunders et al. (2016), this study was designed as an exploratory study. It adopts a qualitative approach; semi-structured interviews were used to collect data from physiotherapists with a role in providing care for pregnant women with LPP. Addressing the above-noted gap in the literature, it aims to identify the barriers, facilitators, and acceptability of the PFP tests.

The study aimed to understand the views of the participants regarding two key phenomena:

1. To identify the barriers and facilitators that affect the use of functional performance tests among pregnant women with LPP.

2. To measure and report physiotherapists' knowledge and perceptions regarding the feasibility of applying the tests in clinical practice.

4.2.3. Pilot Study

As to Bryman (2016), in qualitative research, it is crucial to carry out a pilot test to verify the viability of the study protocol. This is because it can unveil the study's shortcomings and assist researchers in identifying the challenges associated with participant recruiting and data collecting. It might also assist them in assessing the reliability of the inquiries (Janghorban et al., 2014).

A pilot test was conducted including physiotherapists to verify the representativeness of the test methodology. The heads of departments at Kuwait's five maternity hospitals—two of which are private and the other two are public—were notified of the initial request for participation (see Appendix 4). If a senior physiotherapist has worked with pregnant patients for at least ten years, they were invited. Physiotherapists who met these requirements and agreed to participate in an interview were requested to confirm their interest by phone or email to the researcher (see Appendix 3).

Focus group interviews were held with two physiotherapists who accepted the offer, and online Zoom interviews were undertaken due to the Covid-19 conditions. The researcher performed the interviews in English because that is the language used in Kuwaiti healthcare. The researcher assisted the focus group. The supervisory team then went over a transcript and video of the interview to make sure everything flowed smoothly and to look for any problems with data gathering. Based on their expertise, the physiotherapists' interview questions were created to determine the causes of the low usage of PFP testing among expectant mothers as well as the obstacles, enablers, and acceptability of its use. Since the interview's main topics were meant to be thoroughly examined, the amount of time required was noted to make sure that most respondents had enough time to comprehend and provide a suitable response to each issue. The interviewees were advised that they were not obligated to respond to any questions that might make them uncomfortable. They were informed that they might leave the research at any moment and that any inquiries were appreciated. They were told that they might refuse to respond to any inquiry, without giving an explanation. In addition, the participants were invited to share any concerns or doubts they had about grasping the questions' core idea.

After completing this part of the process, the focus group pilot test findings were evaluated, and it was discovered that the test had gone well, and had been well explained. We edited some of the questions after discussing feedback on one remark with the supervisory staff. For instance, two generic questions were utilized in place of three precise, in-depth engagement inquiries. In light of further comments relevant to the preliminary questions, one broad, focused inquiry was utilized in place of four specific ones.

4.3. Data Collection Procedure

Focus group interviews were conducted with all of the participating physiotherapists. The initial call-out for participants was sent to the heads of department of all five maternity hospitals in Kuwait, both public and private (that is, the public and private wings of the AlSalam, AlSeef, and Royal Hayat hospitals) (see Appendix 4). The heads of the department then passed the study invitation on to senior physiotherapist staff with a minimum of ten years of experience working with pregnant women. Physiotherapists who met these criteria and were willing to be interviewed were asked to email or telephone the researcher to confirm their interest (appendix 3). Once these initial responses had been gathered, a follow-up email was sent to each participant to confirm their interest and availability. A further email was then sent, combined with a phone call, to remind the participants, two days before the scheduled session. Due to circumstances related to COVID-19, the interviews were conducted online via Zoom and were divided into two group sessions. All of the participants were required to complete an online consent form, prior to the commencement of the interview process, particularly any recording.

A team consisting of a moderator (the researcher) and an assistant moderator (Dr. Salma) led the focus groups. The moderator facilitated the discussion, with the assistant moderator taking notes, monitoring the recording equipment, briefing the session with the moderator, and also reading and commenting on the subsequent data analysis (Pickering & Watts, 2013). The assistant moderator. Dr. Salma was a specialized medical doctor who had worked for the Kuwait Ministry of Health for 14 years. She obtained her PhD in health care education from the Boston University School of Medicine and had 14 years of experience working in public health and supervising government-led research in the medical field. She had extensive experience in conducting medical research in a Kuwaiti context and thus formed an ideal candidate for assistant moderator, helping to minimize any potential bias and ensuring the integrity of the data collection process.

Since English is the language of health care in Kuwait and is also the language of study for physical therapists, interviews with the two groups were in English. Since each interview lasted for an hour, the majority of interviewees had enough time to comprehend and provide a suitable response to each topic (see appendix 5). Based on their experience, the physiotherapist's interview questions were designed to help them understand the reasons for pregnant women's restricted usage of PFP tests as well as the obstacles, enablers, and acceptability of its use. There were five main questions in the interview that needed to be investigated in-depth. The scoping review research and the literature review served as the basis for all of the interview questions **(see chapter 3)**. The participants were asked to rate the usefulness of functional assessments as well as the length, number of tests, and clinical significance of the functional performance evaluation in their practice. Additional questions were created to investigate the physiotherapist's viewpoint utilizing all three tests in combination, as well as if it is therapeutically appropriate and relevant. Additionally, throughout the interview, the researcher asked follow-up questions **(see Appendix 5 for interview guidelines questions)**.

Before I started the interviews, I explained the purpose of the study, and the participants were encouraged to be honest, reminded that the interviews were confidential, and informed that there were no right or wrong answers and that the researcher did not have any predefined expectations of them.

4.3.1. Data Management and Analysis

4.3.1.1. Introduction to Framework Analysis

Numerous possible approaches were considered for the qualitative analysis of this study's data, including thematic analysis and the grounded theory approach. However, it was determined that framework analysis was the most appropriate method for managing and analysing the study's data. This is a form of thematic analysis, and a method for "systematically identifying, organising, and offering insight into patterns of meaning across a data set" (Braun & Clarke, 2012). Framework analysis was chosen over other forms of analysis for this study for three key reasons: first, as explained in section 4.2.2.2, the study aimed to explore physiotherapists' perceptions of the barriers, facilitators and acceptance regarding the use of the PFP with pregnant women suffering LPP from a critical realist perspective. The grounded theory approach, which is more closely aligned with a social constructionist perspective, was less appropriate for this context as it was unsuited to dealing with emerging issues (Lawrence & Tar, 2013). Interpretative Phenomenological Analysis (IPA) was also considered, but this was also ruled out as it required a detailed examination of the participants' lived experiences (Smith & Osborn, 2007), which lay beyond the aims of this study.

Second, framework analysis fulfilled this study's need for a systematic, transparent approach to the thematic analysis of the data. It allowed the direct comparison of responses from different categories of respondents: step 5 (**Table 4.1**) in particular involves the creation of matrices highlighting the similarities and differences between the perspectives of the respondents. As one of this study's objectives (objective 1) is to identify the barriers and facilitators that affect the use of functional performance tests among pregnant women with LPP, the use of matrices in framework analysis was crucial in supporting this comparison.

Finally, the stepwise processes of framework analysis ensure that the data analysis procedure remains grounded in the data (Ritchie et al*.,* 2013). This guarantees that, as the themes move from being more descriptive to more analytical, the essence of the data is not lost. The steps taken to achieve this are described in section 4.3.2.

There are two versions of framework analysis. The first version, outlined by Ritchie & Spencer (1994), remains the most widespread version used by researchers, as indicated by searches performed on the use of framework analysis in qualitative studies as part of the literature review for this study. There is also a second version, released by Ritchie et al. (2013), which is the one used in this study **(Table 4.1)**. Numerous small differences exist between the 1994 and 2014 versions of framework analysis **(Table 4.1)**, the most crucial being that the thematic framework is finalised at a later stage, and the analysis of the data is constituted as additional steps.

Framework analysis predominates in healthcare research across a range of contexts, such as in studies of the socioeconomic factors affecting cardiac rehabilitation (Pedersen et al., 2017), disordered eating patterns in coeliac disease (Satherley et al., 2017), and nursing students' learning regarding experiences of living with chronic conditions (Olson et al., 2016). Despite this wide variety of usages, there are two disadvantages to using framework analysis that must be carefully considered. Firstly, it is time-consuming and resource-intensive, placing significant demands upon the research that are not always justified by the content of a given study. Second, the successful use of framework analysis is dependent on a multidisciplinary team led by a qualitative 'expert' on the method (Gale et al., 2013). Non-experts can carry out this process, but input by a researcher with experience in qualitative data analysis is preferable (Gale et al., 2013). As this study was undertaken as my doctoral research, and under commensurate limitations of time, this study needed to be guided by a team of two supervisors, both of whom were involved in the creation of the thematic framework. This helped to ensure the credibility of the research process (section 4.5).

Table 4.1: Similarities and Differences between the 1994 and 2014 Versions of the Richie and Spencer Framework

Steps	First (1994) Version	Second (2014) Version	Comment for 2014 Version
1	Familiarisation	Familiarisation	No change from the first version
2	Identifying	Constructing an initial thematic framework	No change from the first version apart from the name
3	Indexing	Indexing and sorting	Similar to the first version, but the

			thematic framework is not finalized in this step.
4	Charting	Reviewing data extract	The thematic framework is reviewed and finalised
5	Mapping and interpretation	Data summary and display	Same as step 4 (charting) of the first version; charts are referred to as “matrices”

4.3.1.2. Management of the Data

Following the guidelines provided by Ritchie et al. (2013), five steps were followed in managing the data.

Step 1: Familiarisation

I listened to the audio recording of each interview and went over the text and field notes again to get a basic understanding of the data. Two transcripts in total, one with five participants (two from private clinics and three from public hospitals), and the other with two from private clinics and two from public hospitals were determined to be the most representative in terms of their data coverage and were subsequently examined in more detail. Then, with the help of a subject-matter expert, I looked at each of these transcripts separately and more thoroughly. In these two transcripts, we each labelled the data extracts by giving them meaning-giving sentences. Next, all of the labels which corresponded to a single broad category were collected. An ‘area’ was defined for this research as a collection of labels that were associated with a specific notion or idea. Similarly, the word ‘broad’ was employed during this initial phase of the analysis to denote my initial impressions of the data. These broad areas were constructed to address the study’s objectives, the questions in the interview guides, and recurring topics throughout each transcript. After we had completed this step independently, we gathered to discuss the labels and broad areas that had been identified. Based on these discussions, five broad areas were created during this initial stage:

1. Participant characteristics
2. Perceptions of the barriers to PFP tests
3. Perceptions of the acceptance of PFP tests
4. Knowledge of assessing pregnant women with LPP
5. Experiences of physiotherapists regarding the current PFP tests

Step 2: Construction of the Initial Thematic Framework

During this stage, the large section labelled 'miscellaneous' was eliminated, and all of its labels were merged into the remaining categories. After that, each broad category was reclassified as an 'initial theme' and given a description to help guarantee that the data extracts were allocated to the appropriate location. Every initial theme was divided into smaller, more logical parts, known as the initial subthemes (**Table 4.2**). An initial descriptive thematic framework was then constructed, using a combined inductive and deductive approach. This approach required the examination of each of the seven broad areas and their assigned labels as identified during the familiarization stage. Ritchie & Spencer (1994) suggest that the process of developing framework categories is informed by both a priori concerns and emergent issues arising from the earlier familiarization step. During meetings with the assistant mediator, the initial themes, subthemes, and their meanings were discussed to ensure that they were coherent and relevant to the objectives of the study. Any subthemes that were considered irrelevant to the study's objectives were removed at this step: this allowed the iterative refinement of the initial thematic framework during its construction.

Table 4.2: Initial Thematic Framework

Initial Themes	Initial Subthemes
Participant characteristics	Specialist
Description: characteristics of	Physiotherapist
physiotherapists that are relevant to	Work experience
the study	Other

Physiotherapists' knowledge of functional performance tests **Description: what physiotherapists' know about LPP and its safety**	Knowledge of assessing pregnant with LPP pain Knowledge of the challenging factors related to LPP patients Other
Physiotherapists' perceptions of the barriers to using functional performance tests **Description: Physiotherapists' perceptions of the barriers to using functional performance tests with pregnant women with LPP pain**	Obstacles related to patients' conditions Cultural reasons for avoiding their usage
Factors that facilitate the acceptance of functional performance tests **Description: Factors that will facilitate or serve as a barrier to physiotherapists using functional performance tests with pregnant women with LPP pain**	Points to consider before applying functional tests Decision-making points Patients' conditions Other
Experiences of physiotherapists with the current or past functional performance tests **Description: Experiences, whether negative or positive, of physiotherapists with performance tests**	Communication strategies Techniques for using performance tests Other
Opinions about the proposed intervention of functional performance tests **Description: Physiotherapists' opinions about using functional performance tests**	Patients' capability Functional limitations Functional impairments Challenges to the usage of functional tests

Step 3: Indexing and Sorting

The nine transcripts were then subjected to the first theme framework. A portion of the transcript data was allocated to each subtheme to which it was thought to be linked. Under the relevant theme, any data which did not correspond to any of the subthemes already in use was labelled ‘other’. After this procedure was completed, titles were assigned to every data extract marked ‘other’ and each was included in the set of subthemes related to the pertinent topic.

Step 4 Reviewing the Data Extracts

We went over each data extract to make sure no important themes or subthemes had been overlooked. Additionally, this evaluation brought to light the significant overlap that existed between the subthemes for many themes; as a result, several themes were combined. This strategy resulted in the finalization of the theme framework.

Step 5 Data summary and Display

To simplify the table interpretation, matrices for every theme were created in NVivo, and then exported into Microsoft Excel. There were four matrices, one for each theme determined by the finalized thematic framework. Each matrix displayed the relevant subthemes along with the data extracts and their summaries. Thus, each matrix allowed the researcher to compare the responses from each of the physiotherapists across each theme. An example matrix is shown in **Table 4.3** (please see the full table in appendix 6).

Table 4.3: Matrix Showing the Physiotherapists’ Perceptions of the Barriers, Facilitators, and Acceptance Related to the Use of Functional Performance Tests with Pregnant Women

The Barriers	Barriers Related to Patients’ Conditions	Barriers Related to Culture

The possible barriers to using the proposed functional performance tests are divided into two categories, some of them related to the patient's condition or the cultural barriers. ***"I can find some disadvantages. same as what he said what my colleague said that sometimes the patient, as we said the patient her functional level"* (G1, P1)** ***"The cons it's not the cons, but a possible barrier let's say the pain, could be a barrier or sometimes."* (G2, P8, page 12)**	**Some barriers are related to pregnant women's conditions, such as their pain level or morbidity, that affect the patients' capability to perform the tests.** **The severity of pain may be an obstacle to performing the functional tests and may prevent movements.** *"even but patients with pain depends again severe very severe I don't think they can tolerate this, but most patients, I think, from my experience, whatever kind of pain, they have, I think they can tolerate this uh huh Thank you yeah." (G2, P9, page 12)* *"Patients with chronic especially chronic lower back pain, they have fear avoidance, believe so. Will this be in my mind? With us in mind, when they were when they have this believe they will have the belief that they have a poor functional capacity so even a simple test like walking or sitting to stand, they will feel that it's difficult for them to perform, so this could be a barrier"* (G2, P8, page 12) Pregnant women may complain of other morbidities with LPP, so this may affect their performance and capability to perform the tests. *"if the patient has core morbidity, other morbidities in addition to lower back pain, this*	**Barriers related to cultural beliefs and the environment, such as the sedentary lifestyle, fear avoidance, and cultural understanding.** **The sedentary lifestyle may be a possible barrier to using the proposed functional performance tests.** *"as well stated in Kuwait, we have a high percentage of a sedentary lifestyle, so I think, women are very inactive before they actually get pregnant. And so, with all the changes that they go through their bodies go through after pregnancy, it makes it very hard for them to become active and functional so that could be one of the cons of administering the three."* (G1, P5, page 8) Pregnant women without an active lifestyle may face fatigue due to combining three tests in a row at once. *"I'm worried about the fatigue and the level of pain"* (G2, P6, page 11) In addition, there is a common belief that being active in the 1st or 3rd trimester may cause a miscarriage or affect the baby's health. *"We have a cultural understanding, especially in the first and the third trimesters that women shouldn't move. You know it's risky for the baby and*

	could also be a factor. That will affect you know her ability not for as physiotherapy I think it's easy and she can do it, but for some patients, we have to consider you know these factors before applying the test yes." (G2, P8, page 13)	*so maybe some of the movements that they are asked to do, or the amount of time that they need to spend doing those functional tests can put them off, so I think those are some of the cons of administrating those tests."* (G1, P5, page 8)

Is it acceptable/feasible to use in the clinic?	Reasons to accept it (advantages)	Reason to not accept it (disadvantages)
The advantages of the proposed functional performance tests outweigh the disadvantages. ***"This is always the case when you combine exercises and tests, but a few put them on a scale and, if you want to weigh the advantages and disadvantages, I think, in that scenario, the advantages are far away and far more than the disadvantages, so in my opinion, it's a good idea, I think it will help our patients and our pregnant women that we see in our practice, so I think it's a promising method to add to our practice."*** **(G1, P3, page 9)**	A possible advantage of the context of the tests is that it reflects general functional performance by using an objective measure, that can overcome the disadvantage of measuring endurance. *"the physiotherapists' opinions need to be measurable rather than subjective. We do subjectively ask the patients if they can walk and they can sit. We see them sitting and standing through observation, but now we are doing it through testing, which is good, measurable" (*G2, P9, page 11)	A possible disadvantage of the context of the tests is that it can't isolate functional impairments, which may make it difficult to consider it as an indication of her dysfunction and can cause fatigue for patents. *"Regarding pain for a pregnant woman with low back pain, these are not indicated not an indication of her dysfunction or her pain. It will not give any indication of any kind of what her problem is"* (G2, P9, page 10)

Text underlined: researcher's summary; Text in italics: direct quotes from the participants

4.3.1.3. Abstraction and Interpretation

Abstraction and interpretation were the final steps in the analysis process. The process was divided into two steps: defining the categories and creating an analytical thematic framework.

Development of the Categories

Due to the exploratory nature of this research, the analysis sought to find a variety of viewpoints pertinent to its goals and contrast them between the two groups (private clinics and public hospitals). This stage required a review of the descriptive thematic framework to evaluate the data gathered for each topic and subtheme in-depth. Every data extract summary was accomplished by first extracting each data summary from each matrix, and then listing the characteristics and distinctions among the responses for each summary. This approach is illustrated, utilizing subtheme summaries, in **Table 4.2**.

The discovered components were then contrasted based on their similarities with the same concept or problem. Parts of the summaries that were originally under one subtheme were relocated because they seemed to fit better elsewhere. The term 'categories' was used to describe the collection of all of the linked components under one label. **Table 4.5** illustrates this process, utilizing a few of the elements from **Table 4.4**.

Table 4.4: Detected Elements from the Subtheme 'Advantages of Using the Functional Performance Tests'

Data Summaries for the Subtheme: Advantages of Using the Functional Performance Tests	**Detected Elements**
The aim of the physiotherapy sessions influenced the planning for the assessment and evaluation tools as well as the treatment plans and strategies.	• Improving functionality and independence while maintaining safety. • Identifying the functional impairments behind the limited functional performance. • The main concern of the patient is to reduce pain.
The general practice in performing the functional tests with pregnant women in the clinic will help to understand the feasibility of	• Different kinds of ADL activities used to be tested in the clinic. • There are common target functional impairments that physiotherapists are looking for.

applying the functional performance tests.	• Using different types of tests with pregnant women with LPP. • The variety of time spent assessing functional performance in the clinic. • The number of tests they chose during the session. • Progression of testing. (How to progress in testing)
The physiotherapists' aims regarding using functional tests during the assessment session provide an insight into what is needed from the functional tests and for what assessments the physiotherapist uses them.	• Combining different tests to investigate more than one target functional impairment. • Identifying which activities are limited and where the difficulties lie while performing the ADL. • Using the functional tests to help to confirm the subjective findings by using an objective measure. • Assessing the movements in different body segments. • Assessing the relationship between pain and the performance of the task.
The advantages of using the functional performance tests.	• Saving patient effort, by providing a short test. • Obtaining rich insights into patients' situations • Guiding further assessment or the planning of rehabilitation programs.

Table 4.5: Categorisation of Detected Elements from the Subtheme 'Advantages of Using the Functional Performance Tests'

Detected Element	Categories
• **Improving functionality and independence while maintaining safety.** • **Identifying the functional impairments behind limited functional performance.**	All elements relate to the patients' goals from the session Category name: patients' aims
• **The main concern of the patient is to reduce pain.** • **Different kinds of ADL activities are tested in the clinic.**	All elements relate to the physiotherapists' goals from the session Category name: physiotherapist aim
• **There are common target functional impairments that physiotherapists are looking for.** • **Using different types of tests with pregnant women with LPP.**	All elements relate to the functional tests Category name: the functional tests
• **The variety of time spent assessing functional performance in the clinic.**	All elements relate to physiotherapist strategies

• **The number of tests they choose during the session.** • **Progression of testing. (How to progress with testing)** • **Combined different tests to investigate more than one target functional impairment.** • **Identifying which activities are limited and where the difficulties lie while performing the ADL.** • **Using the functional tests to help to confirm the subjective findings by using an objective measure.** • **Assessing the movements in different body segments.** • **Assessing the relationship between pain and the performance of the task.** • **Saving patients' effort, by providing a short test** • **Obtaining rich insights into patients' situations** • **Guiding further assessment or the planning of rehabilitation programs.**	Category name: physiotherapist strategies All elements relate to patients' difficulties Category name: patient impairments. All elements relate to analysing the findings Category name: finding analysis. All elements relate to the capability of the patients. Category name: patient capability. All elements relate to planning. Category name: guidance.

Development of the Analytical Thematic Framework

The creation of the analytical subthemes and themes was required for this step (**Table 4.6**). To find the overarching idea or notion that best suited what they represented, groups of categories were first examined to generate the analytical subthemes. Key emergent themes were nevertheless discovered even when there was insufficient information to support the creation of distinct categories for a given subtheme. Corresponding to this, the analytical subthemes were examined to discover what essential concepts emerged from them to produce the analytical themes.

Table 4.6: Development of the Analytical Thematic Framework

Categories	Key Emerging Concepts	Subthemes	Key Emerging Concepts	Analytic Themes
Patients' aims **Patients' impairments** **Patients' capability**	Aims divided into two stages, one related to patients' limited knowledge	Patients aim to reduce the pain.	Different aims while dealing with pregnant women with LPP.	PT's Knowledge of implementing the functional tests

Physiotherapists' aims Physiotherapists' strategies	Physiotherapists demonstrated two categories, one related to the tests themselves and the other to the physiotherapists' strategies when applying the tests.	Knowledge of functional tests	Understanding the general practice related to using the functional tests with pregnant women at the clinic.	PT's Knowledge of implementing the functional tests
The functional tests	The clinical significance of using the functional tests is related to either evaluation or progression/planning aspects.	Assessment of functional tests	Applying the functional performance tests in the clinic while assessing pregnant women with LPP is clinically significant.	PT's Knowledge of implementing the functional tests
Guidance	The advantages of using the functional performance tests with patients and some to the physiotherapist therapist.	Progress and evaluate the treatment plan	The functional performance tests play an important role in assessing pregnant women with LPP.	PT's Knowledge of implementing the functional tests

4.4. Findings

This study aimed to explore the barriers and facilitators affecting the use of PFP tests among pregnant women with LPP. This section presents the study's findings regarding the participating physiotherapists' knowledge of implementing PFP (objective 1) and their perceptions of the proposed PFP test (objective 2).

4.4.1. Sample Characteristics

As discussed in the methodology section, nine expert senior physiotherapists were interviewed for this study. Of the nine respondents, six were females and three males, and all had full-time staff roles in either a public hospital or a private clinic. Four participants worked in public hospitals, four worked in private clinics, and one worked in both. The participants' characteristics are shown in **Table 4.7**.

Table 4.7: Characteristics of the Participants

Participant	Gender	Organization	Educational Attainment	Years of Experience in the Field
1	Female	Private Clinic and public hospital	BSc Physiotherapy	11 years
2	Female	Public hospital	BSc Physiotherapy	16 years
3	Male	Private Clinic	PhD Physiotherapy	14 years
4	Male	Public hospital	PhD Physiotherapy	15 years
5	Female	Private Clinic	PhD Physiotherapy	12 years
6	Female	Public hospital	PhD Physiotherapy	15 years
7	Female	Public hospital	PhD Physiotherapy	15 years
8	Male	Private Clinic	BSc Physiotherapy	15 years
9	Female	Private Clinic	MSc Physiotherapy	11 years

4.4.2. Themes Development

The analysis focused on exploring the participating physiotherapists' knowledge about implementing PFP tests. These findings are presented under two main themes:

Theme 1: considerations to be made before applying PFP tests; this discusses subjective evaluations of patients' lifestyles, as well as the factors influencing their presentation, such as patients' complaints, conditions, and beliefs.

Theme 2: physiotherapists' knowledge about implementing PFP tests; this includes a discussion of how physiotherapists assess the PFP and evaluate patient progress and the corresponding treatment plans.

These themes are comprised of subthemes, which are further divided into categories, as shown in **Table 4.8**.

Table 4.8: The Themes, Subthemes, and Categories Relating to Physiotherapists' Perceptions of the Barriers, Facilitators, and Acceptance Regarding Functional Performance Tests

Themes	Subthemes	Categories
1. Considerations to be made before applying functional tests.	a) Subjective evaluation of patients' lifestyles and complaints. b) Patients' conditions and beliefs.	Decision-making based on the patients' status Decision-making based on the findings Challenges arising from the patients Challenges arising from the tests
2. Physiotherapists' knowledge about implementing functional tests.	a) Improving functionality and independence whilst maintaining patient safety. b) Patients' progress and the evaluation of treatment plans.	Guidance Assessing functional performance

4.4.3. The Sample, Sampling Strategy, and Recruitment

A non-probability, purposive sampling technique was employed as the key sampling strategy for this research. Using this technique, nine expert senior physiotherapists were selected for inclusion in the study. Under this sampling method, the researcher chooses the participants deliberately, based on certain key characteristics (Etikan et al., 2016). The purpose of this type of sampling is to choose participants who are information-rich and ready to provide information that will contribute to knowledge of the phenomenon of interest (Ali et al., 2018). As such, the rationale for this sampling approach was focused on accessing those respondents with the strongest ability to answer the research questions of this study.

Further crucial factors that contributed to this selection process were access to the interview sites and the availability of key informants (see 4.2.6 below for the Data collection methods/tools). Professional physiotherapists face heavy demands upon their time, and hence access to the hospitals where the interviews were to be conducted and the availability of the physiotherapists themselves were key considerations during the selection process.

Two focus groups were conducted, and nine senior physiotherapists in Kuwait were recruited to explore their experiences of using PFP in clinical practice. This resulted in two groups, with the numbers limited to four or five per group, with a minimum of ten years of experience in providing care for pregnant women in Kuwait. This was to ensure that the participants were familiar with the topic, able to provide an in-depth account of their experiences, and well-placed to comment on the use of physical performance tests among pregnant women in Kuwait.

Each focus group was interviewed once for up to an hour by the researcher and the assisting expert moderator. The latter was also involved in the analysis process as they possessed extensive experience in using qualitative research methods. Of the nine respondents, six were females, three were males, and all had a full-time staff role. The participants worked in both public hospitals and private clinics.

This sample size of nine individuals was chosen due to considerations of the point of saturation (**Table 4.7**). According to Bowen (2009), demonstrating saturation may be challenging since it depends on an intuitive understanding of the data, which may only be reached if the researcher is deeply involved personally in gathering and analysing the information. According to (Creswell, 2014) and Mason (2013), the point of saturation for a specific research endeavour determines the most appropriate sample size for qualitative research. The sophistication of the research goals and objectives (Charmaz & Belgrave, 2012), the nature and scope of the research, the data quality, the design of the analysis (Morse, 2000), the knowledge and experience of the researcher (Jette et al., 2003), the diversity of the population, and the number of selection criteria, in addition to the resources at hand, including the costs and time available, all help to determine the point of saturation (J. Mason, 2013; Ritchie et al., 2013).

According to their unique study features, various researchers have utilized various degrees of saturation, demonstrating that choosing the point of saturation is a challenging topic. In contrast to Creswell (2014), who claimed that his experiments' saturation points ranged between five to 25 participants, Guest et al. (2006) concluded that the best sample size for such research was seven sources, without clarifying why. Like Charmaz (2006), who recommended a minimum number of 25 sources, Bertaux (1981) claimed that 15 interviews are sufficient, although others needed about 20 interviews to reach saturation (Green

& Thorogood, 2009). Up to 50 interviews have been recommended by several researchers (Ritchie et al., 2003), however, this is an exception and may seem excessive to most qualitative researchers. It is also important to include M. Mason's (2010) study, which used qualitative interviews to examine sample size and saturation spanning 560 doctorate studies. He discovered that the doctoral researchers' mean sample size in their qualitative interviews was 31, on average.

Nonetheless, concentrating on the complexity of the data as well as the engagement between both the researcher and the participant while recognizing that the cut-off point in qualitative research is inherently arbitrary should be prioritized over the quantity of the data sources to produce rich insights (J. Mason, 2013). Thus, to guarantee that the results correspond to the reality which the respondents encountered, this study recruited a sample of physiotherapists who could provide a wealth of detailed information relating to the objectives of the study. In particular, the goal was to discover a feasible and desirable point of saturation in which the calibre of the responses took precedence over their number. Although it can be claimed that new data might emerge, the researcher believed that any new data was going to be less significant than those already gathered. Moreover, considering the short amount of time provided for the data collection and analysis, it is crucial to guarantee that suitable restrictions are imposed on the data gathering in a study of this sort. Excessive data can appear ‘unmanageable’ in the analysis that follows.

4.4.4. Ethical Approval

Ethical approval was granted by the ethics committee of Sheffield Hallam University by submitting information regarding the study’s nature, aims, objective, and recruitment methods (Ethic Review ID: ER28255453). Furthermore, the researcher requested in-country clearance from the Ministry of Health (MOH) while conducting the research in Kuwait, aware of the regulatory requirements, but this was regarded as unnecessary.

4.4.5. Informed Consent

Written consent was obtained from all of the participants prior to starting the study (Appendix 3). The following steps were taken to ensure that the participants understood the study clearly, prevent the possibility of coercion, and obtain informed consent from all participants:

a) All of the participants were informed that their involvement in the study was purely voluntary, and that they would be able to withdraw from it at any time, without giving a reason.

b) The participants were told that the interviews would be recorded using a digital audio device and that the data collected would be kept anonymous and under tight confidentiality. The researcher would save the taped interviews on a password-protected computer and keep them hidden in a cabinet in her office. The researcher indicated and clarified to the participants that their identities would remain anonymous both before and after the research. The focus group interviews were only in voice, and the participants could not see each other. Furthermore, each person joins using a number rather than their name, so even the reporting will remain anonymous.

c) The participants were informed that they were not required to answer any questions that might cause them distress during the interview. They were informed that they had the right not to answer any question, without providing a reason. They were assured that questions were welcomed, and that they could withdraw from the study at any time (appendix 3).

4.4.6. Themes

4.4.6.1. Theme 1: Considerations to be Made Before Applying the Functional Tests

This theme explores the key considerations that physiotherapists must make before applying the PFP tests. These include the subjective evaluation of patients' lifestyles and complaints, particularly concerning the decision-making strategies based on the patient's status. It also includes the patients' condition and beliefs, as they reflect the challenges that physiotherapists face when performing physical functional tests on pregnant women with LPP. The results of the study indicate that these did indeed constitute major factors to consider before applying functional tests, i.e.: a) subjective evaluation of the patients' lifestyles and complaints, and b) the patients' conditions and beliefs.

1) Subjective Evaluation

This subtheme describes the features of subjective evaluations in current medical practice and explains the key steps undertaken when evaluating pregnant women. All of the physiotherapists interviewed agreed that subjective evaluations were important, which included subjective Active Daily Living (ADL) limitations and previous physiotherapy sessions, as well as patients’ endurance, medical and pain history, as well as their complaints and observation records. The participating physiotherapists generally concurred that a subjective assessment session with a patient usually starts with information regarding their current condition and complaints, medical history, disability, functional activity level, and patient’s goals, but a subjective evaluation is considered to be the current standard for pain measurement.

Concerning subjective patient ADL limitations, the participants indicated that asking the patients about difficulties with their functional activities provides a basis for analysis and evaluation:

*“I focused on subjective history as well, because I think it's important to ask what functional limitations they experience at home. Like their ADL, what they can or can’t do, and then correlate that with what I see.” (*Participant 5)

“We try to take the pain history and the ADL limitations that the patients have to face, and from that point, we go more deeply into what they experience as limitations in their ADL, if they were doing something before, and couldn't do it now.” (Participant 2)

“I take the history, the daily activities, where they do things, what they can do and what they can't do; this is mainly subjective, and subjectively we can go and assess for how long can [the patient] walk.” (Participant 6)

Previous physiotherapy sessions also constituted a factor affecting these subjective evaluations. Participant 2 claimed that subjectively asking a patient if they had attended any previous physiotherapy sessions can strongly affect the flow of a session. Understanding whether a pregnant woman had been exposed to an evaluation tool, exercises, and a physical evaluation made it easier for the physiotherapists to select the most appropriate tests:

“It depends on the treatment or type of exercise that they were following before or not.” (Participant 2)

Key among the other subjective evaluation criteria, patient endurance was identified as a key factor for evaluating patients. Participant 9 mentioned that, during a subjective evaluation, it is important to test patient endurance before and after experiencing pain due to the time restriction on a treatment session. As such, it is generally easier to ask the patient directly ‘for how long you can walk?’:

“I have to ask about how long they can stand; how long they can walk. Because of time constraints, so subjectively we can go and assess how long do you walk before you get the pain, how long you can walk with the pain.” (Participant 9)

As mentioned above, physiotherapists depend on this subjective evaluation when assessing pregnant women with LPP, with taking the history of the patient’s pain or medical history being of key significance. According to the participants:

“A history of even back pain before getting pregnant means that they may have already passed through physiotherapy, they know that there are types of exercises that could reduce pain. And we can use so many techniques to decrease the pain underlying the patient’s coming to me as a physiotherapist.” (Participant 2).

Similarly, understanding a patient’s medical history was felt to be key in helping physiotherapists with their subjective evaluation:

“I’ll go just back to past medical history, to see if [the patient] was complaining of things related to lumbarpelvic pain. If they had any incident any accident or anything like that.” (Participant 10)

“Also, depending on the patient and their history, how I see, how I perceive their six-minute walk test for me is one of the tests that I go by.” (Participant 6)

However, during subjective evaluations, clinical observation measures can help to support patient self-reporting. Physiotherapists start assessing the patients from the moment they enter the clinic: observing the patients’ pattern of walking, the distance they walk, how they sit and move enriches the subjective evaluation and guides the physiotherapists’ choice of the most appropriate tests:

“We have to observe in the beginning, how they walk, how they sit, how they approach, to assess their need to go to the bed, and we begin assessing on this basis, so this is part of quick observations of how they can walk. From observing the patient walk the distance from the door to my office and back and through subjective questions.” (Participant 9)

“Then I ask the patient to do just some general exercises for myself. I will start to try to analyse and see why they cannot do that specific movement and so on,

moving to another movement; so, we'll start with that point, examining posture and we do some spine scans." (Participant 4)

"For me, I assess, you know, I start looking at the patients once they start coming from the door walking and how they sit. How they actually, you know, perform in front of me." (Participant 6)**.**

2) Decision-Making Regarding Patients' Status

The initial stage of patients' subjective evaluation was considered by the physiotherapists to be key in the process of choosing appropriate functional tests, as they claimed that sedentary pregnant women might be unable to perform certain tests. From the physiotherapists' perspectives, their main priority during this stage was to explore the patients' circumstances, particularly their "condition" and "capability". Overall, the key factors influencing the choice of PFP tests were the patients' functional limitations and impairments, based on the physiotherapists' own subjective findings.

When discussing the subjective evaluation process, the participants highlighted that each patient had their own limitations, history, and conditions, all of which affected the decision-making when choosing the most appropriate PFP test. This was described as the "Patient condition" and "Patient capability" part of the evaluation, and the participants explained that a subjective evaluation was useful when observing patients performing in specific relation to their patient condition and patient capability status.

The participants generally agreed that using their own experience as a means of connecting with patients during the subjective evaluation of the patient's conditions was helpful and could facilitate the evaluation:

*"If a patient comes to my clinic with shallow breathing and increased heart rate from just walking a small distance, I might use 10 metre walking test." (*Participant 1)

"So usually, I will ask them to repeat the movement several times to check the pattern, to identify the functional difficulties, to see if there is any accessory muscle recruitment, it depends on the case." (Participant 8)

However, physiotherapists consider the patients' capability to choose the most appropriate functional tests so, if a patient displays a limited endurance level, this would limit the choice of test available. This awareness of limitations was described as a useful way to approach the subjective evaluation and a means of encouraging patients:

"Depending on functional capability, if [the patient] can do it or not, the functional impairments and their problems, depending on that I choose my test." (Participant 6)

"I will share that I use the same or similar approach: usually there are no steps to follow in terms of my practice and evaluation. I just go with the flow and assess the patient's capabilities and then usually I find something that needs to be checked. I will do a maximum of two tests." (Participant 3)

3) Decision-Making Based on the Findings

This section further develops how the subjective evaluation operates in the participating physiotherapists' practice and includes further data segments that build on the previous ones. Here, "patient lifestyle" and "patient complaints" are identified as distinct entities.

Three participants mentioned that consideration of patient lifestyle was significant during the process of choosing appropriate PFP tests. In particular, they claimed that sedentary pregnant women might be unable to perform certain tests:

"As you know, the functional level of the patient, whether they are an active patient or a sedentary patient, having a sedentary lifestyle, that will all limit the number of tests that I can apply for the patient." (Participant 1)

"Regarding the functional test, I usually get stick to one only; I don't use too many because most of my patients, to be honest, are the kind of patients who have sedentary lifestyles, they're not doing any kind of exercise before getting pregnant." (Participant 2)

Another participant described how they considered the patient's performance similar to participants 1 and 2, but included additional exercises to determine the patient's normal level of activity:

"For myself, maybe I'm going to ask the patient to walk and then go up the stairs at the clinic, then if the patient is a bit active, depending on the level of activity, maybe doing some squats or push-ups on the wall, lifting some weights in the gym." (Participant 4)

However, there was a clear acknowledgment of the potential usefulness of patient complaints in guiding physiotherapists to choose an appropriate test type, as well as determining the tests' intensity, frequency, and repetition. Knowledge of a patient's complaints thus assists in the choice of assessment and evaluation tools designed to meet the patient's goals.

Participant 1 outlined their assessment considerations prior to the application of the PFP tests:

"*First of all, the functional performance test: to select the best one, it usually depends on their complaints, the patient complaints." (Participant 1)*

"Patient's complaint will guide me as to which assessment or test I have to do for them" (Participant 6)

4) Challenges Arising from Patient and Test Specifics

Concerning functional evaluation, the participating physiotherapists indicated that different patients' "conditions" and "beliefs" were found to be crucial factors affecting the administration of the PFP tests. During pregnancy, for example, the dynamic stability of the pelvis may be affected due to hormonally-induced ligament laxity, which leads to decreased muscle strength. This physical condition has a crucial impact on the results of such tests, particularly as they are observed during the early stages of pregnancy as well as postpartum. A further key factor affecting functional evaluation is the patients' beliefs. As such, it is crucial to assess how a patient's condition and beliefs might affect the administration of the PFP tests.

Patients' conditions can not only affect the process of choosing appropriate PFP tests but also present challenges for the individuals who are performing the tests. The participants emphasised the notion of "patients' conditions" during the functional testing:

"So, I do the mix of both. It depends on the conditions of, you know, they will bring a woman, usually they come with pain, so depending on what their condition is, so you could just choose what's suitable for their condition." (Participant 9)

"I will ask the patient to carry some weights or lift some weights, to sit, to stand, heel raise, bending in all directions, rotations, stepping, I think even shoulder mobility depends on the case." (Participant 8)

Nonetheless, “patients’ beliefs” can also present challenges in terms of a fear that tests can carry the risk of miscarriage, especially during the first three months of pregnancy. The benefit of this subjective evaluation could thus be an enhanced sense of the causes of a patient’s stress, resulting in an increased ability to cope with a worrying situation arising from a patient’s personal beliefs.

Participants 2 and 3 claimed that the traditional beliefs held by a patient could present challenges when using PFP tests, especially in Kuwait, where the culture encourages rest in the first and third trimesters of pregnancy:

“Most of them have the mentality that they don't want to do too many exercises or too much movement because they are afraid of pregnancy loss. So, I will just go into detail on the point the patient is concerned about, and, from that point, I will support whatever kind of functional assessment I need to do, but mainly I start with this in the second session, not the first session.” (Participant 2)

“yes I agree in the first session, usually i just listen to the patient, and discuss the treatment plan that they need to follow, then on the second session I provide some tests.” (Participant 3)

“From the session itself, from attending to the physical therapy department, then we can gain their trust to start the objective assessment focusing on the functional outcome measurements. I can start patients with initial sessions, then develop after a few weeks, and so on.” (Participant 2)

4.4.6.2. Theme 2: Physiotherapists’ Knowledge of Implementing Functional Tests

This theme focuses on the common practices of physiotherapists when performing the PFP tests with pregnant women with LPP. The theme was identified through observing and analysing the physiotherapists’ strategies for both applying and assessing the PFP when treating pregnant women with LPP. Based on this analysis, it appears that two key factors affected the successful application of functional tests. These were: a) improving practitioners’ knowledge of functionality in practice and improving patient function and independence whilst maintaining patient safety, and b) progressing and evaluating treatment plans.

1) Improving Functionality and Independence while Maintaining Patient Safety

From the physiotherapists' perspective, the aims of a given physiotherapy session influenced their planned use of assessment and evaluation tools as well as the overall development of the treatment plan. The participants mentioned a range of different possible aims when dealing with pregnant women with LPP. In particular, some of the participants mentioned that improving patient functionality and independence was a key consideration, which needed to be considered with a view to maintaining patient safety:

"We aim to give [the patient] better functionality and make sure that the patient has independence while maintaining safety at the same time, so I will check walking; sometimes I will ask the patient to carry some weight or lift some weight." (Participant 8)

"[We] will go through the most difficult tasks that the patient is complaining from and then I will start to try to analyse and see why she cannot do that specific movement and then move to another movement, and so on. So, we'll start with that point, and then we go through the functions that she is suffering from and try to return [the functions] back to pre-pregnancy." (Participant 3)

One physiotherapist emphasised that the patient's main concern is pain, which makes reducing this pain the primary goal within the treatment process. Other participants highlighted the importance of identifying which functional difficulties underlie limited functional performance:

"Usually, my aim is to identify any functional difficulties that could affect performance, for example, self-care tasks, domestic maintenance, or even general community mobility." (Participant 8).

1.1) Physiotherapists' Strategies when Applying Functional Tests

Understanding the feasibility of applying PFP tests can only be achieved through developing a detailed understanding of the general practice regarding using PFP tests with pregnant women in a healthcare setting. A lack of awareness regarding the importance of physical functional performance may constitute a major barrier to the application of PFP tests with pregnant women. The participants indicated that the majority of the tests used focused on the ADL activities that were central to patients' daily lives. However, there was considerable variance regarding the tests used to target specific functional impairments, whilst some tests were considered crucial components of a functional testing strategy. There is a lack of existing information about the different kinds of tests usually chosen for use with pregnant women with LPP, the time spent by physiotherapists in assessing PFP during a given session, the number of tests they choose, and their strategies for testing the progress of pregnant women's functional performance.

Different approaches to "ADL activities" presented dilemmas regarding the limitations imposed on pregnant women by LPP. This was demonstrated through tasks such as walking and sit-to-stand activities. All of the participants agreed on the utility of this kind of task for assessment purposes. In addition to the activities mentioned above, some participants added weighted exercises and reaching activities to cover more ADL functions in their assessments:

"I'm going to ask the patient to walk and then go to the stairs at the clinic, then if the patient is a bit active, depending on the level of activity, maybe doing some squats or push-ups on the wall, [or] lifting some weights in the gym. So usually, I do physical activities and then try to correlate these activities with a patient [who is] active, in their daily life." (Participant 4)

"I will check walking: sometimes I will ask the patient to carry some weights or lift some weights, to sit, to stand or heel raise, bending in all directions, rotations, stepping, I think even shoulder mobility, it depends on the case." (Participant 8)

"Additionally, I then move on to walking the patient, just a normal walk, to check their agility." (Participant 5)

"Maybe a timed up-and-go, so things that are related mostly with the pelvic stability." (Participant 10)

"The stability and the strength and agility of the patients, yes, that can be done, also they are very important for helping me learn the patient's capacity, strength, balance, mobility, all these combined." (Participant 9)

The participants also used key terms in their responses, with repeated references to the "type of test", the "time of the testing" and the "number of tests". The participants highlighted the different kinds of functional tests used in the clinic with pregnant women complaining of LPP. These included the sit-to-stand and timed up-and-go tests, which were mentioned more frequently by the participants:

“So, things related to ADL would be something like walking, maybe sit-to-stand, maybe timed up-and-go, so things that are related mostly with the pelvic stability.” (Participant 10)

Because all the participants were seniors, with extensive experience of dealing with pregnant women with LPP, they had their own individual beliefs and strategies for assessing this group. For example, participant 9 mentioned that they strongly believed in using two unique tests for functional testing that were novel both to the other participants and the researcher, such as functional muscle movement screening and selective functional movement screening:

“I use functional muscle movement screening in addition to some selective functional movement screening, which are both similar if you are familiar with them. One can be used by professionals, which is the selective functional movement screening, and the other one can be used by all types of professions, [that is] the functional muscle movement tests. In these tests there are different kinds of movements like single leg stance, bending, flexion, extension, side bending, set, squatting, lunges, and other tests like a single leg bridge or bridge with a modified single bridge, to test flexibility mobility, and strength. At the same time [to test] rotator stability it's like the bird dog, you know the dog similar to the bird dog test called rotator stability and lunges, line lunges. You have to do the in-line lunges squatting deep, squatting, stepping up, the selective functional movement test.”

In contrast, participant 4 expressed their view that every single case was different and there was no single strategy to follow when assessing pregnant women with LPP:

“Nothing you do is entirely specified; like, I don't follow any specific rule or criteria when assessing my pregnant patients.”

When asked specifically about the timing of the testing, most of the participants mentioned that the average time spent on the functional tests during the assessment session is around 10-15 minutes. However, the shortest periods mentioned by the participants were 30-45 seconds and less than five minutes. Participant 2 mentioned that they relied on their subjective evaluation more than the functional testing, so she spent “no more than five minutes” assessing patients using functional tests.

Moreover, questions concerning the number of functional tests elicited different responses, with seven out of nine participants mentioning that the average number of functional tests used to assess pregnant women with LPP is between two and three tests. The other participants claimed that they relied on functional testing more extensively when assessing patients, using a “minimum of four to five tests” during the evaluation practice by their team.

In physiotherapy testing, there is a wide variety of testing options. Some are complex and others are easy or basic. The participants mentioned how they progressed in testing the PFP (as they start from the general and simple before moving on to more complex and specific tests) When asked about this progression, the participants described their views regarding the variety of PFP tests. The participants would usually begin with general, simple tests, then, per patients’ feedback and performance progress to more difficult, specific tests:

“I always try to start with the simple tests just to get, you know, a general idea, and then from that, I build or think of what I’m going to do next.” (Participant 6)

2) Progression and Evaluation of Treatment Plans

2.1) Testing Goals

This section sets out the aims of the functional tests utilised during assessment sessions. These tests are employed to meet a range of goals, including testing for a target functional impairment, identifying functional difficulties, confirming the findings of a subjective assessment, assessing movement in discrete segments, assessing function for individuals with pain, assessing dysfunction, and assessing the functional capability of pregnant women with LPP.

An analysis of the study data allowed the identification of different functional impairments that the functional tests aim to investigate. These functional impairments were limited to balance, agility, pelvic and hip mobility, “flexibility” and strength. Some physiotherapists combined tests to investigate more than one functional impairment. Participants 3 and 5 reported repeating tests several times to measure endurance in addition to muscle strength:

“I usually use sit-to-stand [exercises] as a test to check muscle power and strength; I will also try to do it several times, to check endurance and to get feedback on the endurance. I know the sit-to-stand [exercise] is more focused on

strength, but sometimes when I ask a pregnant woman to do it several times, then I will get a glimpse of her endurance level." (Participant 3)

"Especially with a pregnant woman in her third trimester, with the weights added, she might be able to do a few repetitions up to the third, fourth, fifth repetition, depending on, you know, on her endurance and strength, so that could be a baseline for me to work from." (Participant 5)

In other instances, some of the physiotherapists reported starting with one test to investigate a specific functional impairment, based on which they could then decide whether more tests were needed to investigate additional possible functional impairments leading to the patient's LPP.

Some of the participants also mentioned the importance of identifying patients' limitations and difficulties in performing ADL:

"What should I test or examine? Usually, my aim is to identify any functional difficulties that could affect performance." (Participant 8)

All of the participants emphasized the critical importance of the subjective evaluation process, reporting that using functional tests would then help them to confirm their findings through the use of an objective measure:

"If the patient comes to my clinic with shallow breathing and increased heart rate from just walking a small distance, so I get them to do 10 metre walking tests. It's also a very good test to measure endurance, so I think it combines the subjective and objective measurements." (Participant 1)

The participants mentioned the key assessment terms, including "movement in different segments", "function with pain", and "functional capability". When asked specifically about the status of functional tests for assessment, the participants acknowledged their importance, specifically concerning how such tests could help to assess the movements in different body segments. Moreover, the participants highlighted the crucial role that functional tests play when assessing the relationship between pain and the performance of a task, and how using these objective measures helped to follow up on problems related to pain's progression. In addition, participants 2 and 9 stated that using functional tests helped them to investigate two key factors: pain intensity with movement and improvements in PFP:

"Functional outcomes measure the combination of decrease in pain and the improvement of functional activities." (Participant 2)

"Testing the joint movements and the strength at the same time, and the pain, all together." (Participant 9)

Assessing functional capability was recognized by the participants as being a crucial motivation for using the functional tests. These tests would guide them when assessing a patient's functional capability, and determining what the patient can and cannot do:

"[It's] very important for me to know the patient's capacity, strength, balance, and mobility. All these will be combined, through the test that I told you about, the selective functional movement [test]." (*P*articipant 9)

2.2) Assessing Physical Functional Performance

Physical functional performance tests play a key role in assessing pregnant women with LPP. An analysis of the study data indicated the crucial advantages of using PFP tests and underlining their clinical significance. These advantages included the efficiency of providing a short test that provides rich insights into a patient's situation, whilst also guiding further assessment and planning for potential rehabilitation programs. The participants also mentioned their crucial role in building patients' confidence; this confers a special utility on any measures that reduce patients' effort, as this then reduces the risks of exhausting patients already under strain due to the stresses of pregnancy.

The participants also reported that they used a clinical significance-based approach to applying PFP tests when assessing pregnant women with LPP. This approach focused on specific clinical concerns, that were categorised within the data analysis as "Quality of movements", "Indications of progress", "Design of treatment plan" and "Confirmation of subjective findings".

The participants elaborated upon their methods of assessment related to "quality of movements", which gives indications about a patient's mobility:

"It will give me a quick [method of gaining] information about so many things, for example, quality of movement." (Participant 8)

Additionally, the physiotherapists repeatedly mentioned the role of PFP tests in providing evidence of progress and evaluating the treatment plan. For example, Participant 4 mentioned the importance of these test results, as these form the basis for the ongoing development of a coherent treatment plan. This was corroborated by Participant 1, who stated:

"You will be able to re-evaluate your work, you will be able to show the patient the improvement and the progression reached across multiple sessions." (Participant 1)

Treatment plan design was also a key consideration when using PFP tests. These tests played a key role in this design process by providing a complete picture of the patient's condition and capability and allowing the targeting of specific functional impairments. The participants indicated that, in addition to the subjective assessment and objective measures, functional tests were crucial for designing treatment programs for patients who were pregnant women.

"It will help me a lot to build a plan for treatment through that functionality, so it definitely will help me in undertaking treatment." (Participant 9)

Confirming subjective findings was also described as being a key aspect of the utility of PFP tests:

"I start taking the history, I plan the tests that I need to perform, then I need to confirm that analysis, so I start to do the tests. Just one test; if I wasn't sure, I would try to do a second test to check that outcome measure." (Participant 3)

4.5. Discussion

This study aims to explore the physiotherapists' perceptions and knowledge regarding the barriers, facilitators, and acceptance regarding the use of PFP tests with pregnant women with LPP. It is an exploratory study that adopts a qualitative approach, based on semi-structured group interviews with expert physiotherapists. It also aims to inform improvements to the assessment of LPP during pregnancy from the perspective of physiotherapists, thus guiding the development of future functional performance tests for pregnant women, with and without LPP.

Three fundamental questions guided the study and served as the foundation for the framework analysis (see the methodology section for the framework). The first question was: Why are PFP tests rarely used among pregnant women? Second, is it possible to assess pregnant women using these PFP tests as evaluation tools? This was to highlight the obstacles, enablers, and acceptability around the use of these PFP tests. Determining logical responses to these inquiries is therefore essential in directing the use of PFP testing with pregnant women. Thus, the information gathered would be extremely helpful in guiding the test's improvement and in addressing the variables causing LPP in pregnant women. Thus, the findings of this study regarding clinicians' perceptions of using PFP tests are unique and help to address the gap within the current literature. The majority of the research on functional performance tests has focused on testing functional performance through self-reported measures, such as questionnaires, rather than physical functional performance tests administered by healthcare professionals. Be it due to individual, environmental, or task-related barriers, the reasons behind the limited use of PFP tests among pregnant women remain unclear. In total, seven main outcomes were determined by analysing the themes and subthemes of the qualitative study. These can be summarised as follows:

First, it is suggested that physiotherapists can gather a range of information from the patients through undertaking subjective evaluations, which can then strongly affect physiotherapists' subsequent choice of which PFP tests to apply (See results of theme 1 section 4.4.6.1/Subjective Evaluation). Pain (level, type, intensity, location, and history) is directly related to patients' functional limitations, playing a major role in limiting functional performance; hence, establishing pain management techniques may be a critical precursor to applying PFP tests. Additionally, physiotherapists can deal with patients with a history of previous physiotherapy sessions more easily, as they will be more familiar with undergoing PFP tests, giving physiotherapists a wider range of options. However, listening to patients' complaints, particularly concerning ADL limitations, and observing the patients when entering the clinic can guide physiotherapists towards selecting the most appropriate testing approach.

The second finding in particular revealed that many factors influenced physiotherapists' decision-making, with these decision-making processes being highly dependent on their initial subjective findings (See results of Subtheme 2 section 4.4.6.1/ Decision-making regarding patients' status). Physiotherapists consider pregnant women's endurance, complaints, and capability when applying PFP tests. A sedentary lifestyle and wider cultural understanding also play a major role in the choice of functional tests.

The third finding revealed that patients' beliefs and cultural norms can affect their acceptance of PFP tests, as applied among pregnant women in a Kuwaiti context (See results of Subtheme 4 section 4.4.6.1/ Challenges arising from patient and test specifics). The fourth finding revealed that physiotherapy session strategies offer several options, of differing severity when selecting PFP tests (See results of theme 2 section 4.4.6.2/ Physiotherapists' strategies when applying functional tests specifics). Choosing the appropriate test level for the patient's capability poses an intrinsic challenge when considering the application of PFP tests.

The fifth outcome shows that there was no specific protocol or set of guidelines followed by physiotherapists when assessing pregnant women with LPP or choosing PFP tests to use with them (See results of theme 2 section 4.4.6.2/ Physiotherapists' knowledge of implementing functional tests). Additionally, the physiotherapists tended to agree that walking and sit-to-stand are ADL activities concerning which pregnant women most commonly experience limitations due to LPP.

The sixth finding revealed that the participants performed different tests to investigate cases with multiple functional impairments (related to balance, agility, pelvic and hip mobility, endurance, and strength), basing their choice of test on their subjective findings (See results of Subtheme 1 section 4.4.6.2/ 1 Improving functionality and independence whilst maintaining patient safety and 1.1 Physiotherapists' strategies when applying functional tests).

Finally, the seventh finding pertained to the limited duration of physiotherapy sessions, as these present an obstacle to measuring endurance objectively (See results of Subtheme 2 and 3 section 4.4.6.1/ Decision-making regarding patients' status and Decision-making based on the findings). In addition to the time limitation and patients' capability and condition, physiotherapists are encouraged to use PFP tests during the session to confirm their initial assessment of the functional impairment underlying a patient's LPP (See results of Subtheme 2 section 4.4.6.2/ Progression and evaluation of treatment plans and testing goals).

4.5.1 Synthesis of the Study's Discussion

4.5.1.1. Physiotherapists' Strategies for Implementing PFP Tests

The literature supports two main methods for measuring and assessing functional performance: self-reported questionnaires and physical functional performance tests (Wendel-Vos et al., 2003). As mentioned by this study's participants, numerous considerations must be weighed regarding the application of these methods to assessing the functional performance of pregnant women. Self-reporting in particular is seen as the 'gold standard' for pain measurement within the current literature, due to its widespread use and consistency concerning the clinical definitions of pain. This creates a dilemma, however, as the subjectivity of the experience of pain is precisely what supports the subjectivity of the self-reported measurement process, being based primarily on patients' perceptions of their pain and, as such, being influenced by a complex range of factors. The existing literature highlights this crucial problem, showing that patients with chronic pain often reported levels of pain that were unrelated to their reported physical disability (Patrick & D'Eon, 1996). This makes the use of self-reporting a relatively controversial method, subject to numerous sources of bias, including recall bias and social desirability bias, as well as simple errors of reporting. Despite these widely-acknowledged limitations, self-reporting remains the most widely-applied method for assessing PFP (Denteneer et al., 2018). The participants in the current study agreed on the crucial nature of their subjective evaluations, which provide indispensable information on patients' subjective ADL limitations, previous physiotherapy sessions, endurance, medical and pain history, complaints, and other general observations. This evaluation was seen as critical to their practice, allowing physiotherapists to formulate strategies for implementing further PFP testing.

It is also crucial to note that, as in the case of LPP, in many cases, simple observational measures are either unrealistic or overly resource-intensive, requiring observations of a patient's daily routine. However, in situations where clinicians can observe patients performing activities related to their pain experiences over a specific period, as with PFP evaluations, these measures become easier and more practical to apply. Strong et al. (2002) in particular highlight the utility of observational measures in corroborating patients' self-reporting.

The implementation of these observation strategies under multi-task conditions is considered a strong indicator of balance issues and fall risks; this is supported by research that indicates that the performance of daily tasks may affect the ability to maintain stability (Shumway-Cook et al., 2000). For example, the Timed Up-and-Go (TUG) test reflects the balance and gait manoeuvres used in everyday life, comprising a selection of daily life activities, such as getting into and out of a chair, walking, and turning, and is used to evaluate alterations to functional mobility while performing tasks to reduce fall risks (Nicolini-Panisson & Donadio, 2014). The TUG test offers the advantages of simplicity and utility when evaluating the functional mobility of patients before, during, and after treatment, with a strong correlation between the time taken to complete the TUG test and patients' functional mobility. The participants in this study confirmed their reliance on patients' TUG test performance when assessing the health status of patients who are pregnant women. As noted below, this suggests an ongoing need for more in-depth knowledge regarding LPP for practicing physiotherapists.

4.5.1.2. Physiotherapists' Knowledge about Implementing Functional Tests

This study's findings offer a deeper, more nuanced understanding of physiotherapists' knowledge regarding PFP during pregnancy. Knowledge remains a key factor in promoting the use of PFP with pregnant women, particularly concerning the safe usage of the tests (Connelly et al., 2015). The lack of specific protocols or guidelines for physiotherapists to follow when assessing pregnant women with LPP or choosing functional tests was a key problem identified in the study data. All of the participants agreed that walking and sit-to-stand are the ADL activities that are most commonly limited due to LPP among pregnant women. As a result, sit-to-stand and TUG tests were mentioned more frequently by the participants than any other type of test. The participating physiotherapists spent, on average, 10-15 minutes, including applying 2-3 PFP tests, to evaluate different functional impairments, including simple ADL tasks such as walking and sit-to-stand exercises. In cases where the participants suspected the presence of more than one functional impairment (i.e., balance, agility, pelvic and hip mobility, endurance, and strength), the interview responses suggest that they based their choice of tests on their subjective findings. This is supported by Malliou et al. (2006), whose measurement and evaluation of LBP found that basic types of muscle activation could be analysed to measure integrated trunk muscle activation capability.

Further corroboration of these findings can be found in Ito et al. (1996), who determined that the ability to maintain muscular contraction over time or sustain effort was an effective measure of PFP. Similarly, the work of (Keeley et al., 1986), which used a straight leg-raising test to evaluate isometric lower back and thigh muscle activation, provides a useful model for practice. Keeley's test measured a patient's maximum straight leg raise by placing an inclinometer over the bony surface just below the tibial tuberosity and raising the leg until significant back or leg pain occurred or the pelvis was observed to rotate (Keeley et al., 1986). This type of precise measurement can provide a powerful tool for improving the overall assessment practices of physiotherapists.

A lack of awareness regarding the importance of PFP may present a major barrier to the clinical application of PFP tests with pregnant women. Likewise, providing objective measures of patient endurance is difficult, due to the time limitations. Despite the time limitation on the physiotherapy session, and further limitations imposed by patient capability and condition, however, the study participants supported the use of PFP tests during the sessions to confirm their analysis of the functional impairments underlying LPP. They claimed that the tests offered a quick method for providing rich information regarding a patient's condition, saving patient effort, and offering a baseline and guidance for further assessment and treatment.

Evenson et al. (2009) identified healthcare professionals and providers as playing a key role in providing information on healthy lifestyles and behaviour to pregnant women; as such, they would play a key role in developing patients' understanding of the benefits of activity during pregnancy, and the relative safety of PFP (Evenson et al., 2009). This study's findings indicate that physiotherapists primarily acquire their knowledge of applying PFP with pregnant women with LPP through direct experience obtained within their day-to-day practice. This experience was invaluable, as it enabled them to recall the key nuances and details regarding the tests and equipped them with the necessary knowledge for the future development of the proposed PFP. However, some physiotherapists acknowledged that, although these PFPs are reliable and valid, they are habitually cautious about applying them.

Notwithstanding these promising indications regarding potential applications of the proposed test, it is also crucial to note that numerous studies have highlighted potential shortcomings regarding the performance of physical and functional activities (Barker et al., 2003; Bayramoğlu et al., 2001; Küçükdeveci et al., 2001; Lee et al., 2001; Rantanen, 2001; van der Velde & Mierau, 2000).

This study's findings also suggest that a comprehensive evaluation of patients with LPP requires the use of both self-reporting and PFP. This is despite the differences between the two evaluation processes, wherein self-reporting measures rate patients' pain experiences through a structured scale metric (Strong et al., 2002) while PFP provides a direct evaluation of patients' pain (Bayramoğlu et al., 2001; Küçükdeveci et al., 2001; Lee et al., 2001). As such, PFP appears capable of assessing key aspects of LPP, providing a description of patients' LPP and the impact of LPP on pregnant patients' lives. Finally, patients' performance in functional tests can demonstrate LPP's effects on their functional activities. As such, this study provides compelling evidence that these tests are a necessary resource for helping pregnant women deal with their functional capability.

4.6. Strategies for Ensuring the Quality of the Study

When establishing the quality of the research methods, qualitative methods require specific assessment criteria, distinct from those used for quantitative approaches (Petty et al., 2012). Denzin & Lincoln (2012), Lincoln (1995), and Guba & Lincoln (1989) listed the key techniques implemented to ensure this research's precision, quality, and trustworthiness. Giorgi (1994), for example, emphasises the more generally held view that ensuring validity and reliability constitute the primary criteria for establishing the robustness of qualitative studies. Nonetheless, notable experts within this field, such as Silverman (2014), have demonstrated the utility of measures more normally applied to quantitative studies for assessing qualitative work. (Guba, 1981), in particular, outlined four key criteria:

a) credibility — in preference to internal validity.

b) transferability — in preference to external validity/generalisability.

c) dependability — in preference to reliability; and

d) confirmability — in preference to objectivity.

Guba asserts that these criteria form a sufficient measure for assessing the trustworthiness of qualitative research. Although certain aspects of the qualitative methodology are “still emerging and being defined” (Lincoln, 1995, p. 275), Guba’s framework of trustworthy research has been widely accepted within the discipline (Gentles et al., 2015; Shenton, 2004; Sinkovics et al., 2008). As such, the precise interpretation of Guba’s framework merits further and more detailed discussion within the context of its application to the present research.

Credibility, in Guba’s formulation, is the extent to which findings can be both believed and trusted; this is inherently linked to the researcher’s interpretation of the complexity of the gathered data (Guba, 1981). The credibility of the present study was established through employing a range of methods; this includes the precise choice of method, with the interview process allowing intense engagement with individuals, and the semi-structured nature of the interview, in particular, enabling the variations existing between the participants’ experiences and perceptions to be explored.

Focus group discussion interviews are preferred by some researchers as they allow more individuals to be interviewed within a specific timeframe (Ritchie et al., 2013). They nonetheless tend to document the “public” rather than “private” views of individuals (Grbich, 2013), meaning that their use can effectively complement other data-gathering techniques that are better suited to accessing such “private” complexes of knowledge and belief. This study conducted two focus groups as part of its data collection process, providing an engaging outlet for all of the participants, particularly those lacking a voice within the wider healthcare community in the matters affecting them. As Carey & Asbury (2016) observed, focus groups are particularly valuable when the group moderator possesses adequate skills, the members are knowledgeable, willing, and capable of communicating, and the topic and items are compatible with the interactions among the participants. The wealth of experience and support available to the present researcher regarding conducting such groups was thus a significant factor contributing to the viability of using this method in the present study. The credibility of the current research was also enhanced by the use of rigorous data analysis processes requiring immersion in the data.

Transferability is the next measure within Guba's framework. It describes the applicability of research findings to contexts beyond that of the original study (Petty et al., 2012). Qualitative research, relies on developing a detailed account of the phenomena under investigation through the use of "thick descriptive data", allowing other researchers to determine the work's applicability to their own settings (Lincoln et al., 1985). As such, this research made every effort to ensure that such rich data were collected at every possible opportunity, and that the research methods were clearly described throughout to help future researchers understand the study's potential transferability. Understanding the present research's methodological approach is key to enabling other researchers to position this study in terms of its potential transferability to other settings. The lead researcher's detailed knowledge and experience of the phenomenon under investigation, functioning as an insider researcher, also facilitated the collection of rich, thick data in this context.

Dependability emphasises the extent to which findings are reasonably based on the data collected, rather than the strict ability of another researcher to reproduce them (Pitney & Ehlers, 2004). In this study, a clear audit trail of all of the processes and procedures was produced to maximise transparency and allow variations within the study data to be understood.

Confirmability, within Guba's framework, relates to a researcher's concern with, and ability to evidence, their relative objectivity (Shenton, 2004). Miles & Huberman (1994) strongly argued that the extent to which researchers admit their own predispositions is the key element concerning confirmability. However, Shenton (2004) further developed this account by highlighting the steps required to ensure that the findings of the research reflect the experiences and ideas of the participants, rather than the characteristics and preferences of the researcher. Ensuring that these steps were followed to the fullest extent possible within the current research was thus a crucial measure for reducing the effects of researcher bias. In particular, the study sample was recruited from individuals working at different hospitals (public and private) to generate results that would be valid for a wider range of contexts.

During the process of reporting each step of the study's framework, several external quality frameworks were used to ensure that the reporting was in line with the current recommended best practice. The 5-step checklist of criteria for a good framework analysis, shown in **Table 4.9**, was used to guide the analysis in this study (Ritchie et al., 2013). The first steps of the framework analysis were carried out by the researcher and then their supervisors guided them regarding the initial thematic framework. We finally met to check the consistency of the framework, and any differences between the approaches were discussed and clarified. Also, the strategies that the researcher had followed were rechecked to ensure the consistency of the data (for example: a) the transcripts of the group interviews; and b) the themes and subthemes).

Table 4.9: Steps of the Checklist Regarding the Criteria for A Good Framework (Ritchie et al., 2013).

Steps	Phase	Criteria for a Good Framework
1	Familiarisation	The data have been transcribed to an appropriate level of detail and then double-checked with the assistance of an expert in this field to ensure their accuracy.
2	Construction of the initial thematic framework	Each broad area was renamed as an ‘initial theme’, and a description was added to ensure that the data extracts were appropriately placed. Each initial theme was broken down into smaller, more coherent components, referred to as the initial subthemes.
3	Indexing and sorting	The initial thematic framework was applied to the nine transcripts. Those parts of the data from the transcripts that were judged to be related to specific subthemes were assigned to these.
4	Reviewing data extracts	Our review highlighted a considerable overlap between the subthemes of distinct themes, and therefore some themes were merged. The thematic framework was then finalised at the end of this process.
5	Data summary and display	Matrices for each theme were generated in NVivo and then exported to Microsoft Excel to facilitate the manipulation of the tables. Four matrices, one for each theme, were identified in the final thematic framework Each matrix displayed the relevant subthemes along with data extracts from the physiotherapists’ comments and summaries of each data extract.

4.7. Reflexivity

In this section, I discuss the concept of reflexivity in research, particularly as it applies to qualitative studies. This focus on reflexivity will facilitate a more detailed discussion of how being reflexive helped me to understand how I, as the main research instrument/tool, exerted a crucial influence on the study design, as well as the collection and analysis of the data. As discussed in section 4.5, four main criteria are used to ensure rigour or trustworthiness in qualitative research. Trustworthiness is a key component when determining the quality of research, best expressed as an answer to the question, “Can we trust the findings?” (Korstjens & Moser, 2018). An analysis of a researcher’s own subjective and intersubjective influence on their research can form a core component to improve the integrity and trustworthiness of the work (Finlay, 2002). Reflexivity is a key technique within such an analysis. In this account, I use the broad definition of reflexivity as “the process of becoming self-aware” as employed by (Mills et al., 2010, p. 2).

Such a reflexive account naturally begins with my professional background, followed by an outline of my research experience both before and during the data collection and analysis. This also includes my personal and professional growth during this research, how my cultural and gender identities influenced the research, and my responses to the challenges it presented. Due to the qualitative nature of the research, this focus on the researcher is imperative as the researchers themselves are a key tool within the research process (Pezalla et al., 2012). In such a context, the researcher becomes an instrument for the collection and analysis of the data (Baxter & Jack, 2008; Pyett, 2003). Researchers’ individual attributes, theoretical positions, interests, and political perspectives can play crucial roles in their interpretation of qualitative data, with a commensurate influence on the research process (Pyett, 2003).

As part of this account, I discuss how the cultural mores, social traditions, and religious beliefs of my society influenced the data collection and decision-making processes, with a particular focus on the effects on the research design, location, and data analysis. Lastly, I outline my own learning and development resulting from the research process, and my responses to the challenges that arose while conducting this research. This process of examining the complex personal, social, religious, and cultural context that underpins my research can only increase the integrity of the findings. Such an effort will also improve the accuracy of this research and provide a strong foundation for establishing the project's ethical credentials.

Reflexivity can improve the transparency of research, not least through investigating potential sources of bias that might influence the research process (Jootun et al., 2009). In particular, the identity of the researcher contributes to a qualitative study's findings by exploring how their personal experiences, beliefs, or biases influence the research process (Dodgson, 2019). This provides a sufficient imperative for exploring the positionality, beliefs, and values of the researcher (Baxter & Jack, 2008; Dodgson, 2019; Walker et al., 2013). Moreover, it is crucial to understand a researcher's position within their research, as this ensures the transparency and clarity needed to reduce or address biases (Dodgson, 2019). Jootun et al. (2009) in particular point out that such biases and other latent beliefs can influence the research in both intentional and non-intentional ways. Thus, reflexivity is a crucial process for establishing the levels of self-awareness needed to approach each stage of a research project with a realistic, nuanced interpretation of the results, processes, and findings.

The global outbreak of COVID-19 meant that meetings about the research had to be conducted via Skype, but the cultural norms meant that it was difficult to find study participants willing to participate in video meetings attended by those of other genders. This required me to adapt by inviting more participants than I needed, simply to meet the minimum number of participants. I also invited previous postgraduate award holders, who were more willing to participate as they understood the value of the research. As a further compromise, the Skype meetings were kept as voice-only recordings, apart from the researcher and assistant moderator, whose video and audio were both recorded.

To reduce potential sources and impacts of bias upon the data analysis, I invited an assistant moderator who was a health professional with a PhD, who was not a physiotherapist, to participate in the project. These requirements ensured that they would be familiar with the practical and technical requirements of healthcare research, as well as the healthcare system as a whole, but would also have a degree of professional and personal distance from the professional and disciplinary conventions surrounding physiotherapy assessments.

The recruitment of a non-physiotherapist as the assistant moderator was also motivated by the research context. I am a senior physiotherapist, and Kuwait is a small country. The community of practicing physiotherapists is small, and most physiotherapists know one another, in many cases on a personal as well as professional basis. This motivated the use of focus groups rather than one-to-one interviews, reducing the risks of questions being manipulated through more personal responses being offered by the participants. Inviting an assistant moderator who was external to this professional community was thus also crucial in controlling the direction of the interviews and so the data results.

The researcher-participant relationship can also play a key role in shaping research results, meaning that the dynamics of this relationship should be considered with care (Finlay, 2002). Finlay (2002) has also suggested that a different researcher conducting the same study may enjoy a different relationship with the participants: the participants may thus respond and ask questions differently, which may, in turn, prompt different replies and results. This dynamic may also be a crucial part of the research process as a whole, and the researcher must remain mindful that participants can be partners in developing, creating, and analysing the research process (Dodgson, 2019). A tacit acknowledgement of the intersubjectivity inherent in the research process, wherein those who research and those who are being researched are open to the potential for renegotiating the boundaries circumscribing each role, can offer significant benefits to the research process as a whole (Dowling, 2006). This informed multiple revisions of the interview questions with the supervisors, as well as a trial interview process as a precursor to the final interview design.

4.7.1. Role of the Researcher (Reflection/Positionality)

As a researcher, I was very aware of the importance of reflection in qualitative research. Acknowledging my values, beliefs, and experiences was a key path towards understanding their impact on my research. As noted above, creating trustworthy research requires researchers to find ways to analyse their subjective and intersubjective influence on that research (Finlay, 2002). Reflexivity is a key component of this analysis.

My background as a physiotherapist had a clear impact on both the research process as a whole and my interpretation of the data in particular. As a physiotherapist and health professional engaged in research on assessing physical functional performance among pregnant women with LPP, some participants may tend to present or even adjust their opinions in ways that aim to accommodate either myself or my perceived research aims. For example, they may say they are using the PFP when they are not and understate the assessments' perceived disadvantages. They may feel that admitting that they were not using any PFP would lead me to develop a negative impression of them. To limit the degree of bias, probing questions were asked to improve the understanding based on the participants' responses.

To facilitate this, I also aimed to keep the participants blind to the research aims, establishing participant-researcher connections or rapport. This has been shown to improve researcher-participant relationships and encourages the participants to answer the questions more freely and openly, leading to richer data (Patton, 2002). To build rapport, I started each interview with a more general conversation, asking opening questions about, for example, the common reasons why women experience LPP. This aimed to create a more comfortable atmosphere and build trust, tacitly encouraging the participants to give their honest opinions without the fear of being judged. I also targeted previous PhD holders for participation in the research, as I felt that this would encourage the participants to express their own opinions more confidently, regardless of any perceived expertise on my part.

My background as a Kuwaiti citizen affected the research's progress because my respondents shared the same social and cultural origin. The respondents might have been more inclined to comment on aspects of their experiences when interacting with a researcher who is a fellow Kuwaiti because they may have felt that we shared a common understanding. Being from Kuwait also helped me to consider and examine certain elements of the participants' encounters that were linked with essential elements of Kuwaiti culture, like the role of religious views and cultural norms.

Communication with the participants, and the research process as a whole, were also influenced by the nature of my status as a qualified female researcher attempting to investigate older people's perceptions of a highly gendered subject (the assessment and treatment of LPP) within a society that exercises conservative and practiced gender segregation. I anticipated the challenges I could face when interviewing males because they are less inclined to cooperate and speak openly to a female interviewer. I discovered that encouraging the respondents to respond to the questions more honestly entailed asking relevant, insightful questions, establishing a rapport with the respondents by including icebreakers, and addressing individuals using their anonymised code numbers.

Another significant element that is likely to have had an impact on the study's quality is my background and specialized training as a researcher. Even though I am a new researcher with little expertise in qualitative research, I took every opportunity to enrol in all of the necessary training programs in data collection, analysis, and efficient interviewing strategies. Making a clear assessment of my capacities and skills as a researcher, as well as my ongoing needs for further training and development, helped me to maintain accuracy and transparency concerning my research.

4.7.2. Memo Writing, Field Notes, and Reflexive Journals

Reflexivity was a crucial component of the research praxis as a whole. To facilitate an ongoing reflexive standpoint, I created and maintained a series of memos and reflexive journals to record the whole research process. These notes formed a further key source of information as they contained details of all of the decisions, challenges, ideas, and thoughts that emerged during the study (Davies & Dodd, 2002). Notes and memo writing are essential for conducting qualitative research processes, especially interview-based research (Charmaz & Belgrave, 2012), and should start at the beginning of the research, informing and directing the data analysis throughout (Schatzman & Strauss, 1973).

From the beginning of the research process, I developed a routine of recording notes and memos in my research diary whenever any relevant thoughts, considerations, or points of action came to mind. I recorded my ongoing views and interpretations of any incidents and events that transpired as part of the research process. During the interviews in particular, I recorded all of the ideas and themes discussed directly by the participants in my journal and returned to these during the interview process as a means of facilitating further explanation and discussion. At the end of each interview, these notes also constituted a crucial asset when writing summaries of the emerging ideas, and recording my overall impressions, thus enriching the context within which I could interpret and analyse the interview material. These notes also proved useful during the data collection and analysis. I wrote further memos during the transcription and analysis processes, using these to, for example, describe the meaning of the individual codes as well as the links between them. I also recorded my ongoing reflections on the challenges that I faced during the research process, and how I addressed these challenges. Finally, I reflected on how my insights and perceptions had changed during this project, and how this affected my views on my career as a physiotherapist.

For instance, I anticipated that certain points would fall under the facilitators' category and some under the obstacles'. Nevertheless, those points seemed to fit into both categories once the data was analysed (they may be benefits and act as facilitators or the contrary). For instance, physiotherapists take "lifestyle in general" into consideration before selecting or utilizing tests related to lifestyle, rather than identifying an active lifestyle as a facilitator and an inactive one as a barrier. Another thing to consider is evaluating pregnant women using a comprehensive approach. For instance, obesity is one of the obstacles to completing the PFP test that has been identified in earlier research; nevertheless, if the expectant mothers were physically active, the physiotherapists did not identify it as a barrier. Thus, the most important thing to think about before doing the PFP tests is to look at the patient as a whole. There are several PFP tests, and everyone can give particular details on the underlying limits, capabilities, and impairments of the patient. To evaluate the PFP among pregnant women, comprehensive testing is necessary since the results of individual tests do not accurately reflect the functional condition of these women.

4.8. Strengths and Limitations

To the best of my knowledge, this is the first exploratory study to explore the knowledge and perceptions of physiotherapists in the state of Kuwait regarding the usage of the PFP to improve the assessment of LPP during pregnancy. No single study has focused specifically on physiotherapists' conceptualisations of implementing such a test. Thus, the findings of this study regarding clinicians' perceptions of using the PFP are unique and novel; they help to address the gap within the current literature. Most of the research on FPF tests has focused on testing functional performance through self-reported measures, such as questionnaires, rather than physical functional performance tests administered by healthcare professionals. The reasons behind the limited use of physical functional performance tests among pregnant women may be due to individual, environmental, or task-related barriers. The group interviews were held in the presence of senior physiotherapists with more than ten years of experience (some were PhD holders). In my opinion, this could be a limitation, and holding group interviews with more of a range of practice experience physiotherapists might have produced better outcomes. The results did not represent the breadth of current practice, although they were directly based on the lead researcher's previous experience.

4.9. Conclusion

To summarise, Chapter 4 presents a detailed review of the qualitative study. It describes the themes, subthemes, and categories relating to physiotherapists' perceptions of the barriers, facilitators, and acceptance regarding physical functional performance tests and a discussion of the key considerations related to quality and reflexivity. The key findings were determined by analysing the themes and subthemes, including the identification of the seven main findings, mentioned above, which helped to explain the qualitative findings. The main findings were that the physiotherapists felt positive about using the PFP with pregnant women. However, there was no specific protocol or set of guidelines that they followed when assessing pregnant women with LPP or choosing the functional tests to use with them. Also, the findings suggest that physiotherapists can gather a range of information from the patients through subjective evaluation, which can then strongly affect the physiotherapist's subsequent choice of PFP tests to apply. This builds on the earlier identification of the tools to evaluate the PFP of pregnant women with LPP in the field that inform current clinical practice that took place during the scoping review. In line with the overarching research aim, which was to explore and understand the clinical application of physical functional performance assessments with pregnant women and then link it to their pain, this chapter has explored and provided an in-depth understanding of clinicians' perceptions and also enhanced the understanding of the relevant issues.

4.10. Acknowledgement

This study has been accepted for oral presentation at the third Kuwait International Physiotherapy Conference (2023) (see Appendix 7).

This study has been submitted for publication in the Frontiers in Global Women's Health journal, (see Appendix 7 for submission confirmation).

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CHAPTER 5: ASSESSING PHYSICAL PERFORMANCE TESTS IN PREGNANT WOMEN WITH AND WITHOUT LUMBOPELVIC PAIN: NORMATIVE STUDY

5.1. Introduction

5.1.1. Pregnancy-Related Pain and Dysfunction

Pregnancy-related low back pain (PR-LBP) and/or pelvic girdle pain (PGP) are very common conditions, affecting up to 86% of pregnant women in the 3rd trimester of pregnancy (Daneau et al., 2021). A recent narrative review presents different mechanisms that may explain the development of lumbopelvic pain (LPP) in pregnant women (Daneau et al., 2021). Pregnancy-related hormonal changes, characterized by an increase in relaxin, estrogen, and progesterone levels, are potentially linked to ligament hyperlaxity and joint instability, thus contributing to lumbopelvic pain. In addition, biomechanical changes induced by the growing fetus can modify posture, load sharing, and mechanical stress in the lumbar and pelvic structures. Finally, neuromuscular adaptations during pregnancy include an increase in the activation of lumbopelvic muscles and a decrease in the endurance of the pelvic floor muscles. It is yet unknown if these alterations and LPP are connected to one another.

The positive correlation between musculoskeletal changes in pregnancy results in structural changes in the body that lead to pain and decrease other qualities, such as physical fitness, functional difficulties, and quality of life (Gutke et al., 2008; Vyas et al., 2020).

The results of research conducted by Üzelpasaci & Akbayrak (2023) reinforce the hypothesis that there exists a positive correlation between muscle dysfunction and PR-LPP. It has been proven that, during pregnancy, the dynamic stability of the pelvis may be affected due to hormonally-induced ligament laxity, as well as muscular dysfunction, which is a critical factor in persistent problems (Norén et al., 2002; Üzelpasaci & Akbayrak, 2023; van Wingerden et al., 2004). In addition, pregnant women with LPP had lower values of back flexor endurance compared with asymptomatic pregnant women (Gutke et al., 2008). The researchers concluded that muscle dysfunction was associated with pelvic girdle pain (PGP), which should be taken into consideration when developing treatment strategies and preventive measures.

Carvalho et al. (2019) found that dynamic balance using a timed up and go (TUG) test differed statistically between pregnant women with and without LBP and non-pregnant women (P 0.038) and that the effect size was moderate to strong in the assessment between the three groups. These findings were similar to Christensen et al. (2019), the time spent on the TUG varied among pregnant women with PGP and was significantly higher (mean (95% CI) 6.9 (6.5, 7.3) seconds) compared to asymptomatic pregnant (5.8 (5.5, 6.0), $p < 0.001$) and non-pregnant (5.5 (5.4, 5.6), $p < 0.001$) women. They also identified the factors associated with increased TUG, they found that increased body mass index (BMI) and taking a sick leave were significantly associated with increased TUG (p-values≤0.02). In pregnant women with PGP, pain intensity was the only significant clinical factor associated with increased TUG ($p = 0.002$).

Pregnant women's movements, activities of daily living (ADLs), and general quality of life (QoL) can all be significantly impacted by the type of discomfort they experience, because it frequently has a detrimental impact on their regular standing, sitting, lifting, and walking activities (Elden et al., 2016; Houtman et al., 2007; Van Beukering, 2002; Wuytack et al., 2015). In addition, it may withhold women from re-entering their work, the societal costs may be considerable (Guideline Company doctors, 2018; Van Beukering, 2002). Sick leave due to LPP is quite common (Wiezer et al., 2020).

Many pregnant women who experience LPP during pregnancy continue to have pain after childbirth beyond the postpartum period (Wiezer et al., 2020). Therefore, Pregnancy related-LPP is a public health concern and it is important to prevent and treat LBP to prevent chronic pain and workforce loss (Kesikburun et al., 2018). To prevent loss in QOL with PR-LPP and to reduce medical and societal costs identification of women who are at risk of developing LPP is worthwhile (Wiezer et al., 2020).

A functional limitation is the incapability to perform a specific activity at a normal level (Shen, 2021). “Normal” must be grounded on factors such as a patient’s age, gender, physique, and profession. Normative values are established by data collected on numerous people executing a task, which is strongly reliant on the activities associated with physical functional performance (PFP) as well as their related needs or requirements (Richards et al., 2012). Based on previous research, PFP depends on certain demographic factors, several factors may be modifiable such as BMI and physical activity (PA) level, while others are unmodifiable, such as gestational age (GA) and parity (Galper et al., 2006; Kear et al., 2017; Matthews & Gallo, 2011).

5.1.2. Why Normative Data?

The process of clinical decision-making related to the rehabilitation of pregnant women with LPP should be based on a rigorous PFP that is related to the ADLs and QoL, to promote an improvement in not only the physical parameters, but also the functional status that permits a return to work and the completion of daily tasks (Bennell et al., 2011). There is a general agreement among physiotherapists regarding the effect of LPP upon the functionality of pregnant women with this particular health condition that also emphasises the significance of taking into account the unique functional profile of every patient throughout the evaluation and treatment procedures (Cowell et al., 2019). Therefore, the judgement of the individual test results should be compared with that of a relevant population, requiring the availability of norm references for the particular population (Tan et al., 2023).

Previous studies explored the importance of clinical normative data such as classifying the patients into different categories based on a reference group, a prediction of functional decline, and as an objective measure for practitioners and policy makers to find the clinical needs (Nakhostin-Ansari et al., 2022; Tan et al., 2023). Tan et al. (2023) provided different performance groups of the Asian population using TUG Normative Reference Values (NRV) as a reference for the physical function. Establishing benchmarks for health assessment, helped in carrying out a possible early and targeted intervention for modifiable risk factors such as obesity and in goal setting for physical function. In addition, a recent cross-sectional study to determine the normative values of several functional performance tests included TUG tests across age groups and genders in healthy Iranian adults (Nakhostin-Ansari et al., 2022). The authors claimed that normative data of the study provided for healthy Iranian adults increase the clinical utility of tests, and serve as a reference to estimating the individuals' balance performance (if it is normal, above or below the expected range) across age and gender groups. Furthermore, they claimed that the normative data provided in this study would be beneficial for clinicians and researchers as they can now compare the balance tests' values reported in this study in individuals with or without balance dysfunctions to the normative reference values established based on healthy Iranian people.

In addition, normative PFP data has helped to identify specific functional deficiencies in different populations, such as older persons by facilitating the assessment of individual performance. The PFP standards for older persons, however, have been firmly developed in several nations and territories, including the United States (Rikli & Jones, 1999), Brazil (Krause et al., 2009), Taiwan (Chen et al., 2009), Norway (Langhammer & Stanghelle, 2011), Spain (Gusi et al., 2012), and Portugal (Gouveia et al., 2013). The creation of a regional normative standard can help in satisfying practical requirements that are required to acquire a more thorough comprehension of the PFP of individuals in a specific region (Chow et al., 2005). To my knowledge, there is no normative data conducted on women or pregnant women's performance in the Middle East.

Furthermore, establishing the normative data would help in the early detection of PFP decline (Samartzis et al., 2011). As for the early detection of functional deterioration, it allows rapid interventions, especially in the case of pregnant women.

For example, Mikos et al. (2018) used both TUG and 10MWT tests to assess the severity of patients' pathological gait by quantifying the degree to which their performance deviates from normative data of an age-matched healthy cohort. In addition, Batko-Szwaczka et al. (2020) established normative data in older adults of different clinical and functional measures to assess the predictive value for the early identification of patients who may benefit from preventive interventions.

Finally, normative data are considered as objective performance-based outcome measures that are crucial for assessing performance throughout clinical intervention practices and research studies. Previous studies showed the necessity of using normative data to evaluate the functional score measures of a person for the detection of clinical needs (Kear et al., 2017; Kristensen et al., 2009; Valet et al., 2019). The normative data could be helpful for several tasks, including assessing and identifying a drop in PFP, keeping track of the results of exercise programs, and giving detailed information about physical domains, including strength, balance, as well as mobility (Kear et al., 2017; Kristensen et al., 2009; Valet et al., 2019).

5.1.3. The Novelty of the Study (Normative data)

The ICF utilises performance and capacity components to distinguish among various patient functioning statuses (Madden & Bundy, 2019). The findings from the focus group interview (chapter 4) show a deep understanding among the physiotherapists, who mentioned that they rely on the patient's condition and functional status to determine the assessment and treatment plan. However, there was no clear objective measure for defining functional status or decline in PFP, as the judgement regarding the physical status of pregnant women was based on the pregnant women and physiotherapists' opinions rather than normative data. The normative data for the PFP tests provide objective measures of functional ability, which eliminates the potential for subjectivity and bias in the assessment process (Tan et al., 2023). This helps to provide a baseline measure for functional abilities, which can be used to track changes in functional ability over time and guide decision-making (Batko-Szwaczka et al., 2020).

However, there is a lack of normative data for any tests of physical functional performance associated with pregnant women. In addition, normative data on the performance times with analyses of the factors that could affect physical functional performance in pregnant women remain unpublished. To the best of our knowledge, no previous information is available regarding normative data on pregnant women.

Previously studies used the PFP tests on pregnant women and no study was aimed to establish normative data (Carvalho et al., 2019; Christensen et al., 2019; Evensen et al., 2015; Wadhwa et al., 2016). PFP tests, such as the TUG and 10-meter walk test (10MWT), can measure physical mobility and have been found to forecast accurately patients' long-term well-being and standard of living (Kear et al., 2017). These tests are a reliable, cost-effective, safe, and time-efficient way to evaluate overall functional mobility. Both tests have normative reference values (NRV) for different conditions, such as multiple sclerosis and hip fracture, but not for pregnant women, with or without LPP (Kristensen et al., 2009; Valet et al., 2019).

Considering all the above factors, it is suggested that establishing normative reference values to understand the factors that influence PFP may be an important aspect when developing recommendations related to the management of LPP in terms of both screening patients upon evaluation and interpreting changes in performance (TUG and 10MWT) with clinical practice. The purpose of this study is to provide normative data about pregnant women, stratified based on potential factors (pain, GA, PA, BMI, parity, age, disability rate). To my knowledge, it is among the first large-scale studies designed to determine the normative values of TUG and 10MWT in pregnant women based on pain and potential factor groups. This will help to guide the clinical decision-making process related to assessing and evaluating pregnant women.

5.1.3.1. Study Aim

To determine the status of physical performance in pregnant women with and without LPP while considering the demographic measure factors.

5.1.3.2. Research Questions

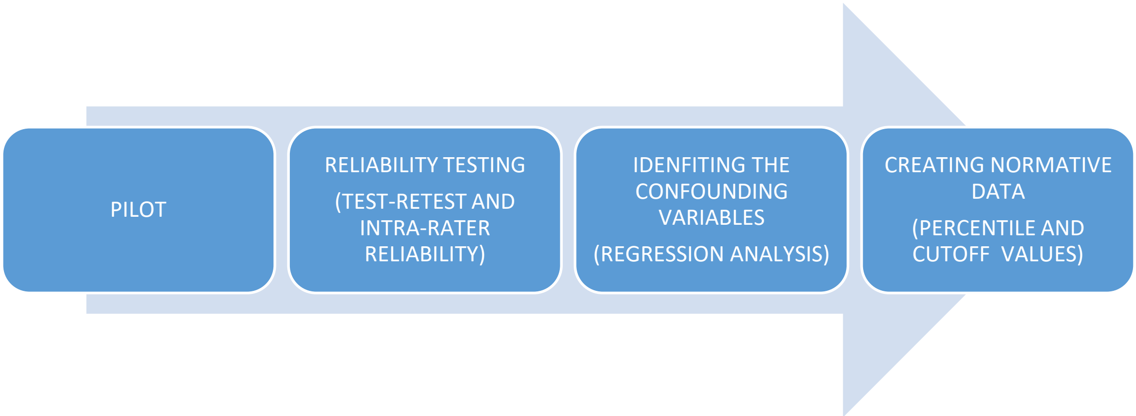
What is the functional status of pregnant women based on demographic factors?

5.2. Pilot Study

The initial pilot testing was conducted using two participants, with the goal of assessing the feasibility of administrating the research procedures at the clinic, as described above. The sampling was carried out at Kuwait’s main maternity hospital: 25 pregnant women were scheduled for check-up appointments with the doctors, and 23 pregnant women declined to participate, stating that this was due to time restrictions and the questionnaires being too long. Only two agreed to participate, and these were women who had been diagnosed with LPP. The research procedure was fairly straightforward, with the key exception being the use of the Pregnancy Physical Activity Questionnaire (PPAQ). All of the participants complained about the amount of the time needed to answer the questionnaires, and 23 participants withdrew due to this time requirement (approximately 10-15 minutes). This was despite the participants being asked to identify and discard all difficult, unclear or ambiguous questions. Using this pilot sample, the time taken to complete the questionnaire was recorded, to enable the researcher to make further decisions regarding its length and suitability.

Having completed the pilot study and discussed any feedback arising from the process with the supervisors, the decision was made to utilise the Short Form International Physical Activity Questionnaire (IPAQ-SF) instead of the PPAQ.

This was largely in response to the complaints regarding the time required to compete the PPAQ questionnaire, with the IPAQ-SF being a reasonable substitute: both tests have Arabic translations, and have a proven track record of use with pregnant women in previous research. A further key point that emerged from the process was that no pregnant women without pain agreed to participate in the pilot sample. Accordingly, to estimate the appropriate sample size for each group, the functional test scores and age variations of the first 50 pregnant women included in the study were used to estimate the sample size for the multiple linear regression models, following the methodology established by Nicolini-Panisson and Donadio (2014) (See figure 5.1 flow chart of the study).



5.1 Flow chart of the study

5.3. Method

5.3.1. Study Design

The study employed a descriptive approach to test the norms of two valid, reliable functional performance tests (TUG and 10MWT) in pregnant women, with and without LPP pain.

5.3.2. Participants

The study was carried out in Kuwait between October 2021 and April 2022 and conducted in three hospitals due to the particular environment required for the collection of data to measure TUG and 10MWT. The Sheffield Hallam University Research Ethics Committee and the Kuwaiti Ethics Committees Authority approved the study (**Ethics Review ID: ER21255253)** (see Appendix 9).

5.3.2.1. Sample Size

A non-probability sampling technique was administered, and 426 pregnant women were recruited to participate in this study. The rationale for this sampling was a convenience sample with two cohorts, as this sampling technique divides the population into two cohorts, which are smaller subgroups. Another factor that contributed to its selection was the fact that it is easy to differentiate between the two cohort groups (with pain and without pain) and also to which trimester group they belong. Normative data were collected for the pregnant women, stratified based on their pain (Check 5.4) and gestational age (trimester).

Eleven participants were excluded from the study because they did not follow the test instructions to walk fast but ran instead during the tests, and so were excluded from the study, giving a total of N=415 pregnant women.

Since this study was carried out in Kuwait, the situation was challenging. Statistics on pregnant women are not published; however, the Kuwait Central Bureau of Statistics (KCBS) has released the 2018 report on births. The number of births in government hospitals in 2018 stood at 27,316 (KCBS, 2022), which averages 2,276 births per month. Based on the National Education Association Information application for the required sample population, the sample size needed to be representative of a given population of 2,276 is S=329, as determined using the table for determining sample size (Krejcie & Morgan, 1970). In Kuwait, 59% of pregnant women reported pregnancy-related LPP during their previous pregnancies (Al-Sayegh et al., 2012): thus, the convenience sample for pregnant women with LPP is 59% of the sample size, at N=194 while, for pregnant women without LPP, it is 41%, at N= 145.

5.3.2.2. Recruitment

This study was carried out in three hospitals, due to the particular environment required for the data collection. The Sheffield Hallam and Kuwaiti ethics committees approved the study. In the waiting area of the OBs and Gyn, PT, and OT clinics as well as the lobbies of the hospitals and clinics, a billboard advertisement was placed, outlining the study’s goals. The advertisement's purpose was to encourage pregnant volunteers to contact the study researcher or the nurse in the PT department. Their mission was to explain the study in detail to the volunteers, obtain their details, conduct a risk assessment, and ensure that the consent forms had been completed. All of the patient-facing materials: i.e., the poster, informed consent form, and participant information sheet, were provided in both Arabic and English (see Appendices 9 and 10).

5.3.2.3. Inclusion and Exclusion Criteria

The study included pregnant women with different parities, to explore whether parity affects functional outcomes. The majority of the previous research reveals that pregnant women start to undergo musculoskeletal adaptation and biomechanical changes from the second trimester onward (14 gestational weeks) (Garshasbi & Faghih Zadeh, 2005). Therefore, this study includes: 1) pregnant women with different gestational weeks' duration, across the three trimesters; 2) pregnant women aged between 20 and 35 years old, as older age is considered to lead to a high-risk pregnancy (Weaver et al., 2013); and 3) pregnant women with and without LPP. Two groups were included: group (A) included healthy pregnant women without LPP, while group (B) included healthy pregnant women with LPP. These groups were selected to make it possible to compare the results and understand the impact of pain on functional performance.

The study excluded women with: 1) absolute and relative contraindications to exercise during pregnancy according to the ACOG guidelines introduced in 2021 and any systemic disorders, to prevent any confounding variables affecting the results; 2) health problems other than pregnancy-related LPP (orthopaedic, neurological, cardiorespiratory diseases) which might influence their functional performance; 3) gynaecological or urological problems that mimic LPP and pregnancy complications, except for LPP (preeclampsia, hypertension, diabetes due to pregnancy, etc.); and 4) visual/hearing problems which may have inhibited their participation.

Eleven participants ran while performing the tests instead of following the instruction to walk, and so were excluded from the study, giving a total of N=415 pregnant women. If any adverse effects monitoring are identified, discontinuation of the study to prevent harm. Furthermore, the participants selected for this study were informed about the warning signs that meant that they should terminate the test, which would result in their exclusion from the study. The participants were provided with a consent form and all of them were willing to sign it.

5.4. Materials

Part one of the materials included three tools (2 questionnaires and a VAS of generic pain), and the second part included the physical functional performance (TUG and 10MWT).

A) Questionnaires:

Two types of questionnaires were used for this study that the participants were asked to complete:

1. The Oswestry Low Back Pain Disability Index (ODI), is only for pregnant women with LPP pain.
2. The Short Form of the International Physical Activity Questionnaire (IPAC-SF), for all participants, with and without LPP pain.

Pain:

The intensity of their pain was scored by the participants on separate 0-10 cm Visual Analogue Scales (VAS) (Carlsson, 1983). On the VAS for pain intensity, the zero-point indicated "no pain" and the 10 cm point indicated "unbearable pain". VAS is a common, quick, reliable, and valid means used to measure pain intensity in a variety of clinical contexts, including pregnant women (Mohseni-Bandpei et al., 2009). Using VAS for PR-LPP showed good responsiveness operating characteristic curve ranging from 0.77 to 0.90, the estimated MICs were 1.3 for ODI (Ogollah et al., 2019).

The Oswestry Low Back Pain Disability Index (ODI):

In the group of pregnant women with LPP, the degree of disability caused by back pain in the lumbar region was also determined using the ODI questionnaire. The ODI is considered a standard questionnaire to assess the impact of LPP on pregnant' daily activities, and it is reliable, acceptable, and sensitive to changes during pregnancy assessment (Bryndal et al., 2022). Research has concluded that the ODI is a valid, reliable, and responsive clinical tool when used to determine the level of function (disability) associated with low back pain (Vianin, 2008). The questionnaire had already been translated into Arabic, and its reliability and accuracy were tested and approved (Algarni et al., 2014; Guermazi et al., 2005). Therefore, the participants will have the Arabic version of the ODI as an option, which is adapted to different Arab populations such as the Saudi and Tunisian, and the reliability and validity of the Arabic version have been tested and approved (Algarni et al., 2014).

Using ODI for PR-LPP showed good responsiveness operating characteristic curve ranging from 0.77 to 0.90, the estimated MICs were 3.1 for ODI (Ogollah et al., 2019). Test-retest reliability was consistently high across studies (Sheahan et al., 2015). The ODQ has been shown to have an acceptable reliability and validity, and also to be sensitive to true change (Mohseni-Bandpei et al., 2009). The ODI questionnaire is a reliable, valid, responsive, condition-specific assessment tool (Sencan et al., 2018).

This self-administered questionnaire was completed by answering ten questions concerning pain intensity, lifting, sitting, sleeping, travelling, personal care, standing, social life, and sexual function. In each topic category on the questionnaire, the patient ticks the statement that most accurately matches their situation, from 0—indicating no disability, to 5—indicating maximum disability. The total possible score is 50. The degree of a pregnant woman's disability is expressed as a percentage (the higher the score, the higher the degree of disability).

The patients were divided into five groups according to their degree of disability expressed as a percentage: minimal disability = 0-20%, moderate disability = 21-40%, severe disability = 41-60%, crippling disability = 61-80%, and a bed-bound patient = 81-100%. According to the inclusion and exclusion criteria for this study, the ODI rate included only two out of the five criteria (minimal and moderate disability only). As the following three criteria are severe disability, crippled and bed-bound, those participants were excluded from the study (Fairbank & Pynsent, 2000).

Physical Activity:

The physical activity level was measured using a reliable, valid questionnaire that the participants completed to analyse the current physical activity level of the pregnant women (Harrison et al., 2011). The Arabic version of SF-IPAQ was already validated in the Arabic language (Helou et al., 2018) and has been validated among Saudi women (Alahmadi et al., 2023).

The questionnaires include the short form of the International Physical Activity Questionnaire (IPAC-SF) and were created as a tool for the standardized evaluation of population health-related behaviours related to physical activity across numerous nations and in various socio-cultural contexts, as well as for the cross-national evaluation of physical activity (Oyeyemi et al., 2011). The short form of IPAQ (IPAQ-SF) has been suggested for use during time-constrained population prevalence investigations since it is simpler and more practical to perform than the extended form.

B) Functional Performance Tests (see appendix 10)

1. The Ten Meter Walk Test (10MWT)

The 10MWT is a performance measure that is used to assess walking speed in meters per second over a short distance. The test was set up using white tape markers placed at points along a 10-m long walkway, at 0 m, 2 m, 8 m, and 10 m. The subjects commenced the test standing with their toes against the tape marker (Moore et al., 2018). The test instructions were as follows: 'After "ready, set, go", walk as fast as you can up to the last white line without stopping or speaking along the way'. The performances were timed (to the nearest 100th of a second) between the 2 m and 8 m markers and later converted into the speed in meters per second (Smeets et al., 2006). The intra-rater reliability for the 10MWT was measured to confirm the robustness of the measurement system before the actual data collection was conducted (Appendix 8).

2. Timed Up and Go (TUG) Test

The TUG test consists of rising from a chair positioned 3 m from a wall, walking for 3 m, turning around a cone, returning to the chair, and sitting back down again. The test was performed as described in the study by Carvalho et al. (2019). The TUG was performed in a large room with a linoleum floor. The times were recorded using a lap stopwatch. All of the participants performed the TUG starting from a chair (height: 46 cm) with a back-support and armrests. The intra-rater reliability for the TUG was measured to confirm the robustness of the measurement system before the actual data collection was conducted (Appendix 8).

5.5. Procedure (Data Collection)

When the participants showed an interest in participating in the study, they were able to sign the information and consent forms electronically using Qualitrics, then proceed to the nurses' station to provide their demographic data (age, parity, height, weight, and gestational age, with a code number), also using the Qualtrics software, prior to their participation (see Appendix 11). Their body mass was measured to the nearest 0.1 kg and recorded using a medical-grade digital scale (Body Composition Monitor BF511, Omron Healthcare, Kyoto, Japan). Their body mass index (BMI) was calculated according to the standard equation Which is weight divided by height squared (Önal, 2019).

Then, the pregnant women answered three sections regarding their pain, physical activity, and disability level by completing the VAS, IPAC-SF, and ODI questionnaires, using the same software (due to the COVID-19 situation, the use of paper was not permitted). The ODI questionnaires were completed if the pregnant women were experiencing pain on a scale from 1-10. Pregnant women with zero pain would skip the ODI "automatically by the software" and start to complete the IPAC-SF.

Once the participants had completed the questionnaires, they were asked to perform the PFP tests used to complement their assessment. The tests included tasks that are the fundamental components of daily activities, which are commonly compromised in pregnant women. However, there was a low risk of an adverse event befalling the participants. Because of this, before performing the tests, the participants' medical history was checked with their physicians. Their vital signs were also monitored.

Before collecting the data, a pilot study was conducted to assess the feasibility of the study and the adequacy of the instrumentation, as well as to identify any potential problems with the data collection strategies and proposed methods (Appendix 11). The test-retest intra-rater reliability was then analysed by calculating the standard errors of measurement and Bland-Altman plots with limits of agreement to ensure the reliability of the tests for use with this specific study population (section 5.5.2).

The pregnant women were instructed by an experienced physiotherapist (the researcher) to complete all of the tests (TUG and 10 MWT) as fast as possible. The investigator had a list of the participants who were willing to participate before they went to the assessment room. Based on their code numbers on the list, they were allocated an even or odd number as a counterbalance, to make their order random. Even numbers started with the TUG test while odd numbers with the 10MWT. The subjects were subjected to one familiarization trial before the actual test to ensure that they had understood the test, and then two trials were performed. The time taken in seconds to complete each test was recorded, again using Qualitrics and, for the normative data, the best result was obtained.

A few considerations were applied to reduce fatigue. A 2-3-minute rest period was provided between repetitions of each functional test (Adegoke et al., 2015). However, due to the physiological condition of pregnant women, this rest period was flexible and could be extended if required. However, no participant asked for additional rest time.

5.6. Data Analysis

Three stages of the study were carried out. Verifying the PFT's reliability is the first step, and then assessing the regression analysis to identify the confounding variables influencing the PFT is the next step. Before the normative data for this study was defined, there were two stages. These were assessing the intra-rater reliability to verify the measurement system's robustness prior to the actual data-collecting procedure and measuring the regression analysis to determine whether confounding variables have an impact on the PFT. (See section 5.2 & Appendix 8).

The final stage is creating the normative data of two valid and reliable PFTs based on sub-groups identified from the regression analysis. Before the data collection, a pilot study was conducted in two phases (Appendix 8).

The final approach to the data analysis was discussed with the supervisory team. The decision was to perform the statistical analysis using SPSS version 26. To prepare the data for the inferential statistical and descriptive analyses; first, the pregnant women were clustered into two main groups: the pain group VAS=1-10 and the no pain group VAS=0. Then, each of these groups was categorized into subgroups based on demographic factors (physical activity, BMI, parity, GW).

The self-reported physical activity levels were categorized into two groups: active (achieving a minimum of at least 600 MET-min/week) and inactive (achieving less than 600 MET-min/week).

Height (cm) and weight (kg) were measured by the nurse, and the BMI was calculated as the weight in kilos divided by the squared height in meters (kg/m2), using the scale: Underweight < below 18.5, Normal weight 18.5-24.9, Overweight 15-29.9, Obese 30 or higher ("Obesity in Pregnancy," 2021).

The participants were also split into three separate groups according to their number of gestational weeks, as gathered from their medical reports, and then classified into three trimesters: the first (1-13 GW), second (14-27 GW), and third trimester (28-40 GW) (ACOG, 2013).

5.6.1. Phase One: Reliability Testing

To determine the reliability of the TUG and 10MWT tests, fifty pregnant women underwent three separate tests in the same time frame, with a two to three-minute interval between each test. One practice trial was permitted and a demonstration was given; the other two were recorded. One therapist completed both assessments, and the difference between them was used to calculate the intra-rater reliability (test 1, test 2).

Bland-Altman plots with limits of agreement and standard errors of measurement were used to analyse the test-retest intra-rater reliability. The standard error of measurement (SEM) and intraclass correlation coefficient (ICC) were used to determine the intra-rater agreements aiming at measuring the absolute agreement. One rater served as the foundation for the desired measuring technique. To identify the intra-rater reliability, a single rating, absolute agreement, and a one-way random-effect model for the rater were used for calculating the ICC values with 95% CI. Moreover, the Bland-Altman plots demonstrated intra-rater reliability. These plots showed the intra-rater standard deviations vs the mean for each measurement, which indicated the rater's intra-rater reliability.

The research was conducted and completed by fifty pregnant women. The pilot study's participant characteristics are listed in (Table 2, Appendix 8). The ICC values for both tests were higher than 0.70, which is often regarded as clinically acceptable (Nunnally & Bernstein, 1994).

5.6.2. Phase Two: Identifying the Confounding Variables

The model of the multivariate logistic regression analysis was used to determine the unique contribution of different variables when performing two functional tests as the dependent variables in time in seconds (10MWT and TUG) for the sample of 415 pregnant women. Possible confounding variables were assessed for both functional tests. First, multivariate logistic regression was performed by analysing the model using the ANOVA (analysis of variance) table via SPSS. The model was considered for further analysis if the F value was significant at $p<0.05$ according to the ANOVA table with the potential confounding variables for each functional test. The logistic regression analysis was later performed to determine partial correlations (r), P-values, t-values, standard error, and statistical significance of each confounding factor within the model. The models were run separately for the TUG and 10MWT tests.

Using the sample of 415 pregnant women, multivariate logistic regression analysis was conducted to examine the relationship between TUG and 10MWT separately (as the dependent variables, expressed as time in seconds) and each of the following independent variables as possible confounding factors: Pain, ODI, BMI, Gestational age and IPAC (See **Tables 5.2 & 5.3**: The regression analysis tables). Using ANOVA analysis (as described in section 5.4.1), the F value suggested a statistically significant model for both PFP and all of the aforementioned independent variables.

5.6.3. Phase Three: Creating Normative Data

The normative reference values NRVs were calculated, including the means, standard deviations, medians, confidence intervals for the means, and percent of participants for the TUG and 10MWT tests, based on demographic factors. The percentiles for the TUG and 10MWT scores (25^{th}, 50^{th}, $75^{th,}$ and 95^{th} percentiles), together with the median and standard deviation (SD), were estimated using linear regression.

The normative reference values presented in **Tables 5.4** and **Table 5.5**, including the medians and 25^{th}, 50th, $75^{th,}$ and 95^{th} percentiles of the participants with a specific time in seconds for TUG and speed in meters per second for the 10MWT test, depending on the demographic factors of each test based on a progression analysis for each test. The fiftieth percentile cut-offs for TUG and 10MWT and the demographic factors of the entire sample of 415 pregnant women. Several categories were created for the calculated percentiles: very high (percentile >75), high (percentile 50-75); low (percentile <50), and Normal (percentile 50) following Alcazar et al., (2021). Furthermore, optimal cut-off values of the PFP in pregnant women are at the 50^{th} percentile.

Finally, the influences of the confounding variables (GA, pain, PA, and BMI) on 10MWT and TUG-test performance will be determined to understand the functional status of pregnant women by measuring the median with the Inter-Quartile Range (IQR) and Box Plot for each normative data and subgroups.

5.7. Results

This section presents the results of the descriptive statistics, regression analysis, and multivariate logistic regression analysis.

5.7.1. Descriptive Statistics

Figure 5.2 shows the figures related to the demographic information about the participants in each category. Four hundred and fifteen pregnant women completed the IPAC-SF and VAS, and 284 pregnant women (in the pain group) completed ODI questionnaires and parity questions. The graph shows that, for the IPAC questionnaire, 187 (45%) of the pregnant women were considered active. The active group included both HEPA and minimal activity groups, while 228 (55%) of the pregnant women were identified as inactive. According to graph 1, regarding the ODI questionnaires, n= 204 (66%) complained of a minimal disability, while 80 (34%) of a moderate disability. Most of the participants were “overweight” (36%), followed by normal weight (21%), underweight (1%), obese (30%) and extremely obese (12%). Therefore, in terms of parity, for 26% (n=109) of the participants, it was their first pregnancy, while for 74% (n=306) it was at least their second pregnancy (**Table 5.1**).

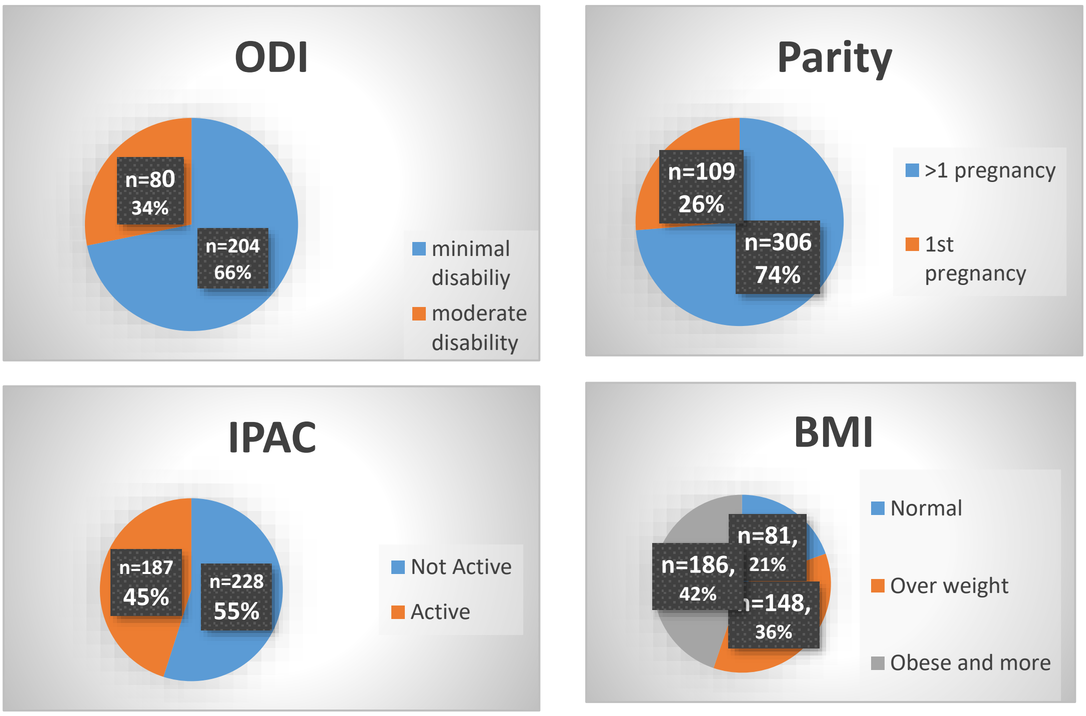


Figure 5.2: Pie chart showing the frequency and number of the categorical variables (Physical activity IPAC, Disability rate ODI and parity). Showing the percentage of total number of pregnant women

Table 5.1: Descriptive Statistic

Variables		**No pain group (n=131)**				**Pain group (n=284)**			
		1st Trimester	**2nd Trimester**	**3rd Trimester**	**Total**	**1st Trimester**	**2nd Trimester**	**3rd Trimester**	**Total**
		30	47	56		56	87	141	
		N	N	N	N	N	N	N	N
IPAC	-Active N=187 (45%)	12	23	28	64	27	35	61	123
	-Not Active 228 (55%)	18	24	26	69	29	52	80	161
ODI	minimal disability 204 (66%)	0	0	0	0	35	64	105	204
	moderate disability 80 (34%)	0		0	0	14	25	41	80
BMI	kg/m^2 Mean(SD)	28.18 (5.19)	26.98 (4.69)	29.88 (4.54)		27.52 (5.19)	30.27 (5.39)	32.93 (6.38)	
parity	Multiple pregnancies N= 306 (74%)	22	36	37	95	42	72	99	213
	First pregnancy N= 109 (26%)	8	12	19	38	14	15	42	71

5.7.2. Reliability Testing

ICC = 0.948 (0.91,0.97) for the TUG performance timings and 0.945 (0.906,0.969) m s-1 for the 10MWT performance periods. This shows that all intra-tester reliability assessments yielded high-reliability results, all of which were statistically significant (p= 0.001). Given that this type of reliability only evaluates within-subject variability and the assessors' ability to time performances at a single testing session, and does not assess whether the test is stable over time, thus, the high values found for the intra-tester reliability for the

Figure 1A: 10 MWT Bland-Altaman graph

functional performance tests were expected. The differences between the Timed 'Up & Go' test and a retest conducted on the same day are displayed in the Bland-Altman plots (**Figure 5.3A** and **Figure 5.3B**). Regarding both evaluations and the presence of identified bias, there was a high degree of agreement in the between-observer plot, indicating a high degree of agreement within an observer. The within-observer plots show a consistent method of rating for the 10 MWT and TUG tests. Plotting the mean for the two measurements (trials 1 and 2) on the X-axis and the differences between the two trials (for each test) on the y-axis produced the Bland-Altman plot. The top and lower lines represent the 95% limit of agreement, while the central line represents the bias, or more precisely, the mean of the discrepancies.

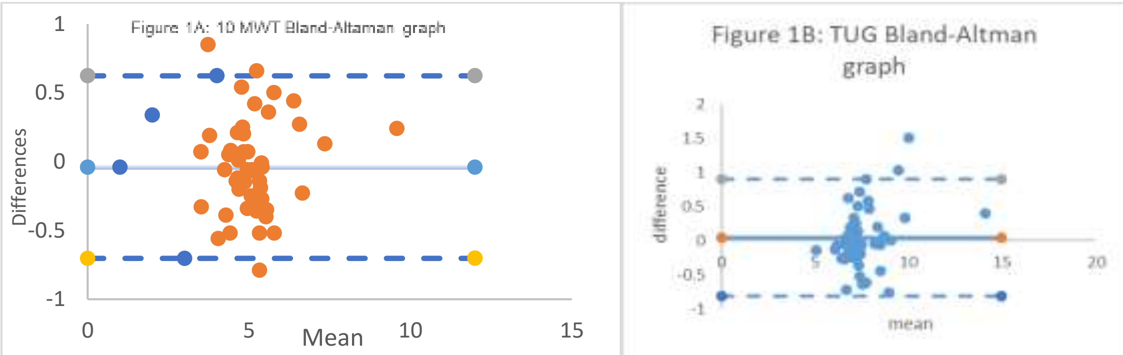


Figure 5.3: Bland-Altman graphs showing the differences between a) the ten-meter walk test (10 MWT) and b) the Timed 'Up & Go' (TUG) test and retest on the same day. The dashed bold lines represent the mean difference score. The dashed lines represent the limits of agreement (mean ± 1.96 × the standard deviation of the difference score).

5.7.3. Identifying the Confounding Variables

The following independent variables were included in the best model created by multiple linear regression analysis to predict the 10MWT values: BMI (P=0.014; r=0.112; F=0.800), pain (P<0.001; r=0.195; F=4.351), physical activity level (P<0.001; r=-0.178; F=7.989), and gestational age GA (P<0.001, r=0.227, F=11.899). Since parity and OSW did not increase the logistic regression model's predictive ability, they were eliminated. Similar conclusions were found from the multiple logistic regression analysis when TUG was taken into account as a dependent variable. The independent variables that made up the best model were physical activity level (P=0.003; partial r=-0.130; F=-1.935), BMI (P=0.001; partial r=0.169; F=0.840), ODI (P<0.001; partial r=0.230; F=1.678), and GA

(P<0.001; partial r=0.154; F= 1.697). For a TUG multiple logistic regression study, pain and parity were disregarded because they had no effect on the model's predictive power (R2). Regression analysis results show that GA, PA, and BMI are confounding factors for both tests, while pain is an additional variable for the 10MWT. These results showed that the time needed to finish the 10 MWT increased considerably with increasing gestational age. Likewise, higher BMI and the presence of discomfort were substantially correlated with longer durations on the 10-minute walking test. Anticipatedly, a rise in IPAC (activity level) led to a notable reduction in the time needed to finish the 10-minute walk test. Similar to the 10 MWT, a rise in BMI and GA led to a notable extension in the TUG task completion time. Moreover, there was a strong correlation found between a decrease in the amount of time spent on the TUG test and an increase in the individuals' self-reported physical activity. ODI showed a substantial increase in the amount of time required for the TUG test with an increase in the rate of impairment, even when pain was not included in the model.

Due to the statistically significant association between the confounding variables mentioned above with the two physical functional performance tests, these variables were considered to develop the normative data further, and the values were classified accordingly. Parity was not predictive of both 10MWT and TUG and was hence excluded from the normative tests. Moreover, for the TUG test, pain was not observed to be a confounding variable for the normative data.

Table 5.2: The results of the regression analysis for the prediction of 10MWT

Variable name	t	Sig. P-value	Partial correlations
GA	4.996	.000	0.227
Pain	4.303	.000	.195
IPAC	-3.917	.000	-0.178
BMI	2.471	.014	0.112

Table 5.3: The results of the multivariate regression analysis for the prediction of TUG

Variable name	T	Sig. P-value	Partial correlations
GA	3.926	0.00	0.154

OSW	4.153	0.00	0.230
BMI	3.422	0.001	0.169
IPAC	-2.991	0.003	-0.130

5.7.4. Normative Reference Values (NRV)

In line with the regression analysis, some of the potential factors were eliminated from both tests, as parity was excluded from the prediction of both tests and pain was not a confounding variable for TUG test normative data. Based on the regression analysis, physical activity level, BMI, and GA are potential demographic factors for both the 10 MWT and TUG tests, while pain was an additional factor for the 10MWT.

The median value of both tests (10MWT and TUG) rises with increased BMI, discomfort, and the development of pregnancy (GA), but falls with physical activity.

The percentiles of TUG and 10MWT in pregnant women are displayed for confounding factors (PA, GA, pain, and BMI) in **Tables 5.4** and **5.5**. The box plots in **Figure 5.4** (A&B) display the extreme instances, median, and interquartile range (IQR) for each confounding variable. The groups' performance on the 10MWT and TUG varied substantially ($p<0.0001$).

The median, 75%, and 25% scores for each of the 10MWT's confounding factors are displayed in **Table 5.4** and **Figure 5.4**. According to normative data from the 10MWT, half of the pregnant women with pain had walking speeds of less than 1.35 m/s and less variability (IQR=0.32 m/s), while half of the women without pain had walking speeds of less than 1.56 m/s and more variability (IQR=0.52 m/s). When it came to walking, half of the active pregnant women had a walking speed of less than 1.41 m/s with more variability (IQR=0.64), whereas the other half of the non-active group walked at a pace of less than 1.37 m/s with lower variability (IQR= 0.37). Half of the pregnant women in the gestations age categories walked less than 1.56 m/s in the first trimester, 1.42 m/s in the second trimester, and 1.33 m/s in the third trimester. With the advancement of the pregnancy, the findings' variability decreases in the first, second, and third trimesters (IQR=0.52, 0.37, and 0.36), respectively. Pregnant women with normal weights exhibited a walking speed of less than 1.33 m/s with higher variability

(IQR = 0.44 m/s), whereas half of the obese pregnant women had a walking speed of less than 1.30 m/s with lower variability (IQR = 0.36 m/s). Pregnant women who were overweight had the lowest variability, with a walking speed of less than 1.38 m/s (IQR = 0.31 m/s). Between each variable's subgroups, the walking speed at its lowest and highest points was quite similar. The results of normative data in TUG for subgroups of physical activity are displayed in **Table 5.5** and **Figure 5.4**. The results show that half of the active pregnant women completed the TUG test in less than 5.99 seconds, with relatively low variability (IQR = 1.14 seconds). In contrast, the other half, who were not active, completed the test in less than 6.1 seconds, but with higher variability (IQR = 2.19 seconds).In terms of the subgroups based on gestational age, 50% of the first-trimester pregnant women walked for less than 5.73 seconds, with variability (IQR = 1.21 seconds). The half of pregnant women in the second trimester, who walked less than 5.98 seconds, had the least variability (IQR=0.95), while the other half of pregnant women in the third trimester who walked less than 6.43 seconds had the most variability (IQR= 2.36 s) among all variable groupings.

Finally, the three subgroups of BMI showed that half of the pregnant women with normal weight had walked time less than 5.81s with the least variability (IQR=0.97 s), whereas half of the over-weight pregnant women walked less than 6.15 s with higher variability (IQR= 2.12s). In addition, half of the obese pregnant women walked less than 6.22s with the highest variability (IQR= 2.12 s). The minimum and maximum walking speeds of each variable subgroup were almost similar.

Table 5.4: Normative Reference Values with the Meters Per Seconds for the 10 MWT Test by Pain, PA, and GA

10MWT Test (sec) percentiles (N= 426) m/s							
	MAX	Very high (P 95)	High (P 75)	Normal (P 50)	Low 25	MIN	**IQR**
PA							
Not Active	2.86	2.01	1.56	1.37	1.15	0.58	0.37
Active	3.26	2.26	1.89	1.41	1.16	0.63	0.64
Pain							
pain	2.26	2.03	1.50	1.35	1.14	0.58	0.32
No Pain	3.56	2.14	1.82	1.56	1.23	0.82	0.52

GA							
1st	3.26	2.28	1.89	1.56	1.32	0.83	0.52
2nd	2.93	2.13	1.62	1.42	1.21	0.63	0.37
3rd	2.88	1.90	1.51	1.33	1.11	0.58	0.36
BMI							
Normal	3.26	2.04	1.72	1.49	1.21	0.90	0.44
Over weight	3.24	1.99	1.50	1.38	1.16	0.63	0.31
Obese	2.88	1.80	1.52	1.30	1.10	0.58	0.36

Table 5.5: Normative Reference Values with the Time in Seconds for the TUG Test by PA, BMI, and GA

TUG Test (sec) percentiles (N=426)							
	MAX	Very high (P 95)	High (P 75)	Normal (P 50)	Low 25	MIN	IQR
PA							
Not Active	4.13	5.74	5.90	6.2	9.34	11.39	2.19
Active	3.96	4.99	5.59	5.99	8.23	10.74	1.14
GA							
1st	4.10	4.72	5.29	5.73	6.57	9.40	1.21
2nd	4.13	4.97	5.68	5.98	7.12	10.97	0.95
3rd	5.9	5.13	5.78	6.43	8.73	11.74	2.36
BMI							
Normal	3.96	4.94	5.32	5.81	6.30	10.03	0.97
Over weight	4.13	4.87	5.56	6.15	7.09	11.39	1.37
Obese	4.20	5.09	5.72	6.22	8.48	11.74	2.12

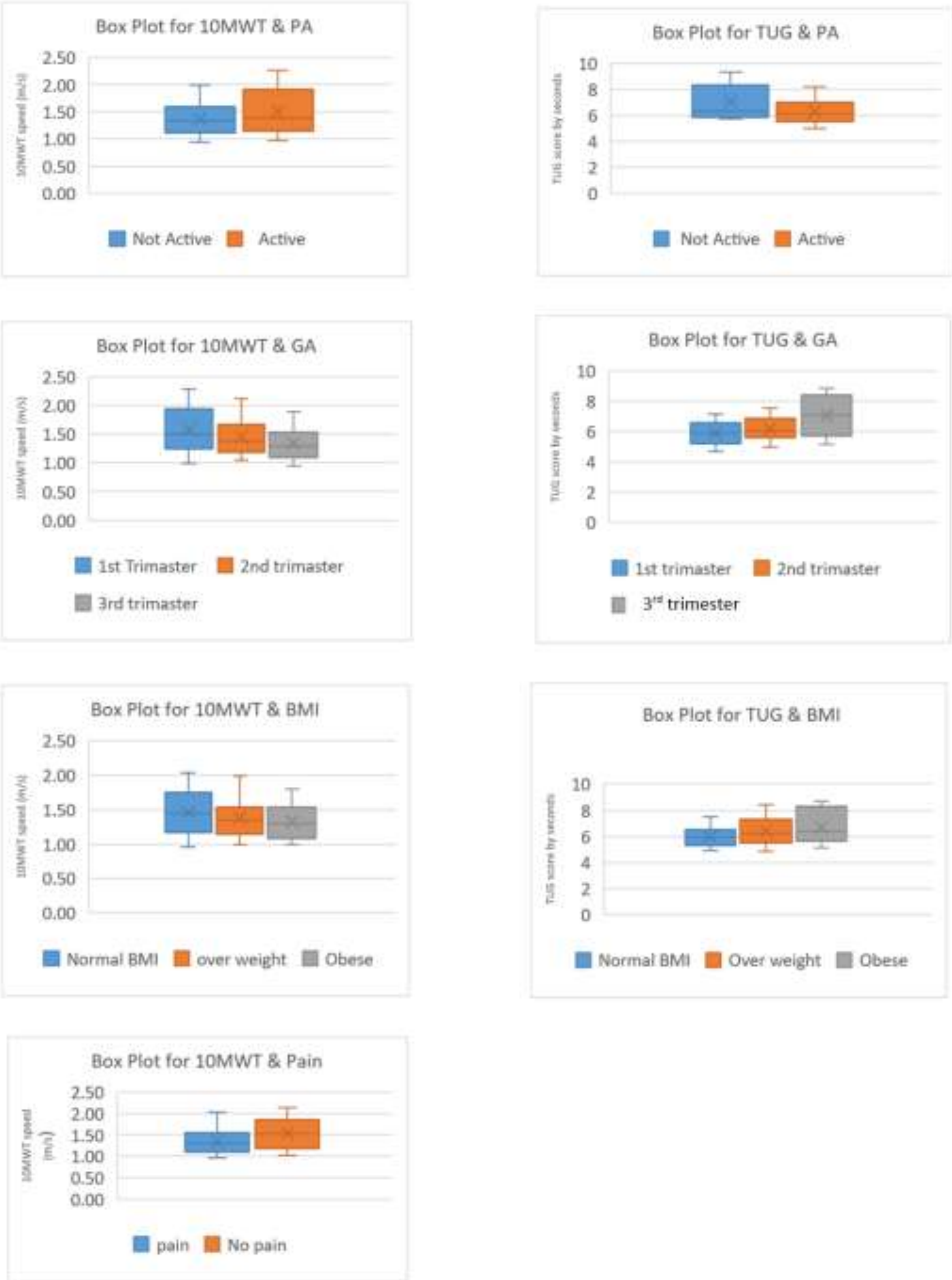


Figure 5.4: A) Box plots for 10MWT variables. **B)** Box plots for TUG test variables

5.8. Discussion

This is the first study to report normative data of TUG and 10MWT among pregnant women. This study aimed to determine the status of functional tests through normative data of the two tests (TUG and 10MWT performance) as a reference for pregnant women with and without LPP, according to the potential demographic factors. The results showed that the active, asymptomatic pregnant women who were within normal BMI and had an early pregnancy performed significantly higher on the TUG and 10MWT tests.

5.8.1. Prediction of PFP Decline

5.8.1.1. Prediction of 10MWT Decline

The findings demonstrate that, for the 10MWT normative data, pain was shown to be a confounding variable. The results are in line with earlier population-based research and demonstrate worse 10MWT performance with higher pain (Dobkin, 2006; Roberts et al., 2014; Studenski et al., 2011). It is crucial to emphasize in this context how the 10MWT speed score decreased significantly as pain increased. The study's findings demonstrated that pregnant women experiencing pain performed the 10MWT less variability and at a slower pace than pregnant women experiencing no pain (p= 1.35, IQR=0.32 m/s, p= 1.56, IQR=0.52 m/s). The link between PFP and muscle dysfunction during pregnancy may help to explain this (Gutke et al., 2008). Another reason might be the negative relationship between pain-affected pregnant women's speed and their fear of moving or being disabled; this suggests that biopsychosocial variables have an impact on gait kinematics (Christensen et al., 2019).

Previous findings have shown how pregnant women with various pain categories varied in their walking speeds (m/s): no pain = 1.33, lumbar pain = 1.31, PGP = 1.24, and combined pain = 1.25 (Gutke et al., 2008). The main findings of the study were that pregnant women with all forms of pain had reduced muscular function in terms of trunk endurance and hip extension muscle strength, as well as a lower preferred gait speed, compared to pregnant women without lumber pain. The pregnant women with PGP showed greater lower back flexor muscle endurance than the women who had never experienced LBP. In both the with-pain and no-pain groups, our sample performs better when compared to our reference values of 10MWT. This might be the result of employing various walking test techniques and locations. The with-pain group performed better than the no-pain group. Thus, doctors can spot variations from predicted levels of function, suggesting possible areas of concern or decline risk, by comparing an individual's performance to normative data (Alcazar et al., 2021).

As a result, a performance drop below 1.56 m/s may indicate approaching discomfort. Patients cannot receive direct access to physiotherapy in Kuwait due to clinical policy; instead, they must be referred to a PT department by an obstetrics and gynaecology. Therefore, it's critical to raise healthcare providers' knowledge of pregnant functional status in Kuwait, the negative consequences of pain, and the contribution of physiotherapy to PFP.

5.8.1.2. Prediction of TUG Decline

Physical Activity

The study's findings indicate that the median TUG values increase with decreasing activity. Physically-active pregnant women performed the best, at 5.99 s (IQR=1.14 s), as opposed to the sedentary group's 6.1 s (IQR= 2.19). This result is consistent with earlier research indicating declines in TUG performance (Kear et al., 2017; Pondal & del Ser, 2008). These studies attribute the longer time needed to complete TUG to a decrease in physical activity and mobility. Women may do the lowest on TUG because of less mobility and lower limb muscular weakness (Bischoff et al., 2003; Zarzeczny et al., 2017).

This might be because walking quickly, maintaining muscle strength, and engaging in frequent, intense physical exercise are all strongly correlated (Hill et al., 2015). Additionally, during the pregnancy, there was a tendency for the amount of physical activity to decrease (246 ± 74 MET hour/week in P1, 227 ± 76 MET hour/week in P2, and 206 ± 84 MET hour/week in P3) (Forczek et al., 2019).

According to a recent meta-analysis and comprehensive review, LPP is linked to a reduction in regular physical activity during pregnancy (Davenport et al., 2019). They discovered that engaging in physical activity before, during, or after pregnancy did not lower the risk of having LPP. On the other hand, certain types of physical exercise during pregnancy reduced the intensity of LPP. Pregnant women's TUG fall in physical activity normative scores is, therefore, associated with lower levels of physical activity and may be predictive of musculoskeletal problems such as back discomfort, joint stiffness, or muscular weakness.

Gestational Age

Additionally, the first trimester of pregnancy showed the highest performance for TUG (5.73 s, IQR= 1.21 s), while the third trimester showed the worst performance (6.43 s, IQR= 2.36 s). These findings were in line with those of a prior investigation carried out in 2016 by Wadhwa et al., which showed that there were statistically significant differences in TUG scores among the three trimesters of pregnancy. There was no normative data collection for the research. The first week of the second month was group A's time, at 10 seconds; the first week of the fifth month was group B's, at 12 seconds; and the first week of the eighth month, at 15 seconds. Nevertheless, the participants in the previous study were much slower than those in the current study. This resulted from the population's sample size, which comprised 30 pregnant women in each trimester for each test. Furthermore, being in the first week of each trimester was one of the inclusion criteria, which might not have shown alterations that happened gradually over the course of the trimesters. A further plausible explanation might be that the previous study was carried out in a different economic environment than the one being carried out in New Delhi.

This emphasizes how crucial it is to take gestational age into account when evaluating PFP. Consequently, given that pregnancy-related physiological changes might affect one's ability to move, balance, and perform functional tasks, GA may be a significant predictor of TUG reduction (Daneau et al., 2021). Further research on the relationship between GA and TUG, utilizing this data as a standard to assess pregnant women's functional performance, might be helpful. In addition, each trimester's treatment plan must be adjusted based on the woman's unique trimester to meet the PFP requirements.

BMI

According to the results, pregnant women who had a normal BMI outperformed overweight or obese women. Prior research revealed that during particular TUG test sub-phases, those with greater BMI exhibited worse dynamic balance (Ganesan et al., 2018). Changes in the biomechanical behaviours in trunk flexion during stand-to-sit and trunk extension during sit-to-stand may be the cause of the drop in the TUG score (Cimolin et al., 2019). Strong evidence suggests that variations from normative standards might point to those who are more vulnerable to PFP reduction (Legrand et al., 2014). Normative data, such as the prediction value of muscular strength and physical performance for hospitalization, as well as the definition of disability, which is defined as a reduction in activities of daily living (ADLs) irrespective of muscle mass, were supplied by Legrand et al. (2014).

The longer times for TUGs in the third trimester may be explained by the decrease in balance, mobility, physical activity, and the musculoskeletal system's adaptations throughout pregnancy (Santos-Rocha et al., 2019). Based on the abovementioned, normative statistics are essential for anticipating the loss of physical functional performance (PFP) since they offer a framework of comparison and help to comprehend population heterogeneity. The normative data findings for the TUG and 10MWT indicate that there was about equal variation in the lowest and maximum performance scores for each variable grouping. As a result, employing the IQR contributes to a more reliable assessment of variability (Vinutha et al., 2018). This might imply that performance differences in the TUG and 10MWT are being caused by variables not taken into account during the study. Even with the constant performance ratings, more research into the possible causes of these results is necessary. Functional performance in the TUG and 10MWT tests may be better understood by looking at other factors or taking interactions between variables into account.

According to a recent meta-analysis and comprehensive review, LPP is linked to a reduction in regular physical activity during pregnancy (Davenport et al., 2019). They discovered that engaging in physical activity before, during, or after pregnancy did not lower the risk of having LPP. On the other hand, certain types of physical exercise during pregnancy reduced the intensity of LPP. The relationship between lumbopelvic pain (LPP) and pregnancy-related behavioural changes, including increased physical activity, explains this. Furthermore, compared to their non-obese counterparts, obese women reported considerably fewer daily activities and scored worse on several physical performance measures, such as TUG (Newton et al., 2009). Ling et al. (2012) looked at the elements of function and impairment in two groups: one with Class III obesity and the other with overweight or Class I obesity. They found that TUG differed significantly between the two groups and that TUG, anthropometrics, and gait characteristics were the best indicators of these patients' ability to engage in active lifestyles. The factors' combined contribution might account for the consistency in performance ratings across subgroups.

Predictive models may be created based on data analysis to determine the chance of PFP drop in pregnant women. The continuous nature of the linear regression-based norms, which are based on the whole sample of participants and modifications for important demographic characteristics, is another benefit (Escudier et al., 2016). To get representative normative data, we attempted to enrol pregnant women with and without LPP in a comparable percentage, with varying GA, BMI, and PA levels. This allowed us to examine the influence of demographic characteristics on judgment and input them as predictors. Additionally, healthcare professionals can identify people who could be at risk of PFP reduction in the future by seeing variations from normal levels. Proactive therapies can prevent or minimize functional decline before it worsens thanks to early identification. By comparing the participants' TUG test scores with a normative cut-off point for old women, previous research revealed that the TUG test helps identify mobility limitations in the elderly (Bischoff et al., 2003). Elderly people living in the community who take longer than 12 seconds to complete the TUG test should be evaluated and assisted right away in everyday clinical practice.

As patients participate in rehabilitation programs like physical therapy or exercise, improvement may be monitored by using the TUG or 10MWT normative data and cut-off points as a baseline. Additionally, if the outcomes are not what is expected, a physical mobility meter measure enables practitioners to evaluate how well the pregnant women are following the treatment goals and notify them of any problems with adherence or motivation. Engaging the expectant ladies and explaining any reductions, expectations, and objectives will also be of obvious help.

5.8.2. Clinical Decision Based on the Target Weaknesses from the Norms

Healthcare professionals evaluate a person's performance on a range of physical functional performance (PFP) tests using normative data. Deviations from normative values point to weak points or functional impairments in the body, such as diminished strength, impaired balance, or limited mobility. Moreover, PFT percentiles were supplied to help researchers and physicians understand the data collected from tested subjects (Wang et al., 2018).

Such reference values may make it possible for researchers to look into the causes of PFP reduction and create predictive models that may be used to identify those who are at risk. An earlier research, for instance, determined normative values and percentile curves for timed functional tests. This made it possible to compare the motor abilities of young people's Duchenne muscular dystrophy (DMD) to those with normal growth and development (Hoskens et al., 2019). The information was also useful in assessing how the illness developed, how those with DMD responded to therapy, and how their natural history unfolded. Longer stance times and double limb support have been discovered in earlier research on pregnant women, which is likely to improve stability and safety during gait in healthy pregnant women (Aguiar et al., 2016; Branco et al., 2015; Forczek et al., 2019; Kerbourc'h et al., 2017). Other studies assessing the ability to walk quickly confirm these results (Roberts et al., 2014). The outcomes are also associated with muscle testing, which is consistent with the previously documented connections between low back pain and a decrease in the endurance of the lower limb muscles (Cai & Kong, 2015).

The study's findings indicate that while the median TUG test value increased with increased physical activity, it decreased with pregnancy progression (GA), pain, and elevated BMI. These results are consistent with earlier research showing declines in TUG performance (Kear et al., 2017; Pondal & del Ser, 2008). According to such research, alterations in the neuromuscular system and a decrease in mobility and physical activity account for the longer time needed to complete the TUG test. Women may do the lowest on TUG because of less mobility and lower limb muscular weakness (Bischoff et al., 2003; Zarzeczny et al., 2017). This might be because there is a direct link between walking swiftly, maintaining muscular strength, and engaging in frequent, intense physical activity (Hill et al., 2015). As a result, any deviations from the normative reference values point to regions of physical function impairment or weakness, such as diminished strength, impaired balance, or decreased mobility.

Health practitioners can utilize normative data and performance test cut-off points from Alcazar et al. (2021) to identify older patients who are more likely to have low leg bone mass index due to their low relative performance. Similarly, this study's use of cut-off points for PFP and normative data, which include confounding factors, may aid in identifying pregnant women who are more likely to function poorly. To determine whether older persons could benefit from lifestyle changes to maintain muscular strength and lower the likelihood of physical and mental limitations, another research created the handgrip strength cut-off points (Ramírez-Vélez et al., 2019).

Pregnant women with low BMI and physical activity levels can undertake lifestyle modifications. An inactive lifestyle was associated with a deterioration in TUG performance. Pregnant women who were obese had the lowest performance (P 50= 6.2 s) and the most variability between subgroup comparisons. When assessing physical ability that has greatly increased as a consequence of a multimodal rehabilitation program, both of these variables are relevant. According to a recent systematic analysis that looked at the connection between prenatal exercise and LLP, prenatal exercise reduced the intensity of LBP, PGP, or LBPP both throughout pregnancy and during the postpartum phase (Davenport et al., 2019).

It has been proposed that physical activity reduces the amount of biomechanical change that occurs during pregnancy by improving spinal alignment and segmental mobility, strengthening joints, and reducing the strain on the spine. Previous research supporting this idea suggested that physical activity during pregnancy might assist in correcting imbalances in the trunk muscles or start a process of pain desensitization that would raise the threshold for pain perception (Colla et al., 2017; Diez-Buil et al., 2023; Gutke et al., 2008). Regretfully, 55% of the pregnant women in our research were sedentary, underscoring the necessity of encouraging PA among expectant mothers and developing a regular prenatal exercise program at each Kuwaiti maternity facility. As a result, by conducting follow-up evaluations to track the progress towards objective goals over time, the PFP tests and comparisons to normative data may be useful. Interventions may be modified in response to advancements or lack thereof.

Furthermore, as more physically active pregnant women have been observed to increase their stride length and speed, it has been shown that the unfavourable changes in walking speed during pregnancy may be mediated by the PA level (Forczek et al., 2019). The study's TUG and 10MWT mean scores for the obese and normal patients were the slowest and quickest, respectively. This shows how body mass index affects back pain, functional disability, and health-related quality of life on both objective and subjective levels (Stienen et al., 2016). The associations between obesity and increased LBP are linked to this positive correlation between BMI and functional impairment (Dario et al., 2015; Shiri et al., 2014). This has previously been explained by the link between a high BMI and impaired functional capacity due to diminished strength, flexibility, balance, and coordination. Furthermore, it affects the intensity of pain, which reduces movement and, thus, overall physical activity, which in turn affects PFP negatively (Danna-Dos-Santos et al., 2018; Opala-Berdzik et al., 2009; Preetha & Solomon, 2011; Ramachandra et al., 2015; Takeda et al., 2015). Therefore, healthcare practitioners set specific goals for improvement based on the shortcomings that have been recognized. To get the person's performance closer to the predicted norms for their condition and associated variables, these goals are frequently defined concerning normative values.

Merely 20% of the subjects in the present investigation fell within the typical weight range, suggesting that elevated BMI is a significant contributing factor to the fall in PFP. According to Frayne et al. (2019), there is a pressing need to support Kuwait's multidisciplinary healthcare system, which consists of doctors, nurses, physiotherapists, and nutritionists, in offering complete treatment to expectant mothers. Both the health results and the patients' pleasure will increase as a result. Our findings might positively influence intervention plans meant to improve functional performance. The findings indicate that pregnancy may have an impact on PFP as physical activity levels tend to decline throughout pregnancy. (246 ± 74 MET hour/week in P1, 227 ± 76 MET hour/week in P2 and 206 ± 84 MET hour/week in P3) (Forczek et al., 2019). This may be due to fatigue, fear of movement, or cultural habits (Al-Sayegh et al., 2012; Harrison et al., 2011; Marín-Jiménez et al., 2019). However, other variables may be changed, like discomfort, lifestyle, and BMI, that can improve or decrease performance. The study's findings offer the cut-off values for each confounding characteristic among Kuwaiti pregnant women, thereby adding to the body of knowledge currently in publication.

5.8.3. Classifying the Participants into Functional Groups

Normative data provided a standardised framework for classifying participants into functional groups based on their physical function. The IQR, along with the median, provided information about the central tendency of the dataset. By dividing the data into quartiles, the IQR highlights the range within which the middle 50% of the data points fall (Vinutha et al., 2018). This helped healthcare providers understand the typical range of performance for a given population, which is crucial for interpreting normative data.

Although clinicians often use classification systems to guide clinical decisions, treatment targeting specific factors is believed to improve patient outcomes. However, limited evidence to support the use of classification systems in clinical practice for reducing pain intensity and disability when managing LBP (Tagliaferri et al., 2022).

The participants were classified into functional groups according to their performance (low, normal, high, very high). These classifications depend on other factors, like pain and GA. This study followed the categorization of a recent study that provided normative data and functionally relevant cut-off points for the physical performance of older subjects using the test (Alcazar et al., 2021).

Therefore, based on the normative data, cut-off points are defined to delineate different levels of performance. For example, the 10th percentile may be used to define the cut-off for "below-average" performance, while the 90th percentile may represent "above-average" performance. In addition, the higher variability in the IQR could also indicate potential subgroup differences within the population. For example, if studying the physical functional performance in TUG of pregnant women across different gestational age groups, a higher IQR may suggest greater variation in performance among pregnant women in the 3rd trimester with (IQR= 2.36 s) compared to earlier trimesters (IQR= 1.21 s).

It is possible to determine how discomfort or musculoskeletal problems impact functional capacities by analysing the IQR of PFP concerning pain levels. Higher pain or discomfort during pregnancy may cause a pregnant woman to show signs of weakness, inflexibility, or limited movement (Fiat et al., 2022). To reduce symptoms and enhance functional results, tailored therapies may involve pain management techniques including physical therapy, massage, or support equipment (Sonmezer et al., 2021).

O'Connor (1990) highlighted the importance of using reference values for PFP, as they describe what is typical in a given demographic at a particular moment. Such reference values are crucial for clinicians as it may be challenging to understand a clinical test score without them. Following the expected level for an individual's age, sex, and other factors, percentiles show how well they perform in comparison to their peers (Svinøy et al., 2021). When evaluating individual or group scores in research, we use reference values to compare the results to the group's typical values in light of the members' age, nationality, gender, or other factors (Jacobsen et al., 2018).

Healthcare professionals can comprehend how functional capacities vary throughout pregnancy by comparing the IQR of PFP across various gestational age groups. For instance, during various gestational stages, they could notice differences in strength, balance, or mobility (Fiat et al., 2022). Customized treatments may be created to target certain issues related to each trimester, including exercising to enhance balance when the center of gravity changes in the third trimester (Davenport et al., 2019).

5.9. The Strengths and Limitations of the Study

First, there were several restrictions on the sample representative, such as the possibility that the results may not apply to other regions or ethnic groups because the participants were Kuwaiti citizens. Nonetheless, it could be relevant in Kuwait and other nations, including the GCC countries, that have comparable health care systems and lifestyles. Furthermore, the study was carried out at hospitals run by the government and private sector, encompassing a range of ethnicities and socioeconomic backgrounds. Another drawback is that the study was carried out at the height of the coronavirus outbreak, which may have had a detrimental effect on pregnant women's psychological health and degree of physical activity. To determine whether different results will be seen in the post-coronavirus phase, additional research is required. Furthermore, we are aware that self-report mistakes can occur with the SF-IPAQ, despite the fact that it is a trustworthy and reputable measure to assess physical activity among pregnant women.

Another significant aspect of our study is the application of linear mixed model analysis, which accounts for heterogeneity both within and across women. The results of this study have given important quantitative information on pregnant women's PFP, which has aided in the establishment of cut-off scores and baseline values. The interquartile range (IQR) is also a useful tool for analysing normative data because of its simplicity of interpretation, adaptability for non-normal distributions, robustness against outliers, and emphasis on central tendency. Because of these features, the IQR is a useful tool for assessing demographic characteristics and summarizing variability in the context of normative data analysis. Obs/Gyn is frequently the primary source of referrals to physiotherapy in Kuwait and other countries. The possible significance of our research for clinical practice is offering clinical practice recommendations for Kuwait's healthcare system. This may be accomplished by implementing the study's ideal cut-off points into the referral system's triage plan. Furthermore, these results have given Kuwait and the GCC countries a baseline and particular insights to guide future efforts.

5.10. Clinical Implications and Recommendations

This study is designed to determine the normative values of TUG and 10MWT in pregnant women based on pain and potential factor groups. The normative values presented in this study might serve as a useful reference for pregnant women's PFP. Detailing both of the functional performance tests based on PA, GA, BMI, and pain will provide researchers and clinicians with more precise representations of functional mobility among pregnant women, with and without LPP, using a simple test.

The clinical application of this study provides a normative table for decision-making. In Kuwait, the scientific committee and protocol committee at the Physical therapy administration (PTA-KW), consists of researchers and physiotherapists responsible for setting and implementing any testing protocol and educating the physiotherapist about it by lectures and brochures. Therefore, it is recommended that policymakers develop and implement physical functional performance testing protocols based on the available scientific evidence. In addition, policymakers can ensure that resources are allocated effectively (space and equipment) and that the physiotherapists and clinicians are informed and educated.

Classifying the patients based on their performance may change the practice (depending on whether the patients are not fit, normal, or fit). This classification may be useful for the triage system in referring pregnant women for physiotherapy and also allocating them to exercise groups with other pregnant women with the same PFP level. In addition, they can use the classification as a baseline reference value to compare the PFP of pregnant women.

I recommend collaboration between policymakers and clinicians to implement the suggested practice model, customised to suit hospitals in Kuwait (**Figure 5.**). First, according to the triage system, the performance of pregnant women will be tested according to their pain. The choice of pain is considered the most common musculoskeletal symptom during pregnancy, and as an indicator and a potent risk factor for a negative impact on QoL, leading to functional limitations (Lagadec et al., 2018). According to the cut-off point (if <= 1.28 m/s), this will follow the red-line triage and the patient will have direct access to physiotherapy.

Pregnant women with no-pain can attend preventive pregnancy rehabilitation group exercise sessions. This was supported by a systematic review that investigated the effectiveness of prenatal physiotherapy in preventing and treating pregnancy-related symptoms (Van Kampen et al., 2015). The findings have shown that the majority of studies indicated that prenatal physiotherapy played a preventative role in LPP, weight gain, and incontinence. Another systematic review also supported the need for prevention rehabilitation exercise, due to the complex nature and unpredictable course of the condition (Davenport et al., 2019). Therefore, the European guidelines for the prevention of LBP (2008) recommended that prevention be aimed at reducing the impact and consequences of LBP rather than focusing on the primary causative mechanisms (Burton et al., 2006).

A recent review of the guidelines for exercise testing and prescription of pregnant women claimed that there are no specific tests for proper assessment of musculoskeletal function—muscular strength and resistance, and flexibility—although these components of health-related physical fitness are addressed in the recommended guidelines for exercise during pregnancy (Santos-Rocha et al., 2022). They added that the functional capability of pregnant women needs to be tested to establish a prenatal fitness class for pregnant women. The same situation occurs regarding the skill-related fitness components, namely agility. Physical performance testing protocols that have been used for the assessment of functional status and fitness components of senior populations might be useful and safe for pregnant women, although there are no reference data to accurately interpret the results. They suggested the Timed Up and Go (TUG) test as an option used to assess a person’s mobility and requires both static and dynamic.

Therefore, I suggest that two levels of exercise program should be established (normal and not fit). Clinicians can use the TUG reference value to assign pregnant women to a matching group based on their performance on the TUG test. The target goal is to achieve a cut-off point in the fit group for each trimester (first, second, and third, at 4.72, 4.97, and 5.13 sec.). This will indicate that the pregnant woman can be discharged.

The above recommendation was shared at the World Physiotherapy Congress in 2023, the Physical Therapy Administration at the ministry of health in Kuwait (PTA-KW), and the Kuwait Physical Therapy Association (KPTA), and have echoed positive opinions about the findings of this study. These agencies have expressed that the referral system was one of the major obstacles to getting the patients referred at the appropriate time and having an objective measure would help to overcome this problem in Kuwait's health system. They added that the triage system of the referral system must be considered.

5.11. Conclusions

The present study has provided normative values for the 10MWT and TUG measurements in pregnant women, with and without LPP, based on physical activity, pain, BMI, and gestational age. A decline in PFP was related to higher BMI, more pain, progress of the pregnancy, and less physical activity. These findings suggest that the TUG and 10MWT may be an especially important objective measure for primary care providers, as they track the PFP progress of pregnant women at any gestational age, with or without LPP. The TUG and 10MWT may provide a helpful baseline measure of performance to assign the pregnant women to the most appropriate exercise group based on their performance and can help the healthcare teams assess the women’s functional progress based on objective values. To evaluate individuals with functional or LPP difficulties and analyse the outcomes according to the reference values to make decisions regarding potential early treatments, normative values for these frequently utilized functional performance tests may be helpful. Also, the normative values offered by this study could be used as a benchmark for making comparisons with other studies to assess the functional performance of pregnant women with various disorders.

5.12. Acknowledgement

This study’s abstract was accepted to participate in the World Physiotherapy Congress 2023 as a poster presentation.

The clinical implications of the cut-off scores in pregnant women

Pregnant women with LPP

Pain <= 1.28 m/s

No pain >= 1.49 m/s

Direct access to physiotherapy

Pregnant women without LPP

programme, allocated to groups based on their PFP

10-MWTcup off based on GA (m/s)

Level 1-exercise group criteria

	Low	Normal	High
1st trimester	3.26	1.46	1.06
2nd trimester	2.93	1.34	0.98
3rd trimester	2.88	1.25	0.95

TUG cutoff scores based on GA (s)

	Low	Normal	High
1st trimester	10.40	6.01	4.72
2nd trimester	10.97	6.12	4.97
3rd trimester	11.74	6.73	5.13

Warning sign

Target goal for dischar

Figure 5.5: The clinical application of the cut-off scores

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CHAPTER 6: DISCUSSION

6.1. Introduction

This chapter presents a detailed discussion of the study's findings. It begins with a review of the findings of the scoping review, followed by a similar review of the findings of the detailed qualitative and quantitative studies that comprise this research project. This is then followed by a discussion of these results in detail comparing and contrasting them with the findings drawn from the current literature. Building upon this analysis, the chapter then outlines the work's implications for policy and practice, as well as the strengths and limitations of the study. Finally, this chapter outlines the study's contribution to knowledge in this field, concluding with suggestions for future research.

6.2. Summary of the Key Findings

This study attempts to thoroughly investigate how physical functional performance (PFP) is used clinically in Kuwait with pregnant patients with and without lumbopelvic pain (LPP). This was achieved by answering the following three questions:

1. What is the importance of using functional performance tests on pregnant women, and how frequently they were used?

2. What do the physiotherapists think about the use, effectiveness, and obstacles of PFP for pregnant women?

3. What is the level of functioning do pregnant women have?

This was carried out by conducting three linked studies, a scoping review, and then subsequent qualitative and quantitative studies. A sequential exploratory mixed method design was applied, where the method of each study was chosen with particular aims and objectives in mind, as detailed below, with each study being constructed to inform the next sequentially (**Figure 6.1**). The data collection for this project was performed in three stages. First, I conducted a scoping review to identify the best possible tools for evaluating the use of the PFP with pregnant women with and without LPP. The scoping review presented in Chapter 3 took the form of a systematic exploration of the breadth of the literature related to the field of PFP in pregnant women, linking this field of study to the literature on pain experienced during pregnancy. The findings of this study concluded that there currently exist only three valid, reliable PFPs (TUG, 10MWT, and STS) that are suitable for use with pregnant women with LPP. However, only two countries (Norway and Turkey) reported psychometric properties of the selected tests. Therefore, a qualitative methodology was used to explore physiotherapists' perceptions regarding the barriers, facilitators, and acceptance of using the PFP among pregnant women, with or without LPP, in clinical practice in Kuwait.

Second, a focus group discussion was conducted to explore the perceptions of physiotherapists regarding implementing PFP among pregnant women in a clinical setting. The key findings from the qualitative study identified three main domains regarding the factors that act as barriers limiting the use of PFP, as well as the facilitators and acceptance regarding the application of PFP among pregnant women in Kuwait. These three domains were the broader psycho-social context of the patients and clinicians, the actions of the clinicians and policy-makers, and the functional status of the patients who were pregnant women. A key finding of this work was that there was no specific protocol or set of guidelines followed by physiotherapists when assessing pregnant women with LPP, or choosing functional tests. The findings further suggested that physiotherapists can gather a range of critical information on their patients through undertaking subjective evaluations, which can then strongly affect the physiotherapists' subsequent choice of which functional tests to apply. These findings build on the earlier identification of appropriate tools currently used in clinical practice for evaluating the physical performance of pregnant women with LPP, that took place during the scoping review.

Third, normative data was generated to assist the stakeholders in using the PFP in their clinical decision-making. Establishing normative data through the use of TUG and 10MWT tests can support this kind of holistic approach by giving healthcare providers a benchmark for determining whether a patient's PFP lies within the normal range for their specific stage of pregnancy. This can also help healthcare providers identify any potential issues or abnormalities in a pregnant woman's PFP and, in turn, offer appropriate recommendations for their treatment and/or management. At the policy level, the creation of a multi-disciplinary team consisting of healthcare professionals was also suggested as a possible future strategy for improving the provision of physiotherapy facilities and services for pregnant women.

6.3. Discussion of the Findings Concerning the ICF and Functional Status of Pregnant Women

The International Classification of Functioning, Disability, and Health (ICF) framework has been used in previous LPP research to provide standards for evaluation and the application of treatment and rehabilitation recommendations (Aartun et al., 2021; Fehrmann et al., 2018; Ibsen et al., 2021; Selb et al., 2021). Likewise, defining normative data and using the ICF framework categorization aided in the comprehension and characterization of pregnant women's functional state (**Figure 6.1**).

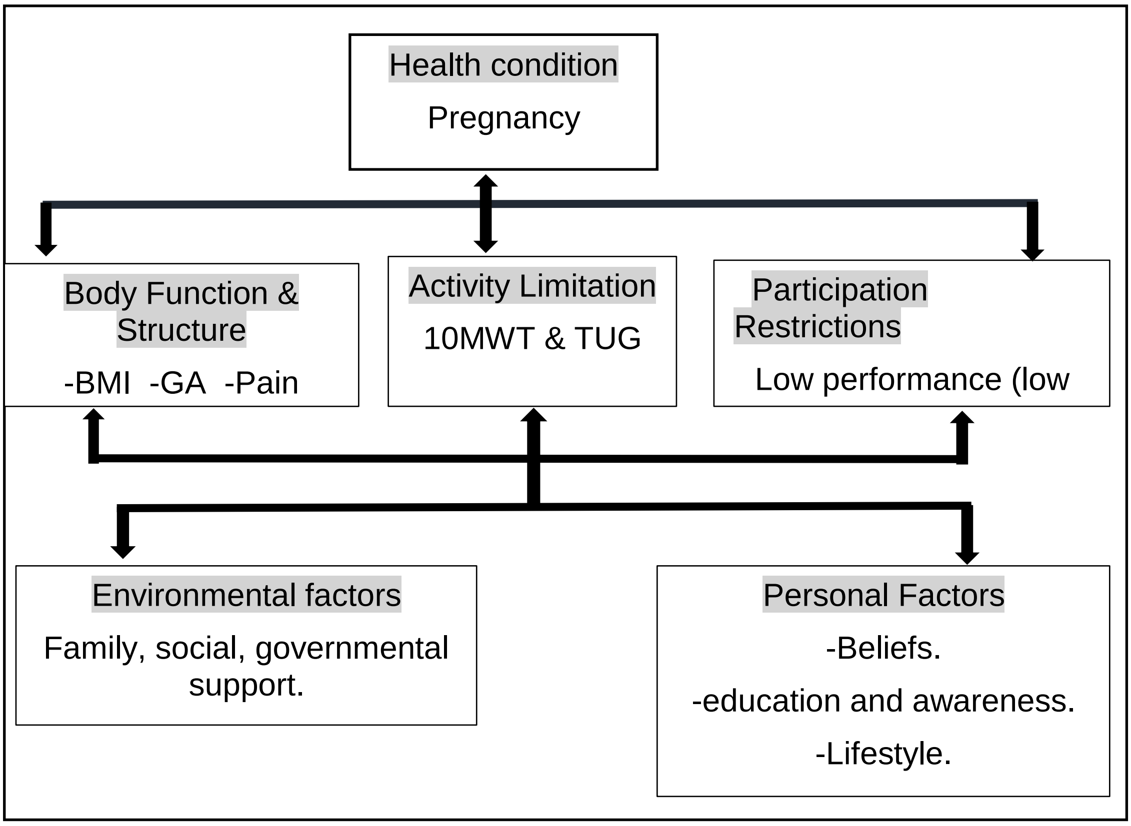


Figure 6.1: ICF Conceptual Framework: Study Outcome

6.3.1. Body Functional and Structure (Demographic Factors)

The first two ICF classifications are related directly to functioning and disability, including any physiological and anatomical changes, and impairments, such as issues with body function and structure (Schroder, 2021). From the regression analysis, we conclude that BMI, gestational age, and pain are three factors that can influence the PFP. Previous studies have indicated that those factors are interdependent (Wadhwa et al., 2016). This may explain our results that the outliners’ scores were almost similar among the categories in pregnant women's functional status.

6.3.1.1. Gestational Age

This study showed that PFP decreases as pregnancy progresses, particularly in the later stages of pregnancy. This may be due to the changes in body weight and posture, which can have the greatest impact on physical ability. With the progression of pregnancy, there are several accompanying changes; for example, the expansion of the uterus, which changes the centre of gravity, and thus affects balance and stability, which in turn leads to a change in the anatomy of the body, and thus many risks, including the risk of falling and a lack of movement (Danna-Dos-Santos et al., 2018; Wadhwa et al., 2016). Moreover, the changes that occur during pregnancy, like weight gain, joint laxity, and changed hormonal status, can affect PFP (Christensen et al., 2019).

Women experience changes in their physical state during pregnancy that affect their functional abilities (Hall & Wilton, 2017). As women may experience changes in their joint mobility and body composition, this will hinder their performance in certain activities (Melzer et al., 2010; Ozdemir et al., 2015). Pregnant women may also experience fatigue, back pain, and other symptoms, that can affect their ability to perform their daily activities and participate in leisure activities (Yoo et al., 2015).

Therefore, gestational age has a significant impact on PFP during pregnancy, so considering GA can provide a more accurate assessment of a patient's functional status by taking into account the effects of pregnancy on physical ability and functional capacity. This will assist in the development of clinical guidelines and best practices for assessing and managing functional limitations during pregnancy.

6.3.1.2. Pain

The result of this thesis showed that pain can also have an impact on the use and explanation of functional performance tests in clinical practice. In the case of low back pain during pregnancy, healthcare providers can consider the woman's pain intensity, pain duration, and the presence of any underlying conditions that may be contributing to her pain (Watanabe et al., 2020). They can also consider the impact of the pain on the woman's mobility, strength, and flexibility, as well as any changes to her posture or gait (Bagwell et al., 2022). Hence, establishing pain management techniques may be a critical sign to applying functional tests. This finding is similar to that of Billis (2010), who proposed that pain intensity, LBP duration, previous LBP episodes, and the presence of pain are associated with some discriminatory value against the LBP classification subgroups. Nevertheless, previous LBP history details have recently been found to be valid predictors of LBP recovery and are thus recommended for use within prospective LBP patient cohorts.

Previous studies have identified several biological risk factors for pregnancy-related LBP, such as having higher parity (Mogren, 2006), a history of LBP (Björklund et al., 2007; Orlikowski et al., 2006; To & Wong, 2003), higher physical workload (Mogren, 2006), higher body mass index (BMI) (Gutke et al., 2008), and lack of exercise (Mogren, 2006). In addition, higher pain intensity and higher pain catastrophising were associated significantly with pregnancy-related LBP intensity and pain interference at very late pregnancy (i.e. after the gestational age of 35 weeks) (Chang et al., 2012).

Individual's constellation of pain, or the kind, pattern, and severity of their pain, often shifts as their pregnancy goes on and into the postpartum period (Drabble et al., 2021). Overall, it seems that pain gets worse with increasing gestational age, both in terms of location and intensity and then gets better in the postpartum period (Dunn et al., 2019). For instance, during the second and third trimesters, lower back and pelvic girdle discomfort are common (Ray-Griffith et al., 2019). There has been a correlation shown between higher pain severity and the number of pain locations identified by pregnant women. Yet, due to delivery and changes in everyday activities (like breastfeeding), the pain might vary from the prenatal to the postpartum period (Gutke et al., 2011). If the discomfort is still restricted to the same spot, such as the truncal or pelvic regions, it might be challenging to distinguish between these two changes (Dunn et al., 2019).

The direction of the association between pain intensity and pain escalating has only recently been investigated extensively (Román et al., 2021). For instance, in patients with chronic musculoskeletal pain, changes in pain intensity and pain interference over time were predicted by clinically significant changes in pain escalating, and there may be a reciprocal link between these changes and pain catastrophising (Román et al., 2021).

Pregnancy-related pain has been closely linked to psychological suffering, including pain catastrophising—the propensity to dwell on, amplify, feel powerless about, and worry about the pain nonstop (Doğru et al., 2018; Miller et al., 2019; Quartana et al., 2009; Román et al., 2021). Pain catastrophising has been linked in pregnant populations to worse physical capacity, poorer postpartum recovery when returning to ADLs, fear of giving birth, and greater pain intensity both before and after delivery (Doğru et al., 2018; Flink et al., 2009; Olsson et al., 2012; Rondung et al., 2019). Furthermore, during the perinatal phase, women who experience more severe pain are also more likely to report symptoms of anxiety, sadness, and/or sleeplessness, which may have an impact on their delivery process (Sedov & Tomfohr-Madsen, 2021). Pain during pregnancy has been linked to an increased chance of prolonged labour, an emergency Caesarean section, aid delivery, and/or more birth problems (Brown & Johnston, 2013). Preterm delivery, gestational diabetes, and preeclampsia have all been linked to persistent chronic pain (Jessa et al., 2024; Kim et al., 2021). Therefore, it's critical to identify women who may have increased pain risks to prevent unfavourable outcomes for babies.

The degree to which pain interferes with social, physical, and everyday activities is referred to as pain interference (Karayannis et al., 2017). Pregnancy-related reports of pain interference have been linked to decreased productivity at work and challenges with everyday activities and physical tasks (Bergström et al., 2019; Dantas et al., 2020). Although there is a shortage of research on pain interference in pregnant populations, pregnant women who report more pain interference are more likely to report higher pain intensity and pain catastrophising (Chang et al., 2012). According to a recent study, women who report greater levels of pain intensity and pain catastrophising are more likely to fall into the moderate or high-pain interference group than the no-pain interference group (Jessa et al., 2024). They demonstrated that pregnant women in the groups with moderate and high-pain interference may be more susceptible to ADL interruptions and may benefit from symptom monitoring and preventive care to lessen the harmful effects of pain interference. Furthermore, they recommended that pregnant women, who are at risk of experiencing clinically significant pain interference, should be identified early to implement suitable pain coping mechanisms. This might lessen the impact of pain-related impairment and enhance the quality of life for those women. Nevertheless, weight gain during pregnancy was not taken into account in this investigation, though it has been connected to increased musculoskeletal system stress and chronic postpartum discomfort (Matsuda et al., 2020; To & Wong, 2003).

A recent study found that, in addition to pain catastrophising as well as interfering with everyday activities, LPP may produce kinesiophobia, or a fear of movement, during pregnancy (Koca & Özer, 2024). They looked at LBP, disability, kinesiophobia (using the Tampa Scale for Kinesiophobia), and physical activity level (using the International Physical Activity Questionnaire short form and the Physical Activity Level During Pregnancy Questionnaire). Regardless of age, gestational week, or gravida, the researchers discovered that pregnant women with LBP had higher BMI and disability rates than the general population. Pregnant women's fear of mobility has a strong correlation with weight and impairment. Additionally, the participating women benefited from frequent exercise and an overall active pregnancy.

These findings highlight the prevalence of pain throughout pregnancy and reinforce the need for regular pain assessment and management, as a part of pregnancy and postnatal care. Clinicians likely think that a person's performance in other areas, including their activity restriction, is highly correlated with their level of physical disability and pain. The evidence suggests that evaluations in several domains capture various sides of the patient's presentation, and also that measurements from one domain cannot adequately replace those from another (Deyo & Centor, 1986; Grönblad et al., 1997; Kovacs et al., 2004; Kuukkanen & Mälkiä, 2000; Mannion et al., 2001; Onoyama-Ball, 1992; Schonheinz, 1995; Waddell et al., 1992). Clinicians can also think that it is not practical to evaluate anything other than physical impairment and pain, given the favourable short-term diagnosis of most acute LBP. Without gathering baseline measurements, monitoring is prone to error. Further evaluations that are used to track progress or establish results might be acquired during later consultations.

6.3.1.3. BMI

The findings of this study reported that the PFPs among pregnant women with higher BMI were significantly slower compared to the participants with normal BMI. The slowest and fastest mean scores listed in this study for both the TUG and 10MWT tests were related to the obese and normal participants, respectively.

This indicates the effect of body mass index on subjective and objective measures of back pain as well as a healthy quality of life (Stienen et al., 2016). There is a positive relationship between obesity and the level of back pain, since body mass is closely related to functional status (Dario et al., 2015; Shiri et al., 2014).

According to studies, having a high BMI is linked to a lower level of strength, flexibility, balance, and coordination, among other functional abilities (Santos-Rocha et al., 2019). Just 20% of the individuals in our study had normal BMIs. Kuwait has the highest prevalence of obesity in the Arab world, with 77% of the population being overweight and 40% being obese. Obesity is a public health problem in Kuwait (Oguoma et al., 2021). The fifth main risk factor for death worldwide is obesity. It has been determined to be a significant risk factor for long-term conditions including diabetes, high blood pressure, and cardiovascular disease. Obesity during pregnancy is linked to a change in the relative risk of preeclampsia, gestational diabetes, and cardiovascular disease of at least 10% (Stubert et al., 2018). Adjusting weight before becoming pregnant is beneficial, but maintaining dietary and lifestyle adjustments during pregnancy is the only way to reduce mother and fetal morbidity over the long-term (Langley-Evans, 2022).

Furthermore, obesity influences the intensity of pain, which reduces mobility and, thus, overall physical activity, which influences the PFP (Danna-Dos-Santos et al., 2018; Opala-Berdzik et al., 2009; Preetha & Solomon, 2011; Ramachandra et al., 2015; Takeda et al., 2015).

According to (Biering et al., 2011), there is a progressive increase in hazards across the overweight and obese categories, and a decrease in risk for underweight individuals compared to those with normal BMI. Additionally, the risk of pregnancy-related pelvic discomfort increases with greater BMI. According to a 2015 study by Narouze and Souzdalnitski, people with chronic pain who are obese have lower HRQL and less functional ability.

In conclusion, a high BMI has a negative impact on PFP, so reducing BMI can be an important factor in improving functional ability and overall health. This highlights the importance of addressing BMI in the management of pregnant women with functional limitations and as an element of rehabilitation programmes.

6.3.2. Activities/Activity Limitations and Participation/Participation Restrictions (the PFT)

The third component, activities/activity limitations and participation/participation restrictions, seeks to explain and evaluate how pregnant women engage with the world (Schroder, 2021). This component concerns which activities are limited for pregnant women, and the defined difficulties they experience when performing these activities. Clinical practitioners can consider the established normative data on pregnant women to determine their ability when performing 10MWT and TUG tests, and the impact of the confounding factors on their performance.

6.3.2.1. The Application of the Functional Performance Tests

The physiotherapists claimed that the lack of accurate, clear instructions and the use of subjective assessment can contribute to time management problems for physiotherapists, and also reflect part of the development of skills that depend on experience (Noll et al., 2001).

In addition, the findings of the qualitative study failed to identify a single strategy or protocol to follow when employing the PFP with pregnant women with LPP pain when applying the tests in Kuwait hospitals. There is a lack of information about the different kinds of tests that are routinely chosen for use with pregnant women with LPP; for example, there is no agreed protocol and guidance at the Ministry of Health in Kuwait. The findings of the current study are similar to those of Kent et al. (2009), who investigated the assessment of acute (<12 weeks' duration) nonspecific low back pain (NSLBP) by primary care clinicians. They concluded that diverse assessment methods for acute NSLBP were reported by primary care clinicians. Thus, this reflects the strategy used, which is based on a lack of consensus during practice. Hahne et al. (2004) highlighted that clinical practitioners evaluate the progress either within or between treatment sessions by measuring the level of physical functional impairment and pain.

Clinical policy also plays a role in the application of functional performance tests. This includes factors such as guidelines, protocols, and reimbursement policies. It is important to understand and follow the established clinical policies and guidelines when selecting and administering functional performance tests to ensure that accurate and valid results are obtained and to promote consistent care across healthcare providers.

Testing Protocol

Having a clear protocol will help to prevent the time obstacle and allow medical doctors, nurses, and physiotherapists to rely on objective measures when assessing pregnant women. Jensen et al. (1992) focused on comparing experienced clinicians with junior clinicians, the patient care aspect, and the extent to which doctors' experience of patient care affects the level of treatment received. It was found that the clinical thinking skills of experienced doctors enabled them to diagnose patients and predict outcomes, as well as classify patients, as their priority was to educate the patients (See Appendix 10 for testing protocol for each test and **Figure 6.2** for the recommended protocol).

From the results of our qualitative study, the lack of time for the application of clinical tests was an influencing factor. Iwata & Dozier (2008) found that time was an important factor for healthcare providers and also for the interpretation of functional tests. This leads to the use of shorter, less comprehensive tests, and thus fails to create a complete picture of the patient's condition. Also, the time factor may lead to restrictions on healthcare providers in terms of their ability to follow up on changes in patients' conditions over time. This affects the determination of the patient's condition to see whether it improves or deteriorates, which affects the determination of the most appropriate level of health care to offer.

Similarly, Middleton (2004) mentioned the limitations of time within a physiotherapy session, as these represent an obstacle to measuring endurance objectively in LBP patients. Slade et al. (2016) highlighted that time constraints make it difficult to implement the guidelines.

6.3.3. Contextual Factors

The second part of the ICF framework focuses on contextual factors, including environmental and personal factors, that can be described as either barriers or facilitators (Schroder, 2021). Healthcare providers can consider women's home and work environments, and any societal or cultural factors that may affect her functioning and disability (Mitra et al., 2015).

6.3.3.1. Lifestyle (Physical Activity Level)

The findings of the qualitative study suggest the importance of considering the functional activity level of pregnant women in addition to their functional goals, previous level of activity, and any other health conditions that may affect their functional abilities when choosing the functional tests. Pregnant women who have a higher functional activity level may be able to take more demanding functional tests than those who have a lower one. The same findings were identified by (Billis et al., 2007), who developed a list of clinical and cultural features that are included in the assessment of LBP patients in Greece, among health professionals. The assessment of functional activity level was linked to the assessment of disability. A systematic review study by Nascimento et al. (2012) found that physical activity can decrease back pain intensity during pregnancy and improve functional ability. Also, the results of the study by Fell et al. (2008) and Zhang et al. (2014) suggest that there was a significant decrease in all of the summary measures for physical activity during pregnancy.

Exercise reduced the severity of LBP, PGP, or LBPP during and after pregnancy, but it did not lower the likelihood of any of these disorders at any point in time, according to a comprehensive review and meta-analysis (Davenport et al., 2019). Furthermore, just 27.3% of the participants in a recent research on pregnant women in Sweden reported having attained the necessary level of physical exercise. Increased physical activity during pregnancy was linked to a lower chance of emergency caesarean section, a lower risk of gestational weight increase, a better self-rated state of health during the pregnancy, and a lower risk of going over the Institute of Medicine's recommended guidelines for gestational weight gain. Increased time spent sitting still was linked to a negative self-rated health status during pregnancy.

PA throughout pregnancy was linked to a lower mean gestational weight gain (GWG), a lower chance of going over the Institute of Medicine's (IOM) approved GWG, and a decreased risk of emergency CS, according to a recent research (Meander et al., 2021). Pregnant women were provided information regarding PA, however only a small percentage of participants stated that they attained the required amount of PA (Meander et al., 2021). Pregnancy-related self-rated health was substantially correlated with both PA and sedentary time. Predictably, 49% of the individuals put on more weight than was advised during their pregnancies. To lower the danger of excessive GWG and enhance the health of both pregnant women and their unborn children, it may be crucial to encourage pregnant women to increase their PA and minimize their inactive time.

While Kuwait's governing bodies have not issued any official guidelines on the subject, several organizations, including the American College of Obstetricians and Gynecologists (ACOG), the Royal College of Obstetricians and Gynecologists (RCOG) in the UK, the Canadian Society for Exercise Physiology (CSEP), the American College of Sports Medicine (ACSM), and the International Olympic Committee (IOC), have established guidelines regarding exercise during pregnancy (Artal et al., 2003; Evenson et al., 2019; Goddard et al., 2023; Liu et al., 2011; Syed et al., 2021; Wolfe & Davies, 2003). Common concepts are shared by several of these recommendations. Pregnant women are advised to strive for at least 150 minutes of moderate-intensity exercise each week, emphasising the value of core stability and pelvic floor exercises (Kegels) (See appendix 14: Physical Activity Guidelines 2019).

Pregnant women's health and well-being are promoted by the thorough and well-researched UK national guidelines on exercise during pregnancy. However, there is still space for development in areas like training recommendations, specific strengths, and personalisation. Although the recommendations offer a broad framework, they do not cater to the unique requirements or situations of every expectant mother. Furthermore, the recommendations don't go into great length about safe strength training techniques during pregnancy, just mentioning low-resistance workouts in passing. Pregnant women make an effort to walk, but because they must rest for extended periods, the changes brought on by pregnancy affect how active they are compared to the prenatal phase (Kazemi & Hajian, 2018). For instance, owing to their health during pregnancy, pregnant women with back discomfort may not be able to participate in tests involving rigorous activity, but they may be able to participate in tests involving light exercise. Women could benefit from more detailed advice and examples on how to appropriately include strength training. Furthermore, what one person considers to be moderate may be severe for another, and the definition of "moderate intensity" might be arbitrary. Women may find it easier to choose the right amount of intensity if there were more guidelines or examples of moderate-intensity workouts.

Therefore, the guidelines should be improved by adding more customised suggestions depending on the health condition, exercise levels, and pregnancy phases of pregnant women. The recommendations may be more inclusive if the suggested activities were expanded to include more accessible or culturally diverse alternatives. This might make it easier for women from various backgrounds to locate appropriate workouts. Cycling, for instance, may be challenging in Kuwaiti culture and is regarded as a sport mostly enjoyed only by kids. Instead, it could be better to emphasise other culturally acceptable hobbies, like dancing. The guidelines may be even more helpful in assisting expectant mothers in maintaining and enhancing their functional status during their pregnancy if these constraints are addressed.

6.3.3.2. Culture and Lifestyle

Different cultures may have different norms and expectations regarding physical function, which can affect how functional performance tests are used and interpreted. For instance, some cultures may emphasise physical function more than others, while others may lay greater stress on other factors, such as social support and spiritual well-being.

Kent & Kjaer (2012) conducted a systematic review to explore how education and clinical culture have emphasised the assessment of physical impairment and pain. For example, pregnant women in Gulf Council countries do not include physical activity as a part of their daily routine. Moreover, in terms of lifestyle, a study by Madani et al. (2000) added that this reduction is due to the adoption of an increasingly sedentary lifestyle. With recent socio-economic changes, a sedentary lifestyle for women and the culturally-mediated factors of the local population have been cited as the pervading influences leading to the high prevalence of obesity (Al-Riyami & Afifi, 2003).

In addition, Naser (2011) listed multiple cultural factors and traditional cultural norms concerning pregnant women that can increase their risk of obesity. A patient's beliefs can also influence how the functional performance tests are used and interpreted. For example, patients may have different beliefs about what constitutes a "normal" level of physical function, and these beliefs can affect how they view their own functional status and respond to functional performance tests. To summarise, culture, a patient's beliefs, and norms influence the use and interpretation of functional performance tests in clinical practice. Therefore, it is important for healthcare providers, when working with patients, to be aware of these factors and understand their background to consider how they may affect the use and understanding of functional performance tests.

The findings from the current qualitative study demonstrated that physiotherapists considered pregnant women's lifestyle before applying the PFP. If pregnant women were not involved in physical activity, this might affect the physiotherapists' choice about using the PFP and, accordingly, may affect the patient's performance. In addition, study 3 (the normative study) found that physical activity has a positive effect on PFP performance. Also, the results of the study presented by Samartzis et al. (2011) indicated that paying attention to an appropriate lifestyle and taking into account modifications, such as developing healthy eating habits and taking appropriate exercises, reduces the risk of developing LBP.

This was also observed by Gray & Howe (2013), who claimed that different factors (such as PA, diet, and smoking) affect health-related choices and found that being busy and socialising decreased PA levels. Hence, healthcare professionals, along with stakeholders, have an important role in raising physical activity awareness and its importance. Hospitals and medical centres can provide facilities that offer specialised exercise or PA services for pregnant women in collaboration with physiotherapy departments. All health professionals must be educated to encourage pregnant women to use these facilities.

6.3.3.3. Influence of Fear Avoidance Belief (FAB)

Patients may experience fear of the testing process; this might include worry of failing the test, fear of falling, or fear of being weak. This may have an impact on their drive and exam performance. Research has indicated that psychological elements, such as attitude, belief, cognition, worry, and concern, have a greater influence on the risk factors associated with back pain than biomechanical factors (Ramond et al., 2011).

Recent research on Saudi women found a correlation between disability, physical activity, and employment, as well as a link between fear avoidance attitudes and persistent low back pain (Buragadda et al., 2018). This study went along with prior research on LBP patients, which has presented a strong link between the Roland Morris Disability Questionnaire (RMDQ) and the Fear-Avoidance Beliefs Questionnaire for Physical Activity (FABQ-PA) (Chung et al., 2013; Rashidi Fakari et al., 2018). Nevertheless, there was no significant link between the MODQ and FABQ-PA outcomes, according to (Cai et al., 2007). The age, gender, and/or collecting tool variations might be the cause of this. Additionally, a self-report questionnaire was utilized to evaluate incapacity, allowing participants to express the extent of pain-related impairment as opposed to real levels of pain and disability.

A previous systematic review of physiotherapists' assessment and management of psychosocial factors in LBP patients explored the opinions of 23 medical practitioners concerning which clinical features should be included in the LBP assessment (Gray & Howe, 2013). There was a general acceptance among the physiotherapists of the importance of including FAB when assessing the psychosocial factors on their final list of items.

The effects of a compliance enhancement programme on the perception of pain were also investigated by Middleton (2004), which reported that the exercise group completed a significantly higher number of exercise activities ($P < 0.005$). However, the intensity ratings for pain recorded immediately before and after exercise indicated significant increases in pain ($P < 0.001$). It was suggested in this study that this increase in pain may contribute to the low compliance rates with exercise, in accordance with a fear-avoidance model of inactivity. The recommendations of the study highlighted the need for the referring physiotherapists to be aware of the patient's beliefs.

In addition, previous studies across different countries (Pakistan, Iran, and Sweden) indicated a strong association between FAB and pain during pregnancy (Fernando et al., 2020; Rashidi Fakari et al., 2018; Zehra et al., 2020). This suggests an implication for further research in the Middle East and Kuwait, to determine the association of FAB as a mental element with LPP during pregnancy. In addition, these studies also indicate that high FAB in the third trimester may increase the risk of having LPP for 6 months in the post-partum period. Therefore, FAB is a tool, which can be used to clinically predict which pregnant women are at risk of LPP. It seems important to consider these results when developing rehabilitation strategies for post-partum women with LPP (Fernando et al., 2020).

6.4. Strategies and Policy Making

According to our study's functional status analysis of pregnant women in Kuwait, over 50% of them were inactive, and over 80% of the studied population was overweight or obese. This brought to light two important variables to be taken into account: being overweight or obese, and leading an inactive lifestyle during pregnancy. The Kuwaiti Ministry of Health has proposed two policies, Kuwait Vision 2035, and the National Kuwait Healthcare Policy, which have the foundations for improving the country's healthcare system and can be modified to address the issues identified by this study.

6.4.1. The National Kuwait Healthcare Policy: The Missing Role of Women's Health

A comprehensive framework designed to address the rising burden of chronic and non-infectious illnesses in Kuwait is the current National Kuwaiti Policy and Strategy for the Prevention of Chronic and Non-Infectious Disease (2017–2025) (Kuwait Healthcare policy, Ministry of Health, Kuwait, 2017). The management of chronic diseases, illness prevention, and health promotion are among the main areas of emphasis for the plan. These are the strategy's primary five elements:

1) Health Promotion and Education:

This includes public awareness efforts that use mass media, educational programs, and community actions to raise public knowledge of the modifiable risk factors (bodyweight, lifestyle, smoking, and dietary variables), and to encourage a healthy lifestyle by promoting quitting smoking, exercising, and eating healthfully. This entails working together to foster a culture of health with stakeholders including community centres, various businesses, and schools.

2) Disease Prevention

Developing screening programmes to find chronic illnesses like cancer, diabetes, and high blood pressure early. These initiatives focus on high-risk groups to detect illnesses early on when they are more controllable or avoidable.

3) Healthcare System Strengthening

To better treat chronic illnesses and enhance basic healthcare services. This entails educating medical personnel (nurses and physicians), enhancing facilities, and guaranteeing that necessary prescription medications are accessible.

4) Policy and Regulation

Encourage companies to implement health-promoting practices for their workers, such as offering healthy food alternatives and facilitating chances for physical activity at work.

5) Patient Empowerment

Offering programmes and tools to individuals suffering from chronic illnesses so they may better manage their symptoms. This covers the use of digital health technologies, support groups, and patient education. Furthermore, to guarantee that medical treatments are customised to patients' requirements, honouring their choices, and incorporating them in the decision-making process**.**

6.4.2. Kuwait Vision 2035: The Big-Tent Governmental Vision for Kuwait's Future

Additionally, Kuwait Vision 2035 emphasises tackling major health issues, including the high rates of diabetes, cancer, and mortality that currently exist in the state of Kuwait, as well as having a comprehensive focus on sustainable development and economic diversification. Numerous targeted activities and comprehensive programs are part of the approach to prevent and treat these chronic illnesses. This is how the vision targets these particular locations:

The goal of the vision is to avoid chronic illnesses through weight control, physical exercise, and good nutrition through lifestyle education. Differences between genders are not specifically stated; rather, the focus is mentioned in general. Exercise plans specific to women may be needed; taking into consideration changes in hormones, puberty, pregnancy, and the healing process after giving birth. Previous research has connected pregnancy-related physical inactivity and obesity with diabetes and certain cancer types (Lee et al., 2021; Park et al., 2020; Yang et al., 2023).

The goal of Kuwait Vision 2035 is to reduce inactive lifestyles by 5% of the population. Given that women make up 48% of Kuwait's population in 2024, it is imperative to take into account particular suggestions for them to successfully reduce the prevalence of such inactive lifestyles (United Nations, 2024). Furthermore, earlier research has shown that boys had a considerably higher frequency of PA (30.8%) than girls in the same age range (10.5%) (Badr et al., 2019).

To avoid further complications, the vision also emphasises regular screenings for high-risk populations and early diagnostic encouragement. To ensure that screening services are widely accessible, it is also recommended to construct mobile screening units consisting of qualified physicians and nurses who can visit underprivileged and rural regions. Regretfully, gestational diabetes, which can have long-term health consequences for both the mother and the child, was not taken into account in this vision for pregnant women who are at risk. Specific guidelines for diagnosing, treating, and avoiding gestational diabetes are not included in the plan.

In Kuwait, the predicted adult prevalence of type 2 diabetes in 2019 was 22.0%, much higher than the global prevalence, which was 9.3% (Mohammad et al., 2021). Sedentary lifestyles are associated with several negative health impacts, such as increased risk of cancer, cardiovascular disease, diabetes mellitus, hypertension, dyslipidemia, and musculoskeletal disorders (Park et al., 2020). Furthermore, Andò et al. (2019) highlighted the processes that connect obesity with breast cancer. According to a recent systematic review and meta-analysis, sedentary lifestyles are linked to a 15.5% higher risk of breast cancer (Lee et al., 2021).

6.4.3. Suggested National Action Plan

Kuwait's comprehensive plan is to improve the quality of treatment for individuals with chronic diseases, promote a healthy population, and lessen the incidence and effect of infectious and non-infectious diseases in Kuwait by tackling the problem from several perspectives. Nonetheless, a major drawback of the existing policy is the strategy's lack of a specifically targeted section on women's health.

First, the occurrence and treatment of chronic illnesses can be influenced by the special health demands of women, which are mostly tied to hormonal fluctuations and reproductive health. Specialised care is necessary for conditions like breast cancer and gestational diabetes, which may not be sufficiently provided by a standard chronic illness approach (Yang et al., 2023).

Second, even before socioeconomic variables are taken into account, women frequently have a major impact on family health, influencing physical activity, nutrition, and healthcare usage in the home. Thus, targeted health education and resources may empower women and improve community health in many ways

(Blossfeld & Kiernan, 2019). Furthermore, women are more likely to be affected by economic inequality, which may limit their access to chances for physical exercise, healthy food, and healthcare (Liu et al., 2020). For instance, previous studies state that women's gym membership prices in Kuwait are three times more than those of men's gym membership fees. Reducing such differences is essential to the prevention and management of chronic diseases (Othman, 2022).

Third, there is a gender gap in medical research as women are underrepresented in clinical trials, which has left gaps in our knowledge of how diverse populations are affected by chronic illnesses (Merone et al., 2022). Without specifically addressing women's health, a plan may fall short in promoting the essential studies and evidence-based treatments designed with women in mind.

Few fruitful results may be a result of health treatments that do not take gender variations into account. Strategies for preventing cardiovascular disease, for instance, may overlook early warning indicators in women if they fail to take into consideration sex-specific symptoms and risk factors. Furthermore, if certain approaches are not taken into consideration to meet the particular health requirements of women, pre-existing health disparities can worsen, which would have a negative impact on women's health (Merone et al., 2022). Thus, neglecting to incorporate women's health may result in lost chances for early intervention and chronic illness prevention that are particular to, or more common in, women.

Therefore, this thesis suggests that in future versions of the approach, women's health concerns should be explicitly incorporated, with a focus on gender-specific hazards, preventative tactics, and treatments; thus, recognizing the different ways in which men and women experience health and illness, and incorporate gender-specific practices into all health promotion and disease preventive initiatives (Lindsay et al., 2019).To guarantee that their needs and viewpoints are fairly reflected, women, and advocates for women's health, should also be involved in the creation and execution of health policies. By addressing these issues, Kuwait may develop a more comprehensive and successful plan for managing and preventing chronic illnesses, which will eventually improve the population's health.

Physical exercise is essential for the management and prevention of diabetes, especially gestational diabetes, according to Kuwait Vision 2035 (Yang et al., 2023). Furthermore, gestational diabetes mellitus was a considerably greater risk for expectant mothers who were engaged in high levels of sedentary behaviour (Yong et al., 2020). Accordingly, raising PA may aid in reducing the prevalence of diabetes and obesity/overweight among expectant mothers as well as among women in general (Yang et al., 2023). Public health initiatives must stop the increase in diabetes and overweight/obesity rates, and Kuwait Vision 2035's objective supports this pursuit.

Finally, the vision aims at improving the health system by offering 500 medical professionals—nurses and doctors—specialised training in managing chronic diseases with an emphasis on the most recent treatment protocols and patient education strategies. Kuwait Vision 2035's emphasis on training programs solely for physicians and nurses, with little consideration for other crucial healthcare experts like physiotherapists, midwives, and other allied health professionals, is one of its most obvious shortcomings. Since this vision specifically mentions physical activity and weight control, patient treatment pathways may be incomplete without these professionals' assistance, resulting in less-than-ideal health results.

6.5. Recommendations and Implications for Policy and Practice

The recommendations are discussed initially concerning the PFP guidelines. From my experience as a physiotherapist working in the field of women's health, and also my previous experience of establishing a prenatal clinic, I believe that the results of this research are very important. They will enhance the evaluation and assessment during pregnancy of women in Kuwait, as I can help to clarify and inform the health care system about pregnant women’s functional status. Consequently, this may help clinical practitioners to understand the pain-dysfunction related to pregnancy in Kuwait. As the literature review about the complications (pain and disability) related to pregnancy shows, there is a lack of knowledge about specific factors related to the PFP in Kuwait. Much of the available evidence was transferred from studies conducted in other settings and with a focus on other health conditions. It is therefore recommended that research built on a broader Middle-East states’ context should be prioritized.

The strength of evidence pointing to the physical functional status in pregnant women either with or without LPP shows the need for different strategies to be adopted to solve this problem, such as:

- Recommendation for Kuwait policy and vision
- Recommendation and implications for policy and practice
- Suggested clinical practice strategies for the health care system in Kuwait
- Clinicians' and physiotherapists' strategies
- Educational strategies
- Impact on pregnant women

Other important issues regarding obesity and sedentary lifestyle in Arabian Gulf countries, as cultural factors observed in the physiotherapists' experiences with pregnant women, also played a key role in social acceptance. Healthcare providers and policy-makers need to make qualitative evaluations that reflect the social and cultural norms to design effective assessments and interventions around the specific cultural norms, community factors, and individual motivations affecting health-related behaviour (Krans & Chang, 2011). Harrisons' systematic review (Harrison et al., 2018) supports this view, finding that the limited physical activity in pregnant women from different ethnic backgrounds could be attributed to the unique barriers and socio-economic factors' impacts on their health-related behaviour. Work-related factors were the most commonly reported barriers to undertaking leisure-time physical activity during pregnancy (Connelly et al., 2015). The women frequently reported a lack of time and energy due to work commitments, perceiving that their job was already physically demanding and thus contributed toward meeting their recommended levels of physical activity. Education also plays a role in the acceptance of these tests among pregnant women, with physiotherapists playing a key role in educating pregnant women regarding the safety and importance of these tests. As such, they constitute key facilitators for the usage and acceptance of the proposed test among pregnant women with LPP. Furthermore, as Connelly et al. (2015) point out, knowledge is a crucial factor in promoting functional performance during pregnancy; for example, knowledge of how functional movements are safe during pregnancy. Existing qualitative studies point to this as a crucial gap in the provision of advice to pregnant women, with some women reporting not having received any advice at all (Christiaens et al., 2011).

6.5.1. Recommendation for Kuwait Policy and Vision

The advice to improve women's lifestyles might be accomplished by developing exercise guidelines that take into consideration Kuwait's social and cultural contexts, as well as the physiological variations and life phases of women. Safe exercise during adolescence, pregnancy, and the postpartum phase following menopause requires clear guidelines. Physiotherapists are qualified to evaluate a patient's level of fitness and design a customised fitness plan that meets their unique demands and medical circumstances. Exercises for strength, flexibility, balance, and aerobics should be included. Additionally, it is imperative to guarantee that all women, even those residing in less wealthy areas, have inexpensive access to healthy food options, fitness centres, and healthcare services.

Second, to track the success of lifestyle education initiatives, details about women's health outcomes must be gathered and analysed. Regular evaluation and revision of guidelines should be done in light of the resulting findings.

As part of Kuwait Vision 2035, it is also suggested that the training programs be expanded to include physiotherapists, midwives, experts in nutrition, and other allied health professionals. By putting these targeted strategies and recommendations for women into practice, Kuwait can successfully reduce the prevalence of obesity and sedentary lifestyles among women. Physiotherapists are essential to this endeavour because of their proficiency in encouraging physical exercise and offering individual treatment. Kuwait can significantly advance the implementation of targeted measures and solve the highlighted problems in its future healthcare policies, thus achieving this crucial public health goal.

6.5.2. Suggested Clinical Practice Strategies for the Health Care System in Kuwait

6.5.2.1. Clear Protocol

The result of our qualitative study showed that there is a need for physiotherapists to have a standard, basic, simple, and holistic PFP test to use as a baseline measure, including the different functional performances of ADL.

They suggested using a test that targets 3-4 functional impairments, and they can spend 10-15 minutes assessing the PFP. These tests are employed to meet a range of goals, including testing for a target functional impairment, identifying functional difficulties, confirming the findings of a subjective assessment, assessing movement in discrete segments, assessing the function of individuals with pain, assessing dysfunction, and assessing the functional capability of pregnant women with LPP. The findings from previous studies recommended that clinical policy-makers set clear testing preparation steps that must be followed before administering a functional performance test (Jette et al., 2003; Mearns et al., 2009).

Concerning the patient and test selection, it is important to select the appropriate patient population for the test. This includes considering factors such as age, medical history, and current health status. In addition, selecting the appropriate test for the selected patient population is important. This includes considering factors such as the patient's functional abilities, limitations, and goals. Therefore, policy-makers play a crucial role in devising test administration instructions, because it is important to provide clear, detailed guidelines and instructions to the medical staff about the recommended tests and how to perform them. This includes instructions on positioning patients, equipment use, and safety precautions. Due to the limited time available for the sessions, decision-takers and policy-makers must prepare the test environment and ensure that it is safe, comfortable, and appropriate for the tests to take place. By following these steps, healthcare providers can ensure that the functional performance tests are administered correctly and that the results are accurate and reliable. This can ultimately lead to better patient care and outcomes.

Specific Action Plan: To provide a report on the validity and reliability of PFP tests conducted on pregnant women, together with the protocol for each test, to the protocol committee leading Kuwait's physiotherapy administration.

6.5.2.2. Develop PFP Guidelines for Pregnant Women

Patients’ pain and lifestyle remain key considerations that affect the results of the tests; the physiotherapists suggested that the tests can correlate pain with dysfunction, giving an insight into how pain affects the quality of functional performance and patients’ progress. This recommendation regarding the development of guidelines for physical functional performance (PFP) assessment in pregnant women has implications for the Quality Assurance and Scientific Committee in the Kuwait physiotherapy administration. Policy-makers can work in collaboration with healthcare providers to develop standard PFP assessment guidelines that are evidence-based and consider the needs and perspectives of both patients and clinicians. This can help to promote best practices in PFP assessment and ensure that pregnant women receive consistent, high-quality care, regardless of where they receive their care.

Specific Action Plan: To submit a report detailing the key conclusions of this study and stressing the significance of developing standards for assessing the PFP among pregnant women to the quality assurance committee at the Ministry of Health's Kuwaiti physiotherapy administration.

6.5.2.3. Triage System

According to studies 1 and 2, both of the tests are valid and reliable for use with pregnant women with PGP, as the physiotherapists claimed that there are no specific guidelines to follow (see graph 6.1 below). However, they usually start with a simple task from PFP and then progress to more complex tasks. In addition, the physiotherapists mentioned that the delayed referral of pregnant women leads to a worsening of their condition and makes it difficult to assess or physically evaluate the pregnant women before providing pain management. According to these results, there are opportunities to recommend certain strategies while applying the PFP test in the clinic to assess pregnant women with and without LPP pain in Kuwait.

First, it is suggested that physiotherapists should start with the 10-MWT test as a simple task to assess pregnant women and determine their functional status according to the pain factor. Therefore, clinical pathways to facilitate triage into rehabilitation systems should be used to promote practical interventions to optimize the physical functional evaluation throughout the pregnancy trimesters. This triage system will help to provide an early intervention and promote optimal long-term functioning in pregnant women. It is suggested to add a triage system when referring patients to the PT department according to the pain cut-off point on the 10-MWT.

Specific Action Plan: The Kuwaiti Physiotherapy Administration and the Kuwaiti Physiotherapy Association assigned me to represent the physiotherapy administration at the World Physiotherapy Congress (*World Physiotherapy Congress 2023* **|** *World Physiotherapy*, 2023) and requested that I submit a comprehensive report on the proposed triage system. I will also be working with Kuwait's Minister of Health, Dr. Ahmad Alawadhi, to revise the health policy strategy.

6.5.3. Clinicians and Physiotherapists' Strategies

6.5.3.1. Multi-Disciplinary Team

Since it has become clear from the results that a sedentary lifestyle depends on physical inactivity, there has arisen an urgent need for approaches and strategies to develop solutions and coordinate multiple stakeholders (for example, dietitians, physiotherapists, obstetricians, nurses, and psychologists), so that a single phenomenon can be viewed from several angles and works as one unit to provide holistic services for pregnant women. As obstetricians are not tasked with providing comprehensive services, to achieve this, the integrated team approach offers the ideal solution. One of the most basic suggestions is to have a multi-disciplinary team in the antenatal clinics to help support a healthy lifestyle. In Kuwait, there are no midwives in the health care system so, when a woman attends antenatal care, the obstetricians are best placed to question her about LPP and explore the extent of her pain, its impact on her function, and her general wellbeing. Obstetricians may need to advise women to seek the assistance of physiotherapists by referring women for advice, education, and pain management related to this condition, both during and after pregnancy.

Nutrition education can help pregnant women to manage their weight and also provide physical activity programmes that will facilitate and encourage them to engage in physical activity during their pregnancy. This study recommends that a comprehensive classification system can also help to improve communication between healthcare providers by providing a common language and framework for describing patients' functional status. This is especially important for patients who are seen by multiple providers or are transferred between different healthcare settings.

Specific Action Plan: To present a report on the results of this thesis to the PT administration and department heads to develop a group exercise schedule for every trimester.

6.5.3.2. Educational Strategies

Addressing PFP is a fundamental evaluation skill for physiotherapy practitioners. As a result, both health professionals and colleges and universities need to take into account these significant educational needs. This training must start with pre-registration training and cover both PFP assessment and management, to be able to facilitate the assessment and evaluation of the functional status of pregnant women. It will be crucial to incorporate both theoretical and practical elements into the educational curriculum during pre-registration training before moving on to clinical placement environments, to allow for monitored skills practice regarding the assessment of pregnant women with PFP.

To develop a training programme to enhance physical activity among pregnant women in Kuwait:

To guarantee that courses incorporate PFP amongst pregnant women, the clinical educational programs provided by Kuwait University and hospitals must be examined and revised. Another consideration is to train the entire multidisciplinary team engaged in antenatal care, in addition to educating the healthcare professionals on their roles in evaluating the PFP and supporting healthy behaviour, incorporating PA. This includes how to test the PFP of pregnant women and compare the results with the cut-off points. Also, providing regular education and support for the physiotherapists responsible for group exercise training would be useful.

Specific Action Plan: Professionals might see change as a chance for renewal. The University of Kuwait will get a report detailing the results of this thesis along with recommendations for potential modules and resources to enhance the curriculum on health promotion.

Specific Action Plan: To plan a series of lectures for Ministry of Health employees that will address the main conclusions of the study concerning their involvement in PA promotion and offer recommendations for how they may enhance their participation in it.

6.5.4. The Impact on Pregnant Women

Healthcare practitioners enable pregnant women to actively participate in their own health management by including them in conversations about their functional status and taking their preferences into account when planning their prenatal care. This involvement in the decision-making process for healthcare promotes a sense of empowerment, independence, and collaboration. Additionally, by lessening discomfort, encouraging independence, and making it easier for a woman to engage in activities that are important to her, enhancing functional status during pregnancy, can improve a woman's quality of life. Women's general well-being and contentment with their pregnant experience could be enhanced by addressing functional constraints and optimizing physical function.

<u>Specific Action Plan:</u> Give expectant mothers a leaflet outlining their functional status, which demonstrates their capacity to carry out regular tasks like standing, walking, and moving around painlessly, and explain it to them. The importance of maintaining a good functional status for her general health and the health of her pregnancy should be emphasized.

6.6. Future Research

6.6.1. Establishing A Test Battery

It is vital to identify a gold standard test battery for pregnant women and validate the reliable PFP measures, to identify a single tool that is capable of capturing all of the functional domains of performance across pregnant women’s functional and demographic status, and applicable to all disciplines within pregnant women’s rehabilitation.

As such, having patients perform PFP tests may help physiotherapists identify the underlying problems, assisting the decision-making regarding any further assessment requirements or the development of the patient’s treatment plan. In addition, the physiotherapists expressed a belief that establishing a test battery can correlate pain with dysfunction, allowing physiotherapists to check how pain affects the quality of PFP and facilitates ADL improvements. The participants were nonetheless in agreement that the advantages of having such a test, which can reflect the general functional performance of pregnant women, highlight the utility and necessity of establishing a PFP test battery. Despite the impact of pain and lifestyle on the results of the test, provided that these factors are considered during its application, this will have a positive impact on physiotherapists' practice.

From the above discussion, it is clear that the PFP test battery can influence the physiotherapists' assessment of pregnant women, not only concerning LPP but also concerning pregnant patients' general health. A complete evaluation of this approach would require the functional test battery to be implemented and performed with patients in a research context. Specifically, future research on this topic should particularly consider the patients' specific characteristics, such as their age, physical abilities, and specific dysfunction. This will ensure that the data gathered will be reliable, valid, and useful for practicing clinicians.

6.6.2. Triage System

Having a triage referral system for the physiotherapy department was another recommended policy-maker-level strategy in the current thesis. Future qualitative research could explore the stakeholders' and policy-makers' perspectives regarding establishing a red line of direct access to physiotherapy in Kuwait.

6.7. Strengths and Limitations

This research was a sequential exploratory study that makes a unique contribution to the physical functional performance field by being the first to consider the perceptions of physiotherapists about their current practice, elucidate future developments, and establish normative data on PFP among pregnant women in Kuwait. The findings of this research have provided valuable qualitative and quantitative data that help to establish cut-off scores that suggest clinical practice strategies for the health care system in Kuwait. These findings on the PFP of pregnant women provided a baseline, and specific insights to inform future interventions, not only in Kuwait but also across different countries with similar health systems, such as GCC countries. Another strength is that the NRVs were collected from different sectors in different areas, so it could be argued that our sample may be more representative of pregnant women in different settings and can be generalized to Middle-East countries.

Despite these efforts, there was a limitation to the study, which was unavoidable due to the circumstances, as the research data collection for the qualitative and quantitative studies coincided with the Coronavirus crisis in 2019, which reduced the number of in-person meetings possible, making it harder to schedule interviews and meetings with policy-makers and patients. In addition, the pandemic may also have had an impact on the psychological well-being of pregnant women, so it was difficult to assess their physical functional performance. At this time, in Kuwait, the government enforced strict regulations and over three pandemic curfews, which affected the changes in physical activity due to restricting movement. The effect of the pandemic on pregnant women's physical activities was not considered, so this may be considered a weakness of this research that can provide a starting point for future research.

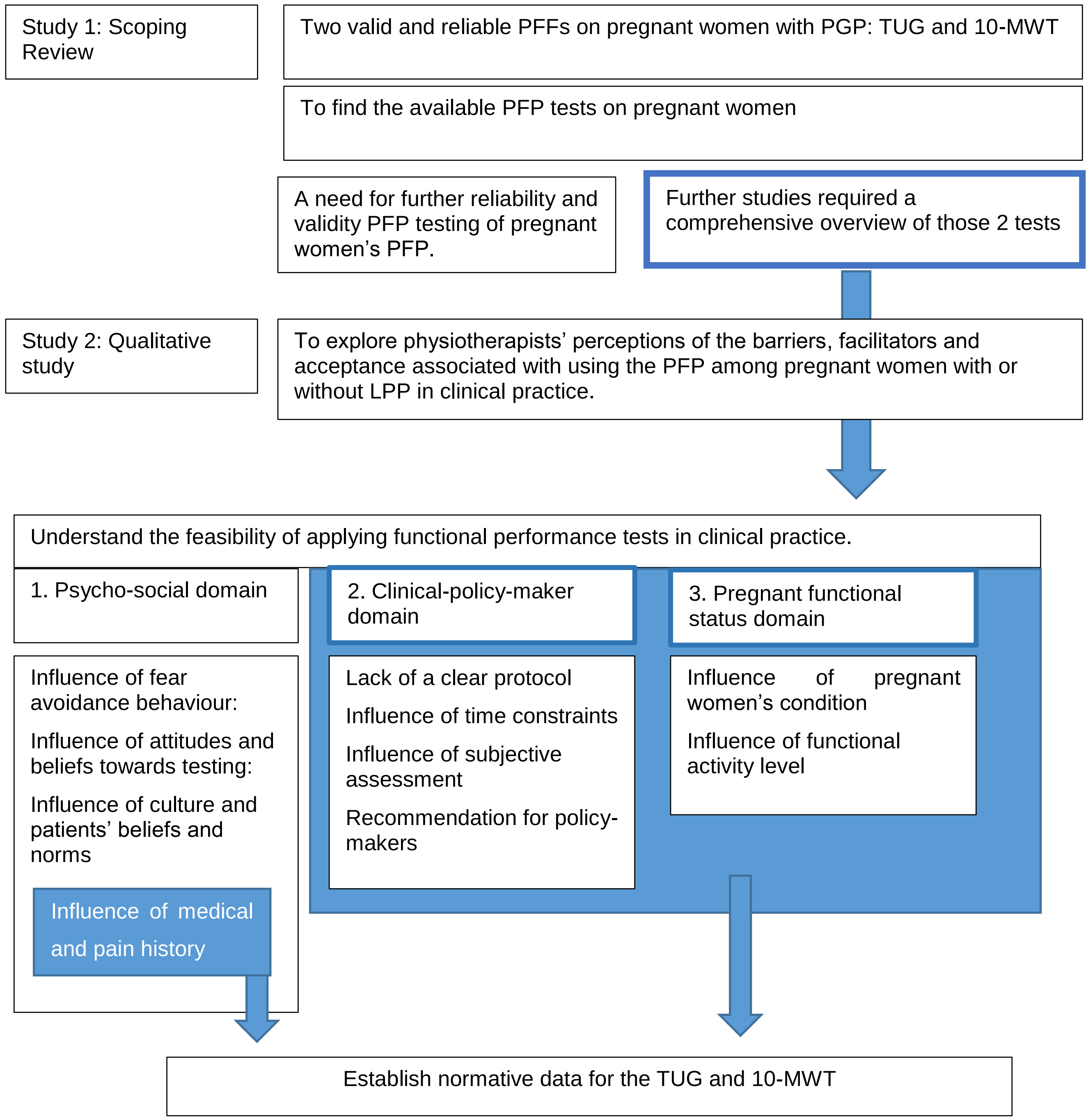
6.8. Conclusion

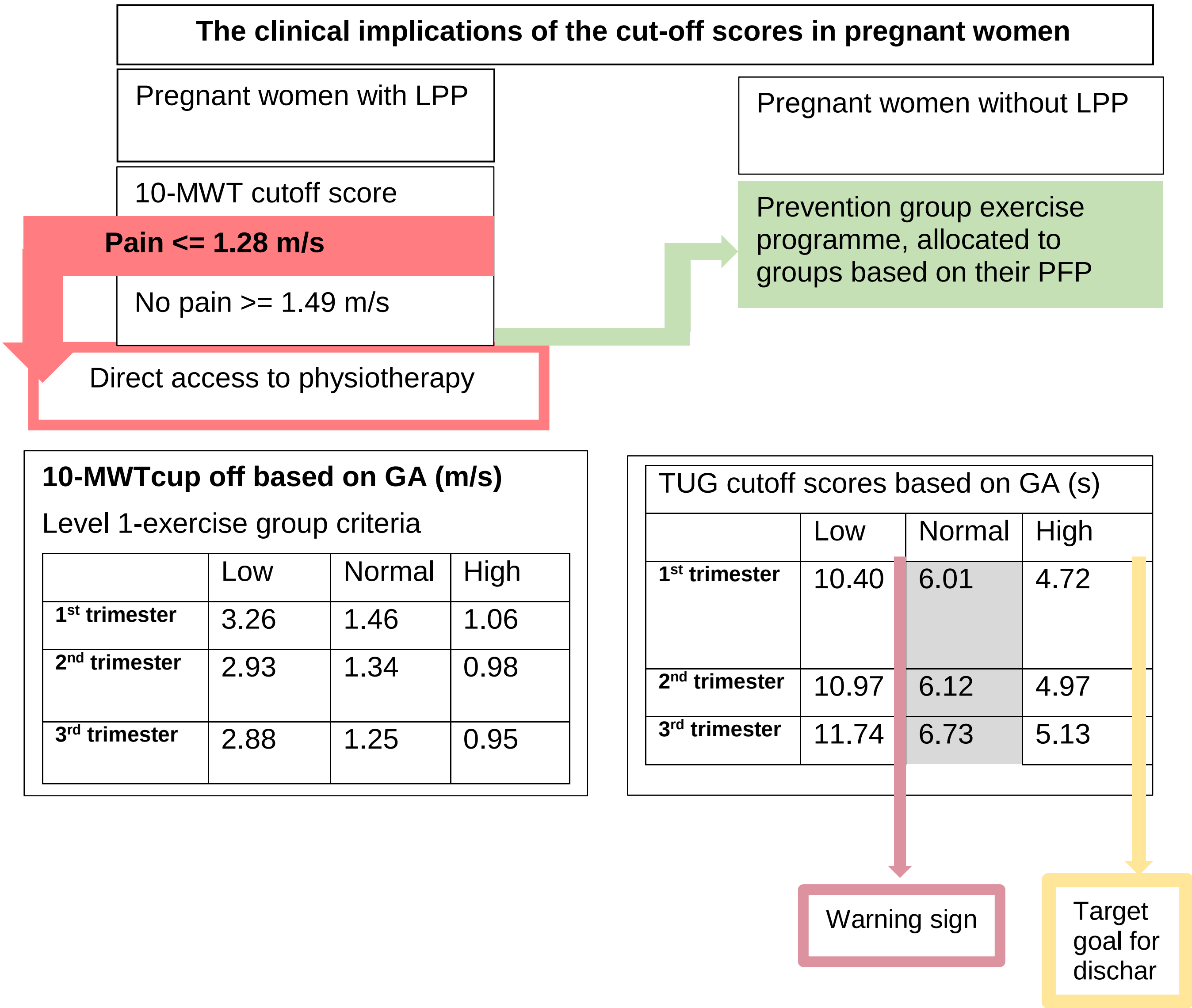
Physical functional performance is essential for assessing and evaluating pregnant women, with and without LPP pain. The importance of PFP in preventing and managing pregnancy-related pain and dysfunction is well documented; therefore, encouraging the usage of PFP among physiotherapists is essential to improve clinical practice. This mixed-method study established a foundation for a meaningful baseline and criteria guidelines, based on assessing the PFP among pregnant women. This may be achieved by mapping the literature in the field of PFP among pregnant women and then using the voices of senior physiotherapists in Kuwait to identify the barriers, facilitators, and acceptance related to PFP among pregnant women. Finally, we conducted normative data to establish baseline scores for the PFP among pregnant women to understand their functional status.

The findings of the research project demonstrate the need for collaboration between the policy-makers and stakeholders regarding the implementation of the suggested physical functional performance testing protocols and classification system, considering the potential risk factors.

Recommendations for strategies that promote the use of PFP among physiotherapists and help to overcome the barriers to using those tests have been put forward. These could inform the clinicians, including physiotherapists, doctors and nurses, policy-makers, and Ministry of Health managers, about possible ways to enhance clinical practice when assessing or evaluating pregnant women in Kuwait.

The findings from this study could form the basis for future guidelines on how to assess and evaluate pregnant women, with or without LPP. To be effective, antenatal clinics in Kuwait should include a multi-disciplinary team to control some of the demographic factors that may have a negative impact on the PFP among pregnant women. In addition, it is recommended that a new triage system be adopted for referring pregnant women who are on the borderline of PFP. This can be achieved by following the developed PFP guidelines for pregnant women by providing educational lectures and workshops for both undergraduates as well as fellow physiotherapists to ensure that the up-to-date, evidence-based practice for assessing and evaluating pregnant women is followed.


Study 1: Scoping Review
Two valid and reliable PFFs on pregnant women with PGP: TUG and 10-MWT
To find the available PFP tests on pregnant women
A need for further reliability and validity PFP testing of pregnant women's PFP.
Further studies required a comprehensive overview of those 2 tests
Study 2: Qualitative study
To explore physiotherapists' perceptions of the barriers, facilitators and acceptance associated with using the PFP among pregnant women with or without LPP in clinical practice.
Understand the feasibility of applying functional performance tests in clinical practice.
1. Psycho-social domain
2. Clinical-policy-maker domain
3. Pregnant functional status domain
Influence of fear avoidance behaviour:
Influence of attitudes and beliefs towards testing:
Influence of culture and patients' beliefs and norms
Influence of medical and pain history
Lack of a clear protocol
Influence of time constraints
Influence of subjective assessment
Recommendation for policy-makers
Influence of pregnant women's condition
Influence of functional activity level
Establish normative data for the TUG and 10-MWT



10-MWTcup off based on GA (m/s)

Level 1-exercise group criteria

	Low	Normal	High
1st trimester	3.26	1.46	1.06
2nd trimester	2.93	1.34	0.98
3rd trimester	2.88	1.25	0.95

TUG cutoff scores based on GA (s)

	Low	Normal	High
1st trimester	10.40	6.01	4.72
2nd trimester	10.97	6.12	4.97
3rd trimester	11.74	6.73	5.13

Figure 6.2: The clinical application of the thesis

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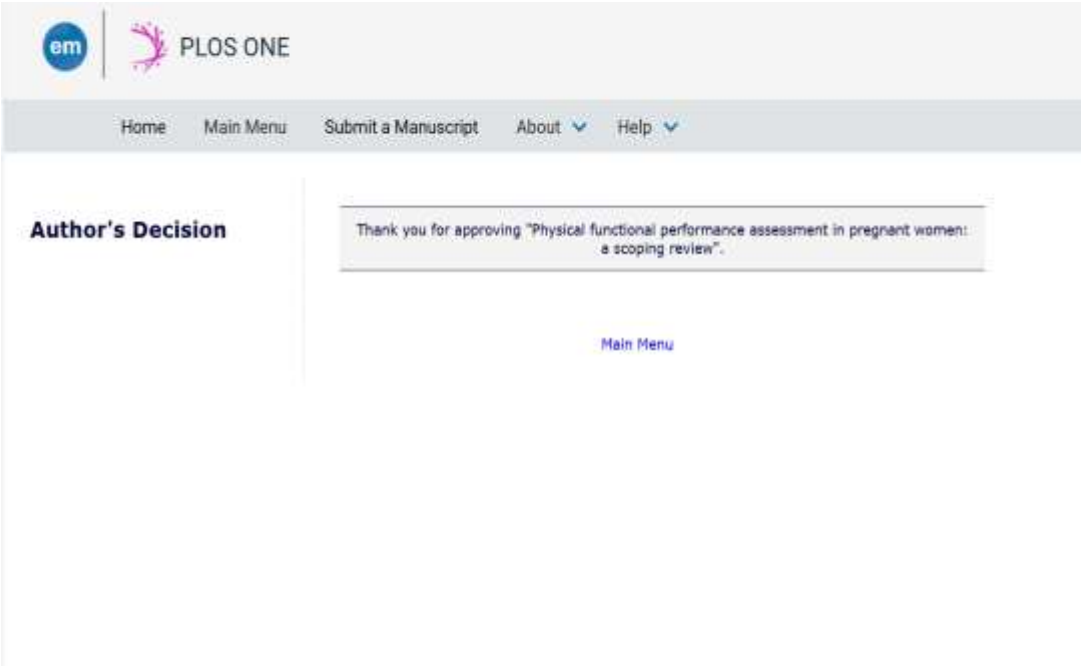
APPENDIX 1- SUBMISSION CONFIRMATION



APPENDIX 2- ANTE-NATAL ASSESSMENT SHEET

ANTE-NATAL ASSESSMENT

Name :______________________ **Age :** ____ **File No:**____________

Nationality :______ **Occupation:**___________ **Phone:**____________

D.O.A:_______ **D.O.R:** _______ **Referred by :** ________________

Diagnosis:____________________________

History:

Obstetric : Parity : _______, G.Wks :___ ,LMP :_____,EDD :_____

Prev.complications :__________________________

Delivery Type: ____________________________

Present : Pain : Upper back( ), Lower back( ), Pelvic region( )

Other pain :____________________________

____

Cramps( ), Varicose vein ( ), Giddiness ( )

Vaginal bleeding ( ), Carpal Tunnel Syndrome ( )

Incontinence:( )__________________________

Breast/Nipple Changes( )______________________

Past Medical : HTN( ),DM( ),Hypothyroidism( ),IHD( ),Anaemia( )

B.Asthma( ),Others(if any)______________________

____

Medications(If Any):______________________________

Social : ______________________________________

Observation:

Palor :________________________________

Built :__________________________________

Posture :_________________________________

Gait :__________________________________

Others :_________________________________

Examination

Tenderness:____

Odema :____

Breathing pattern:____

Muscle tightness:____

Muscle strength:____

Sensation:____

Others:____

Pain Assessment:

Site:____

Radiating (   ),If yes,specify:______________________________

Type :____

Intensity:(VAS)

Aggravating factors:____________________________________

Relieving Factors:____________________________________

4.Special Tests(if any) :

Problem List:____

Precautions(Ifany): ____________________________________

Treatment Goals:____

Treatment Plan:____

APPENDIX 3- PARTICIPANT CONCENT FORM

SAMPLE PARTICIPANT CONSENT FORM

TITLE OF RESEARCH STUDY:
Physiotherapists' perceptions of the barriers, facilitators and acceptance of functional performance tests battery for pregnant women with lumbo-pelvic pain in Kuwait: a qualitative study.

Please answer the following questions by ticking the response that applies

	YES	NO
1. I have read the Information Sheet for this study and have had details of the study explained to me.	☐	☐
2. My questions about the study have been answered to my satisfaction and I understand that I may ask further questions at any point.	☐	☐
3. I understand that I am free to withdraw from the study within the time limits outlined in the Information Sheet, without giving a reason for my withdrawal or to decline to answer any particular questions in the study without any consequences to my future treatment by the researcher.	☐	☐
4. I agree to provide information to the researchers under the conditions of confidentiality set out in the Information Sheet.	☐	☐
5. I wish to participate in the study under the conditions set out in the Information Sheet.	☐	☐
6. I consent to the information collected for the purposes of this research study, once anonymised (so that I cannot be identified), to be used for any other research purposes.	☐	☐

Participant's Signature: ____ **Date:** ___________

Participant's Name (Printed): ____________________________________

Contact details: ____

____

Researcher's Name (Printed): _ROKAYA KH ALSHATTI
Researcher's Signature: ____

Researcher's contact details:
(Name, address, contact number of investigator)

Please keep your copy of the consent form and the information sheet together.

APPENDIX 4- INVITATION LETTER

Sheffield Hallam University | Faculty of Health and Wellbeing

Dear Physiotherapist,

This is Rokaya AlShatti, a 3rd year PhD student in Sheffield Hallam university, I would like to invite you to attend an on-line focus group to get you perception regarding the barriers, facilitators and feasibility of functional performance tests battery for pregnant women with lumbo-pelvic pain in Kuwait.

If you are interested and can spare 60-90 minutes, please check the attached information sheet and contact me by either my mobile number or by email: @my.shu.ac.uk

Regards,

Rokaya AlShatti

APPENDIX 5- INTERVIEW GUIDELINES QUESTIONS

Types of questions	Purpose of the questions	Interview questions	Constant comparison with the literature review
Introductory and Engagement	ADL	1. How do you assess ADL's through physical tests?	References from the literature review about the ADL: - Walking has been documented to be a concern for almost 73% of pregnant women who experience pelvic girdle pain (Hansen et al., 1999; Stuge et al., 2011; Mei et al., 2018). -A systematic review concluded that poor physical function could contribute to the development of pain in pregnant women and observed that pregnant women with LPP were slower in performing ADL tasks like walking compared to pregnant women with no pain during pregnancy (Wong and McGregor's., 2018) Also see: 1. (Berber & Satılmış, 2020). 2. (Cooke et al., 2020). 3. (Fatmarizka et al., 2021).
	Functional performance assessment	2. How do you admin the functional performance assessment in term of time, number of tests and its clinical importance in your practice?	Measuring functional performance during pregnancy can provide information about patients' cardiovascular fitness and mobility and help to identify any functional impairments or limitations that may affect their health and well-being during pregnancy (Hulens et al., 2003). -It is advised to use objective performance tests to assess physical function thoroughly since they supplement patient-reported findings with additional data (Reiman & Manske, 2011). Pregnancy is a dynamic process, and women's functional ability may be shown to change over time by

			regularly measuring their PFP during pregnancy (Stuge et al., 2011). Also see: 1. (Barten et al., 2012). 2. (Manske & Reiman, 2013) 3. (Kear et al., 2017).
Exploration/ core	Tests combination 5STS; TUG and 10MWT	3. We have 3 tests (5STS; TUG and 10MWT) that measure strength, agility, dynamic balance, and endurance. What do you think on pros and cons of the tests combinations as a general functional performance test? 4. Say about its safety, relevance, clinical significance, tests order, classifications for intervention designing, etc. 5. Do you think these tests are sufficient to address the underlying functional impartments in pregnant women with LPP?	The result of the scoping review (chapter 3) showed only 3 tests were reliable and valid on pregnant women which are 5STS; TUG and 10MWT (Alshatti., 2024). -The TUG and 10mTWT are reliable, objective functional tests for pregnant women with PGP. Both tests are suitable for use in clinical and research settings (Evensen et al., 2015). -The 5TSS test is a reliable and valid functional mobility outcome measure in pregnant women with and without PGP (Yenişehir et al., 2020). -Both the TUG and 10 mTWT were valid weight-bearing physical performance measures (Evensen et al., 2016) Please see more LR supporting the importance of the tests in clinical practice: 1. (Jakobsson et al., 201 9) (Robertson et al., 2017).

APPENDIX 6- TABLE – MATRIX SHOWING THE PHYSIOTHERAPISTS' PERCEPTIONS OF THE BARRIERS, FACILITATION AND ACCEPTANCE OF FUNCTIONAL PERFORMANCE TESTS BATTERY FOR PREGNANT WOMEN

What are the barriers	Barriers related to patients' conditions	Barriers related to culture
The possible barriers of using the proposed functional performance tests is divided into two categories, some of them related to the patient's condition or the cultural barriers.	**Some barriers are related to the pregnant women's conditions, such as their pain level or morbidity, that affect the patients' capability to perform the tests.**	**Barriers related to cultural beliefs and the environment, such as the sedentary lifestyle, fear avoidance and cultural understanding.**
***"I can find some disadvantages. same as what he said what my colleague said that sometimes the patient, as we said the patient her functional level"* (G1, P1)**	**The severity of pain may be an obstacle to performing the functional tests, and may prevent movements.**	**The sedentary lifestyle may be a possible barrier to using the proposed functional performance tests.**
***"The cons it's not the cons, but a possible barrier let's say the pain, could be a barrier or sometimes."* (G2, P8, page 12)**	*"even but patients with pain depends again severe very severe I don't think they can tolerate this, but most patients, I think, from my experience, whatever kind of pain, they have, I think they can tolerate this this uh huh Thank you yeah." (G2, P9, page 12)*	*"as well stated in Kuwait, we have a high percentage of sedentary lifestyle, so I think, women are very inactive before they actually get pregnant. And so, with all the changes that they go through their bodies go through after pregnancy, it makes it very hard for them to become active and functional so that could be one of the cons of administering the three."* (G1, P5, page 8)
	"Patients with chronic especially chronic lower back pain, they have fear avoidance, believe so. Will this in my mind. With us in mind, when they were when they have this believe they will they will have the belief that they have a poor functional capacity so even a simple test like walking or sit to stand, will they will feel that it's difficult for them to perform, so this could be a barrier" (G2, P8, page 12)	**Pregnant women without an active lifestyle may face fatigue due to combining three tests in a row at once.** *"I'm worried about the fatigue and the level of pain"* (G2, P6, page 11)
	Pregnant women may complain of other morbidities with LPP, so this may affect their performance and capability to perform the tests.	**In addition, there is a common belief that being active in the 1st or 3rd trimester may cause a miscarriage or affect the baby's health.**
	"if the patient has core morbidity, other morbidities in addition to lower back pain, this could also be a factor. That will affect you know her ability not for as a physiotherapy I think it's easy and she can do it, but for some patients, we have to consider a you know these factors before applying the test yes." (G2, P8, page 13)	*"We have a cultural understanding, especially in the first and the third trimesters that woman shouldn't move. You know it's risky for the baby and so maybe some of the movements that they are asked to do, or the amount of time that they need to spend doing those functional tests can put them off, so I think those are*

		some of the cons of administrating those tests." (G1, P5, page 8)

Is it acceptable/feasible to be used at the clinic?	**Reasons to accept (advantages)**	**Reason to not accept (disadvantages)**
The advantages of the proposed functional performance tests outweigh the disadvantages. *"This is always the case when you combine exercises and tests, but a few put them on a scale and, if you want to weigh the advantages and disadvantages, I think, in that scenario, the advantages are far away and far more than the disadvantages, so in my opinion, it's a good idea, I think it will help our patients and our pregnant women that we see in our practice, so I think it's a promising method to add to our practice."* (G1, P3, page 9)	**A possible advantage of the context of the tests is that it reflects general functional performance by using an objective measure, that can overcome the disadvantage associated with measuring endurance.** *"the physiotherapists' opinions need to be measurable rather than subjective. We do subjectively ask the patients if they can walk and sit. We see them sitting and standing through observation, but now we are doing it through testing, which is good, measurable" (*G2, P9, page 11) *"what I like about these just the combining of them, I see the big picture, the combination of this, this gives you the kind of level of what the patient can tolerate, and endurance, I can test endurance, and through this how she can tolerate all these tests, together with the tolerable kind of pain or capacity we're talking about in general. These tests are not a simple task." (G2, P9, page 12)* The proposed functional tests include basic ADL and standard tasks. *"I think they're very usable because all of the movements are functional, their movements that we use on a day-to-day basis and it doesn't interfere with pregnant women. So, yes, I do use those moments." (G1, P5, page 12)* *"I think they will cover the whole aspect of the patient, they will cover endurance, about their strength and balance, so their cardiopulmonary plus the musculoskeletal system."* (G1, P1, page 11)	**A possible disadvantage of the context of the tests is that they cannot isolate functional impairments, which may make it difficult to consider the results as an indication of patients' dysfunction and can cause fatigue for them.** *"Regarding pain for pregnant woman with lower back pain, these are not indicated as an indication of her dysfunction or pain. It will not give any indication of any kind about what her problem is."* (G2, P9, page 10) *"but they're not very specific to all or tests that can give me a clear picture of what's going on with the underlying dysfunction so they're a good functional test, simple, but not very indicative about what's the cause of the underlying issue." (G2, P9, page 14)* *"How it feels from fatigue, because I think combining those tests will affect their performance." (G1, P3, page 9)* **Some possible disadvantages to the application of the tests battery that cannot be applied to patients with severe pain and may waste time.** *"I think that, especially when you're assessing them during the first session, if they're in severe pain and we're applying too many tests and we're irritating them, it might affect their compliance and it might affect, you know, how receptive they are to their rehab."* (G1, P5, page 6) *"could be a Cone because sometimes, like, we don't have the enough space. So we have room sometimes, like when we say to the patient 'Let's just go outside' and maybe we have a bigger space or*

It was mentioned by the physiotherapists that their aims in using the functional tests is to test different daily activities was to discover which functional impairments were causing the LPP. With this proposed tests battery, that combines three different tests, they will be able to test multiple functional impairments at the same time.

"it's a great idea to have. Three functional tests that examine the balance endurance and strength, at the same time, and we can use them and try. It's good to administer those three tests because they are assessing so many domains." (G1, P2, page 10)

"For a pregnant woman, it depends on which semester she is in now. It's kind of a little bit that can give you also an extra point for assessing her, not only endurance." (G2, P9, page 12)

In addition, it may reflect the general functional performance, assess pain tolerance with movements and indicate impairments in the lumbarpelvic area

"what I like about these is just the combination of them. I see the big picture. The combination of this gives you a kind of level of what the patient can tolerate and her endurance. I can test endurance, and through this assess how she can tolerate all of these tests, together with the tolerable kind of pain or capacity that we are talking about in general. These tests are not a simple task." (G2, P9, page 12)

"They are good tests to check agility, lumber-pelvic strength and function. It's so nice, so good to have some kind of a battery to do this kind of a combination of tests to check agility, dynamic balance and endurance, with pregnant women. Such a nice way to add, a nice

something like that, it could be a Con, because it's just going to take some time from the assessment time." (G2, P10, page 14) *way to see some kind of battery or test combined together." (G2, P9, page 14)*

"Together with a tolerable kind of pain or capacity that we're talking about in general, now we can't say that this indicates the level of pain. This is one of the cons to this. Can we do this with the kind of level of pain in patients?" (G2, P9, page 12)

Some possible advantages to the application of the tests battery are that it is easy, does not need any equipment and can save time.

"so it's very good and I think it's easy to apply and it doesn't need equipment or a big space to apply them." (G1, P1, page 9)

"you don't need more stuff. Of course, everything's available for you, the space and one chair, one stop watch, it's easy, and this equipment, I think, as they said, they don't require a lot of time, they don't require a lot of equipment so, yeah, I agree." (G1, P5, page 12)

"can really speed up some kinds of things that you may do with the patients, which is number one." (G2, P9, page 10)

"if we're talking about the time barrier, we should start with the holistic tests and, from that point, proceed to more specific tests, as my colleagues said, otherwise we're going to waste time and we're going to waste also resources." (G1, page 15)

"they are well-known exercises and I use them frequently and also they're very common and they give us a good insight about the patient so, yeah, I do use them." (G1, P3, page 16)

What can facilitate the use of the proposed functional tests battery?	The clinical significance	The safety procedures and recommendations
The perception of pregnant women and the role of physiotherapists in facilitating the use of the proposed tests battery. As pregnant women are young, they able to perform the basic tasks included in the tests battery. Also, education plays a role in the acceptance of these tests among pregnant women. *"If she trusts your plan, if she trusts what you give as an education program for them, then they'll be able to perform any functional exercise you ask them to do."* (G1, P2, page 7) *"I think pregnant women usually are more active, I mean, sorry, I mean, they were active they are young, so they can do it."* (G2, P6, page 11) *"I think education and knowledge are the first things that we should concentrate on."* (G2, P8, page 13)	**Different perceptions of the possible clinical significance of the proposed tests battery.** **Clinical significance of the proposed tests battery related to the tests battery's components. It works as a baseline and general functional assessment tool that correlates pain with dysfunction.** *"I think, as we just said before, we can use them as a baseline measurement to check progression." (G1, P2, page 3)* *"I think so too. We're combining the most well-known exercises and easy to use ones. It's a very good thing to do and combining both, combining all those three, will give us a clear picture about the patient's level of performance and a huge amount of information regarding the patients' status, yeah, so I definitely suggest that's okay." (G1, P3, page 11)* *"I mean, the pain could be, it could be an issue with endurance, it could be an issue with strength, it could be balance, it could be mobility, it could be many things. I think administering this stuff is an objective measure so you can kind of classify where their issue is or what's the, what's the main issue contributing to that pain." (G1, P5, page 8)* **Clinical significant related to the end findings of the tests battery. Through identifying the problem, this will help the decision-making, and guide them on further testing**	**The physiotherapists agreed on the safety of the proposed functional tests and provided some recommendations. They emphasized that the tests are safe to use with pregnant women because they include simple, basic and familiar tests** Familiar tests *"absolutely, they are safe, as I believe that, as in any other special test for a pregnant woman, because we're dealing with a pregnant woman who has, who might go through more physiological changes."* (G1, P1, page 9) *"yeah, if we are all familiar with the test, I think it's totally safe, totally safe. Well, let's talk about five times sit to stand is totally safe. Let's talk about time up and go, also very safe. The 10 meter walk test, definitely safe." (G2, P9, page 12)* Simple and basic "it's very basic, very simple, I don't think it's, it's by all means." (G2, P9, page 12) "yeah, sure, it's very safe. As my colleagues just said, it's very safe easy and simple, uh huh." (G2, P8, page 13) **Some recommendations related to both the patients and physiotherapist from the participants would facilitate the application of the proposed**

	and when designing the rehabilitation program.	**functional performance tests battery.**
	Identify the problem *“tests combined together, they're really comprehensive and give us a really nice background of what the problem is, where the problem is and where to go from there." (G2, P10, page 16)*	The recommendations were related to patients, to check their vital signs and facial expressions and measure their Rate of Perceived Exertion (RPE). *“Checking their vital signs, facial expression and so on, I think, the same as for any other test involving pregnant women.” (G1, P1, page 9)*
	Help with decision-making *“it can give us a good insight into what we can do next, and what we should, we should do.” (G2, P8, page 16)*	*“If we’re just concerned about the fatigue of the patients during the test, the three tests together, we can use the target heart rate monitoring of the heart rate or RPE, so that's going to give us, like, a subjective measure from the patients while we do the objective one at the same time, so that's going to help us if we can do the three during the same session.” (G1, P2, page 10)*
	“what do I want to do more? Should I go more with the balance and strength? Should I test endurance more? You know, what I mean, more with the, with the, with agility and so on.” (G2, P9, page 16)	
	“from there, you can decide if you want to carry on and do more specific tests with pregnant ladies and we see this is like really such a nice comprehensive group of tests that they can give you a nice insight.” (G2, P10, page 14)	Recommendations related to the physiotherapists taking precautions by providing close supervision and mastering the tests before applying them with pregnant women.
	Guidance on the treatment plan *“I think, yeah, it has clinical significance because then you can administer your rehab program and focus on those things that you find and those tests, so I think, yeah, there's high punisher relevant stuff like that.” (G1, P5, page 8)*	Taking precautions “*it's good to start with, with, as I said, a caution and you follow all the rigorous, safety measures.” (G1, P3, page 9)* Close supervision *“think that they are doable, it's doable, not that difficult but, of course, with good supervision and good precautions, yeah, we can, we can do it, do them all during the,*

during one session, yeah, for sure.” (G1, P3, page 11)

“but because we’re dealing with a pregnant woman who has, who might go through more physiological changes, so I think you have to be more careful with your patient, and keep an eye on them to observe them very well, before, after and during the test.” (G1, P1, page 9)

Mastering the tests

“it's just about the fatigue and your endurance level. If you can focus on that, if you can explain to the patient and be concise. be accurate and be on, on time, on a spot for each test without your, to master each test as a physio. When applying the three tests, our three tests at the same time, you need to master those three, so I said just, of course, planning and pre-planning and practicing several times, and then, when you’re confident, we can apply it to a pregnant woman so, of course.” (G1, P3, page 10)

“but building that with caution and I think, if we can explain everything to them and conduct every test in a concise way without further fatiguing the patient, I think it can be done, but always, always, it’s always the case when you combine different exercises, you should take care of the fatigue that will, will affect the patient, and hence their performance.” (G1, P3, page 9)

Text underlined: researcher’s summary; Text in italics: direct quotes from participants

APPENDIX 7- AKNOWLEDGEMENTS

My Frontiers

OVERVIEW | MY SUBMISSIONS | MY INBOX | MY INVOICES

My Submissions

Author Guidelines

Search by title or ID | Status: All | Article types: All

1 All | 0 In Preparation | 0 Initial Validation | 1 Editorial Assignment | 0 Independent Review | 0 Interactive Review | 0 Review Finalized | 0 Accepted

Editorial Assignment
Original Research

Physiotherapists' Perceptions of the Barriers, Facilitators and Acceptance of Functional Performance Tests for Pregnant Women with Lumbo-Pelvic Pain in Kuwait

Rokaya AlShatti, Rachael Spencer, Anna Lowe and Mohsen Shafizadeh

Frontiers in Global Women's Health
Maternal Health

Submitted on 30/04/2024 | Editorial Assignment on 01/05/2024

Go to Review Forum

3rd Kuwait international Physiotherapy Conference Inbox ×

alyaa@kuwaituniversal.com 8:30 AM (27 minutes ago)
to Rogaya, scpt_q8, gracy

Dear Miss. Rokaya Alshatti,

I am writing on behalf of the 3rd Kuwait international Physiotherapy Conference organizing committee. I am pleased to inform you that your abstract, entitled "Physiotherapists' perceptions of the barriers, facilitators and acceptance of functional performance tests for pregnant women", has been accepted for presentation at our conference.

Please note that the presentation should be in line with the abstract submitted, and any significant changes must be approved by the conference organizers. Final PowerPoint presentation (using the presentation template or at least the event logo – both attached) should be emailed to us latest by 2.00 PM 25th February 2023. Late presentations will not be accepted.

The presentation will be of 15 minutes duration and the exact timing and date of the presentation will be mailed to you. We will provide you with a detailed schedule of the conference closer to the date.

Kindly note, you will need to be registered as a delegate to be able to participate as Abstract Oral Presenter.

Kindly acknowledge receipt of this email accepting this offer. If you have any questions or require further information, please do not hesitate to contact us.
Thank you again for your contribution and we look forward to your presentation.

Sincerely,

Gracy Rodrigues
Business Development Manager
Universal Co - Kuwait
Event Coordinators
+965 97328975

APPENDIX 8- INTRA-RATER RELIABILITY TESTING

Intra-Rater Reliability testing

The following procedures were applied for both the reliability and normative sampling.

The pilot study was conducted in two phases. Phase 1's aims. As suggested by Prescott and Soeken (1989) based on a review of then-current nursing research textbooks, included the assessment of (a) feasibility (b) adequacy of instrumentation, and (c) problems with data collection strategies and proposed methods. Phase 2 was related to (d) answering methodological questions, and (e) planning a larger study.

Pilot study:

Saunders, Lewis and Thornhill (2016) advise that a pilot test be conducted before commencing a study using questionnaires. A pilot study allows researchers to refine their proposed questionnaire to limit the participants' difficulties with answering the questions posed. Two key strategies are suggested by Saunders et al. (2016): convening a panel of experts to comment on the representativeness and suitability of the questions on the questionnaire, and asking this same expert panel to scrutinise the structure of the questionnaire and suggest improvements to it.

In line with these recommendations, a pilot test was undertaken to assess pregnant women's ability to understand the language of the proposed questionnaire. The pilot test was also used to assess the representativeness and practicality of the research procedure, and gain further opportunities to test the reliability and content validity of the tool. The questionnaire was translated into Arabic, the national language of the research context, to reduce difficulties with comprehension occasioned by the study's use of terminology and language specific to the discipline. This proved to be a crucial consideration within the pilot test, as the use of Arabic reduced the possible ambiguities or misunderstandings impacting on the participants' responses. As such, it was considered crucial to avoid the assumption that Arabic-speaking respondents would be able to understand the entire questionnaire in English. The questionnaire's Arabic translation had been used with pregnant women in previous research. The steps used in the piloting process are listed in Table 1: in particular, steps were taken to ensure that the small pilot group of volunteers were as similar to the target population as possible, thus allowing the piloting process to provide insights into the local political circumstances or other context-specific problems that had the potential to affect the research process.

A. Phase one pilot Study

Table 1- Phase 1 Participants' Details									
Participant #	Demographic data					TUG		10 WMT	
	Age yrs	Weight Kg	Height m	Parity	GA wks	Trial 1 sec	Trial 2 sec	Trial 1 sec	Trial 2 sec
1	35	81.5	1.75	4	11	8.53	7.88	4.52	4.66
2	34	69	1.61	5	35	9.84	9.09	5.97	6.24

B. Phase two of pilot study

Following the first trial, another pilot study was conducted, this time increasing the number to 51 participants and using the IPAQ-SF questionnaire. As a further refinement to the process, data entry was conducted using the Qualitrics software package. In this second and more extensive pilot study, only one participant withdrew (she had an important call and could not complete the trials), and the participants reported a far simpler and smoother process overall in their feedback. The aim was to test the intra-rater reliability of the TUG and 10MWT.

To establish the reliability of the TUG and 10MWT, pregnant women were tested on three occasions within the same period, with 2-3 minutes' rest between the tests. A demonstration was provided and one practice trial allowed, while the other two were recorded.

The intra-rater reliability was determined by comparing the two measurements performed by one therapist (test 1, test 2). The characteristics of the 50 participants included in this reliability study are shown in Table 2.

Table 2 Characteristics of the participants in pilot-Phase 2

	No pain N=12			**Pain** N=38		
	1st Trimester (N=2)	**2nd Trimester** (N=7)	**3rd Trimester** (N=3)	**1st Trimester** (N=11)	***2nd Trimester*** *(N=21)*	***3rd Trimester*** *(N=6)*
	Mean(SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age years	23 (.0)	26 (4)	33 (3)	29 (4)	28 (3)	30 (3)
BMI kg/m^2	24.99(2.90)	26.73 (.16)	29.67 (4.00)	27.49 (5.15)	27.54 (4.28)	31.47 (5.53)

Pain: VAS	0	0	0	3. (2)	4 (1)	4 (2)

APPENDIX 9- KUWAIT'S MINISTRY OF HEALTH ETHICAL APPROVAL

دولة الكويت
وزارة الصحة
وكيل الوزارة المساعد لشئون
التخطيط والجودة

State of Kuwait
Ministry of Health
Asst. Undersecretary
for Planning & Quality

كويت جديدة
NEWKUWAIT

التاريخ: ٥/١٠/٢٠٢٠

المرجع: ١٤٥٠

السيد الفاضل / د. وكيل الوزارة **المحترم**

تحية طيبة وبعد،،،،

الموضوع / تسهيل مهمة الباحثة / رقية خليل الشطي
لأجراء البحث
(رقم البحث2020 / 1330) تحت عنوان:

Assessing Physical Performance Tests Battery in pregnant women with and without lumbo-pelvis pain Normative study

يرجى التفضل بالإحاطة بأن اللجنة الدائمة لتنسيق البحوث الطبية والصحية المشكلة بموجب القرار الوزاري رقم 207 لسنة 2012 قد أوصت باجتماعها الثامن والستين (2020 /6) (الاجتماع عن بعد / بالتواصل المرئي VTRTUAL MEETING) بالموافقة على إجراء البحث رقم(2020/ 1330) المقدم بتاريخ 19/8/2020 تحت عنوان:

Assessing Physical Performance Tests Battery in pregnant women with and without lumbo-pelvis pain Normative study

وذلك بعد أن قامت اللجنة استنادا للقرار الوزاري رقم 207 لسنة 2012 والتعميم الصادر من السيد / وكيل الوزارة برقم 156 لسنة 2012 باستطلاع آراء الجهات ذات العلاقة بموضوع البحث حيث وافق السيد / وكيل الوزارة المساعد للشئون القانونية بالكتاب الوارد برقم 742 بتاريخ 14/9/2020 كما وافق السيد / مدير ادارة خدمات العلاج الطبيعي بالكتاب الوارد برقم 697 بتاريخ 7/9/2020 وتم استطلاع رأي السيد / د. رئيس مجلس اقسام النساء والتوليد بالكتاب رقم 767 بتاريخ 24/7/2020 والكتاب رقم 1615 بتاريخ 9/9/2020

1

P.O. Box : (5) 13001 Safat, State Of Kuwait
Tel.: 24622230/24622228 - Fax : 24866514

ص. ب. (٥) الرمز البريدي ١٣٠٠١ الصفاة، الكويت
تلفون: ٢٤٦٢٢٢٣٠/٢٤٦٢٢٢٢٨ - فاكس: ٢٤٨٦٦٥١٤

دولـة الكـويـت
وزارة الـصـحـــة
وكيل الوزارة المساعد لشئون
التخطيط والجودة

State of Kuwait
Ministry of Health
Asst. Undersecretary
for Planning & Quality

كويت جديدة
NEWKUWAIT

التاريخ: ٢٠٢٠/١٠/٥ المرجع: ١٤٥٠

ويتم البحث من خلال استخدام استبيان ونموذج لجمع البيانات وإجراء الفحوصات والقياسات حسب بروتوكول البحث.

ولا يتضمن البحث إجراء أي تجارب طبية أو إعطاء أدوية أو أخذ عينات حيوية خارج اطار الخطط العلاجية.

برجاء التفضل بالاطلاع والتوجيه بما ترونه مناسباً نحو اعتماد توصية اللجنة والموافقة على مخاطبة الجهات ذات الصلة بموضوع البحث ***(السيد / د. الوكيل المساعد للشئون الفنية / السيد / د. الوكيل المساعد لشئون الخدمات الطبية المساندة (ادارة خدمات العلاج الطبيعي)/ السيد / د. رئيس مجلس اقسام النساء والتوليد / السادة / مدراء المناطق الصحية والمستشفيات)*** *بهذا الشأن للعمل على تسهيل مهمة الباحثة لإجراء البحث.*

مع مراعاة التزام الباحثة بالمحافظة على حقوق المشاركين بالبحث بالخصوصية وسرية المعلومات وعدم تداولها خارج إطار البحث وتقديم تقارير متابعة دورية **Progress Reports** للجنة الدائمة لتنسيق البحوث الطبية والصحية عن مدي التقدم في سير الدراسة ومدي تحقيقها للأهداف المرجوة من إجرائها *والتنسيق مع رؤساء الأقسام التي ستجري بها الدراسة وفقا للضوابط المنظمة لذلك.*

وتفضلوا بقبول فائق الاحترام،،،،

الدكتور / محمد جاسم الخشتي
الوكيل المساعد لشئون التخطيط والجودة
رئيس اللجنة الدائمة لتنسيق البحوث الطبية والصحية

يعتمد،،

حسب النظم

وكيل وزارة الصحة

٢٠٢٠/١٠/١

ص. ب. (٥) الرمز البريدي ١٣٠٠١ الصفاة، الكويت
تلفون: ٢٤٦٢٢٢٣٠/٢٤٦٢٢٢٢٨ - فاكس: ٢٤٨٦٦٥١٤

P.O. Box: (5) 13001 Safat, State Of Kuwait
Tel.: 24622230/24622228 - Fax: 24866514

APPENDIX 10- PHYSICAL PERFORMANCE TESTS IN PREGNANT WOMEN

Physical Performance Tests Battery in pregnant women
The physical functional performance test protocol
The Ten Meters' Walk Test (10MWT) The 10MWT is a performance measure used to assess walking speed in meters per second over a short distance. The test was set up using white tape markers placed at strategic points along a 10-m long walkway: at 0 m, 2 m, 8 m and 10 m. Subjects commenced the test by standing with their toes up against the tape marker (Moore et al., 2018). The test instructions were as follows: 'After "ready, set, go", walk as fast as you can up to the last white line without stopping or speaking along the way'. Performances were timed (to the nearest 100th of a second) between the 2-m and 8-m markers and later converted into speed in meters per second (Smeets, 2006). The test reliability, validity, and responsiveness of the physical capacity tasks designed to assess functioning in patients with low back pain were confirmed by several authors (Smeets, 2006; Andersson et al., 2010; Simmonds et al., 1998; Teixeira da Cunha-Filho et al., 2010), and for pregnant women with pelvic girdle pain (Evensen, Kvåle & Brækken, 2015).

Timed UP and Go (TUG)

The TUG test consists of rising from a chair positioned 3m from a wall, walking 3m, turning around, returning to the chair, and sitting down again.

The test was performed according to the manner described in the study by Christensen et al. (2019). The TUG was performed in a large room with a linoleum floor. The participants wore sneakers and could use walking aids if needed. The time was recorded with a lap stopwatch. All participants performed the TUG from a chair (height: 46 cm) with a back-support and armrests. This reliable and valid TUG variant (Evensen, Kvåle, & Brækken, 2015) included standardized instructions, asking the participants to walk as fast as they could, and a timing protocol.

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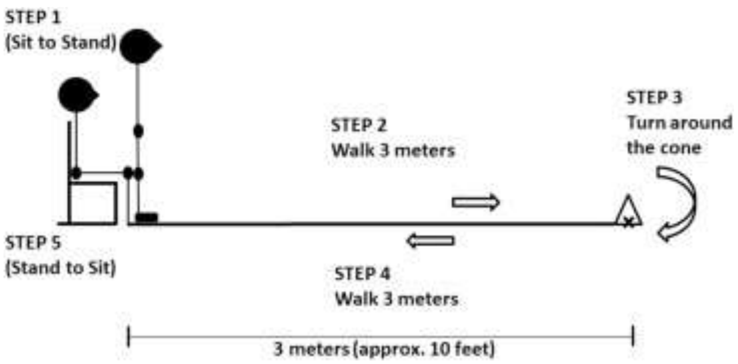
Image source:

https://images.app.g



APPENDIX 11- PARTICIPANT INFORMATION SHEET

Sheffield Hallam University

PARTICIPANT INFORMATION SHEET

Title of Project

To test the performance in different daily activities among pain-free pregnancy or experiencing pain in the lower back, pelvis or hip areas: Normative study

Legal basis for research for studies.

The University undertakes research as part of its function for the community under its legal status. Data protection allows us to use personal data for research with appropriate safeguards in place under the legal basis of **public tasks that are in the public interest.** A full statement of your rights can be found at https://www.shu.ac.uk/about-this-website/privacy-policy/privacy-notices/privacy-notice-for-research. However, all University research is reviewed to ensure that participants are treated appropriately and their rights respected. This study was approved by UREC with Converis number **ER21255253.** Further information at https://www.shu.ac.uk/research/ethics-integrity-and-practice

Opening statement:

You have been invited to participate in a research study that will help us better understand how the field of physiotherapy can reduce pain for women during and after pregnancy. Before you decide whether to take part it is important for you to understand why the research is being done and what it involves. Please take time to read the following information carefully.

We will describe the study and go through this information sheet, we will then give you time for further consideration and answer any questions you have. Before starting the study, we will ask you to sign a consent form to show you understand what will happen and agree to take part. Of course you are free to withdraw at any time, without giving a reason. This would not affect the standard of care you receive. We will ask your permission to inform your doctor that you have taken part.

Why have you asked me to take part?

If you choose to accept, you will be part of a group of 380 women, that have been chosen due to them being pregnant, that may or may not be experiencing pregnancy pain (lower back, pelvis or hip), and have no historical medical problems before or during pregnancy.

Do I have to take part?

No, this research is entirely voluntary. You will choose whether or not take part. If you agree to take part, then a copy of the information provided here is yours to keep, along with the consent form, which states that you are willing to participate. You can change your mind about taking part at any time without giving a reason. Your usual care will not be affected if you decide to withdraw from the study.

What will I be required to do?

The study will last for approximately 10-15 minutes depending on your performance. A member of the research team will meet you following your expression of interest until the end of the test, which requires one session only.

If you agree to take part, you will be performing two different tests, and the tests will be repeated 3 times. The tests will be performed in the physiotherapy department at the hospital, so you will have full privacy and feel comfortable while performing the tests. No follow-up session is required.

Physical function

Please Note:

You are NOT required to complete any or all tests in this section if you feel unable to do so. You will be asked throughout the completion of tests if you are happy to do them or if you require rest. The tests do not have to be completed together and can be spaced apart as much as you like.

The two tests will cover four areas: fitness, strength, balance and flexibility that will help us understand your physical performance.

1) To measure your balance ability, we will ask you to perform a test that requires rising from a chair with your arms folded across your chest, walking for 3 meters, turning around and sitting down on the chair again. This will be repeated three

times and the physiotherapist will record how much time you need to perform the test.

2) To measure your fitness ability, a 10-Meters walk test will be performed. The physiotherapist will record how much time you need to perform the test.

Each test will be repeated 3 times, one as a trial for the test and the we will be recording the last two times.

Where will this take place?

The tests will be performed in the physiotherapy department at the hospital, so you will have full privacy and feel comfortable while performing the tests. No follow-up session is required.

How often will I have to take part, and for how long?

The study will last for approximately 10-15 minutes depending on your performance. A member of the research team will meet you following your expression of interest until the end of the test, which requires one session only.

Are there any possible risks or disadvantages associated with taking part?

There is low risk and there might be a possibility of an adverse event. However, before your participation we will ensure that you do not have any relevant medical history that would pose as a risk; please note that this will be in correspondence with your doctor. In addition, throughout the test your vitality signs such as breathing rate and heart rate, will be monitored.

If you do not exercise or perform any form of physical activity regularly, and you suddenly increase your physical activity by performing the tests, as a pregnant woman this may cause fatigue or muscular injury through excessive stress or strain. To avoid this, we advise you to take a break and rest between the tests as required, and if you feel uncomfortable in performing any of the tasks, you are free to withdraw at any time. Moreover, the department nurses will ensure that your vital signs such as heart and breathing rate are stable throughout the assessment via a monitoring equipment, which will be placed on your finger.

To prevent muscular injury through excessive stress or muscle strain. The study team will ask you to start with the walking test as an aerobic and stretching warm up exercise. We will make sure to use the appropriate size/weight equipment and to follow American College of Sport Medicine guidelines and adhere to safe practice while reinforcing safety precautions.

You might be at risk of slips, trips and falls while performing the tests. This will be prevented by keeping a table in front of the you for support whenever you need. In addition to keep the test areas clear of any obstructions, any spillages would be cleaned up immediately.

Please do not hesitate to talk to the research team members if you want to find out more.

What are the possible benefits of taking part?

We cannot guarantee that these tests will directly benefit you right away, but through contribution, you can help us in the medical field understand women and their common pregnancy related issues. In return this will help us provide solutions that you may benefit from the next time you are pregnant or even your friend, sister or daughter.

When will I have the opportunity to discuss my participation?

You can contact the researcher anytime you like, her name is Rokaya AlShatti and this is her email address: (B8038099@my.shu.ac.uk).

Will anyone be able to connect me with what is recorded and reported?

We will follow ethical and legal practice and all information about you will be handled in confidence.

Who will be responsible for all of the information when this study is over?

If you join the study, the data collected for the study will be looked at by authorized persons from Sheffield Hallam University who are organizing the research. They may also be looked at by regulatory authorities to check that the research is being conducted correctly. All of authorized persons will have a duty of confidentiality to you as a research participant, and we will do our best to meet this duty.

Who will have access to it?

The authorized persons from Sheffield Hallam University who are organizing the research

What will happen to the information when this study is over?

Personal data (e.g. Name, Telephone number) will be kept for 3-6 months after the end of the study so that we are able to contact you about the findings of the study and possible follow-up studies (unless you advise us that you do not wish to be contacted). All other data (research data) will be kept securely for 10 years. After this time, your data will be disposed of securely. During this time, all precautions will be taken by all those involved to maintain confidentiality. Only members of the research team will have access to personal data.

How will you use what you find out?

Results from this study will be used as a guideline, which will help us understand pregnant women's needs and therefore assist us in planning the appropriate treatment and check its progress. These findings will be published in healthcare and health education journals and will be presented at health conferences. Personal data of participants will not be shared.

How long is the whole study likely to last?

This is a part of PhD research. This part will take approximately a year to gather and analyse the data. While the whole research will take a further two years.

How can I find out about the results of the study?

The results of this study will contribute towards PhD research. If you would like to know more about the research, them please talk to me in the clinic or contact me by phone on or by email: You will see me around the physiotherapy department as well so please do not hesitate to ask me anything about the study.

Details of who to contact if you have any concerns or if adverse effects occur after the study are given below.

Researcher/Research Team Details:

You should contact the Data Protection Officer if:	**You should contact the Head of Research Ethics (Professor Ann Macaskill) if:**
• you have a query about how your data is used by the University • you would like to report a data security breach (e.g. if you think your personal data has been lost or disclosed inappropriately) • you would like to complain about how the University has used your personal data	• you have concerns with how the research was undertaken or how you were treated
Postal address: Sheffield Hallam University, Howard Street, Sheffield S1 1WBT Telephone: 0114 225 5555	

Thank you for taking the time to read this

APPENDIX 12- PARTICIPANT CONSENT FORM

Sheffield Hallam University

PARTICIPANT CONSENT FORM

TITLE OF RESEARCH STUDY:

Assessing Physical Performance Tests in Pregnant Women with and Without Lumbo-pelvis Pain: A Normative study

Please answer the following questions by ticking the response that applies

	YES	NO
1. I have read the Information Sheet for this study and have had details of the study explained to me.	☐	☐
2. My questions about the study have been answered to my satisfaction and I understand that I may ask further questions at any point.	☐	☐
3. I understand that I am free to withdraw from the study within the time limits outlined in the Information Sheet, without giving a reason for my withdrawal or to decline to answer any particular questions in the study without any consequences to my future treatment by the researcher.	☐	☐

4. I agree to provide information to the researchers under the conditions of confidentiality set out in the Information Sheet. ☐ ☐

5. I wish to participate in the study under the conditions set out in the Information Sheet. ☐ ☐

6. I consent to the information collected for the purposes of this research study, once anonymised (so that I cannot be identified), to be used for any other research purposes. ☐ ☐

Participant's Signature: ______________________________________ Date: __________

Participant's Name (Printed): ___________________________________

Contact details: ____

Researcher's Name (Printed): ______________________________________

Researcher's Signature: ____

Researcher's contact details:

(Name, address, contact number of investigator)

Please keep your copy of the consent form and the information sheet together.

APPENDIX 13- AKNOWLEDGEMENT

World Physiotherapy Congress2023

DUBAI 2-4 June 2023

20 March 2023

Dear Royaka

Congratulations, the following late-breaking abstract has been accepted for presentation at World Physiotherapy Congress 2023, which takes place from 2-4 June 2023 in Dubai.

Display number	PO-LBA-1-171 *(The numbers represent your presentation day and poster board position)*
Abstract title:	ASSESSING PHYSICAL PERFORMANCE TESTS IN PREGANANT WOMEN WITH AND WITHOUT LUMBO-PELVIC PAIN: NORMATIVE STUDY
Presentation format:	Printed poster *(This may be an alternative format to your submission and is the final decision from the congress programme committee)*
Presentation date:	Friday, 2 June 2023
Session time:	12:30 – 13:35 Gulf Standard Time
Room:	Poster area, Exhibition hall, Dubai World Trade Centre
Presenting author:	Royaka Alshatti

Please note:

- as all presenters have now been notified of their presentation date and time it is not possible to accommodate any requests for changes.
- to avoid confusion between abstract numbers and poster display numbers, all posters will now be referred to by their poster display number rather than abstract number. Therefore, from now on **your abstract reference for this poster will be <Presentation number>**

Session format

- Posters will be mounted on poster boards in the exhibition hall. Each poster board will have two posters on each side. The space for each poster is restricted and it is therefore essential that posters are produced to comply with the congress size requirements.
- Posters must be produced as A0 size in landscape. A template is available on our website.
- Each poster will be on display for one day only during the congress.
  - All poster presentation times have been allocated during the lunch break to provide unopposed poster and exhibition viewing time.
  - During your poster session you should be at your poster for the full 45 minutes to discuss your work with participants and answer their questions.

APPENDIX 14: PHYSICAL ACTIVITY GUIDLINE FOR PREGNANT WOMEN

APPENDIX 15: THESIS FLOW CHART