Undergraduate UK nutrition education might not adequately address weight management

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Research Article:

UNDERGRADUATE UK NUTRITION EDUCATION MIGHT NOT ADEQUATELY ADDRESS WEIGHT MANAGEMENT

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DISCLOSURE STATEMENTS

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Conflict of Interest

None

Authorship

David Rogerson conceptualised the investigation, collected and analysed the data and wrote the manuscript. Hora Soltani and Robert Copeland verified the codes, themes, theoretical frameworks and analyses as indicated in the manuscript and assisted with editing.

Ethical Standards Disclosure

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/ patients were approved by Sheffield Hallam University's Research Degrees Sub-Committee. Written informed consent was obtained from all subjects/patients.

ABSTRACT

Keywords: Weight Management, Weight Loss, Weight Maintenance, Nutrition Education, Qualitative

Objective: Weight management appears to be multidimensional and complex and registered Nutritionists might work to educate, promote and provide weight management services to communities, groups and individuals. However, Nutrition education might not adequately reflect the weight management requirements of individuals and groups. The aim of this study was to investigate if the Association for Nutrition's Undergraduate core competency framework for accredited degrees sufficiently reflects weight management needs and experiences of individuals.

Design: A qualitative investigation, conducted within critical realist ontology, was performed to understand the weight management experiences of dieters and compare these to the Association for Nutrition's accreditation criteria for Undergraduate Nutrition degrees.

Setting: Framework Analysis was used to identify and explain participant's experiences thematically and to compare these to the Association for Nutrition's core competency criteria.

Subjects: Participants (n=8) with weight loss (n=4) and weight maintenance experiences (n=4) were interviewed using semi-structured interviews to understand weight management at the agential level.

Results: Participants described knowledge, exercise, planning, psychological constructs and behaviour-change techniques, determinants of eating and social support as features of weight management. The competency criteria provided clear guidance on all aspects discussed by the group apart from psychological constructs and behaviour change techniques and social support.

Conclusions: Accredited Nutrition courses might not fully reflect the weight management needs and experiences of individuals. Nutritionists might require greater knowledge of psychology and behaviour-change to better understand and accommodate weight management needs.

INTRODUCTION

Nutritionists work in diverse roles with groups, communities, individuals and within industry to educate about and promote good health [1]. Depending on their specialism, Nutritionists might work with Dieticians and other health professionals in hospitals and clinics, within public health and policy development, or provide consultancy services within private practise [2]. To become registered in the UK, Nutritionists must register with the UK Voluntary Register of Nutritionists, which is regulated by the Association for Nutrition [3]. The Association for Nutrition (AfN) also accredits Undergraduate Nutrition degrees which must adhere to strict professional and ethical standards and evidence that the AfN's core competency criteria for Undergraduate degree courses have been embedded into the curriculum [3, 4]. These competencies were established to define the areas of knowledge and expertise of U.K Nutritionists [2]; reflect an international drive to develop standards for practice and workforce development [5] and were developed from research highlighting the breadth of knowledge required by professionals and that the role should be defined in terms of specialist proficiencies [2]. The first of the competencies is "Science", which contains 17 sub-competencies (CC1a-CC1q) that describe the scientific basis of nutrition and nutritional requirements. The second is "Food Chain" which contains 5 sub-competencies (CC2a-CC2e) that demonstrate knowledge and understanding of the food chain and its impact on dietary choice. The third is "Social/Behaviour", which contains 9 sub-competencies (CC3a – CC3i) that demonstrate knowledge and understanding of food in social or behavioural contexts. The fourth, "Health/ Wellbeing," contains 8 sub-competencies (CC4a-CC4h) that describe the application of nutrition science for the promotion of health and wellbeing. Professional Conduct (the fifth), contains 7 sub-competencies (CC5a – CCg) that demonstrate professional conduct and the nutritionist's code of ethics [6].

While the competency criteria appear to be comprehensive, Nutrition has been criticised by some authors who suggest that Nutrition knowledge has been biased towards positivistic science [7, 8], that many diet-related issues are underscored by social and behavioural issues [7, 8], that dietary problems are only partially understood by nutritionists and that nutritionists might not be best-equipped to deal with them [7, 8]. A growing body of evidence indicates that overweight and weight management are multi-dimensional conditions that have physical, social and behavioural dimensions [9, 10]. Weight-loss appears to be equally complex and appears to be dependent on dietary, lifestyle, cognitive and behavioural changes [10 - 12]. Dieters, it appears, have individual-specific needs and might require bespoke treatments to be successful [12]. It is not clear then, on the basis that weight management is multi-factorial and perhaps individual-specific, if Undergraduate education adequately encompasses the multi-dimensionality of weight management, and prepares

Nutritionists with the knowledge and skills to work with dieters, who might have complex, individual needs [12]. The aim of this study was therefore to compare the AfN's Undergraduate degree core competency criteria, which provides a framework for Undergraduate Nutrition curricula, with agential data that highlights the breadth of individual's weight-management experiences using qualitative research methodology.

EXPERIMENTAL METHODS

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Sheffield Hallam University Research Degrees Sub-Committee. Written informed consent was obtained from all subjects. In order to address the aims of this research, this study was performed in two sequential stages. In stage one a group of 8 participants were interviewed to understand their weight loss experiences. In stage two the participants' data was compared to the core competency criteria. Core competency criteria were provided to the principal investigator by the AfN and can be found online [6].

Philosophical and Methodological Underpinnings

This study was underpinned by critical realist ontology described by Maxwell [13]. Critical Realism is a meta-theory that is being increasingly used to underpin applied health research [14] and allows for the thematic description and explanation of data to be performed concurrently in qualitative research [13-14]. Data was handled in Nvivo 10 (Qualitative Solutions and Research International, Victoria, Australia) and Microsoft Word (Microsoft Corporation, Redmond, WA) and analysed using Framework Analysis (FA) which is a flexible approach, allowing a systematic management of qualitative data [15]. Framework analysis necessitates the creation of matrices that compare themes (developed during the analyses) and cases (participants vs. competencies) which would enable the comparison of participant's experiences with the competency document [18 - 19] and has been used successfully in research with similar aims [16].

Participants

A purposive sample of four male and four female (n= 8) participants were interviewed using a semi-structured interview to explore their weight loss experiences. Four participants were slimming club members and the remainder were recruited through networking with colleagues. All participants were white, adult and British nationals.

Interview Data Collection

All Interviews were conducted in a quiet, neutral environment. Interviews were conducted face-to-face, prompted with an interview guide that was developed from the literature and supplemented with field notes [17]. Respondent validation was sought after each interview [15]. Interviews were recorded using a digital recording device (Olympus Digital Voice Recorder, model WS-321M, Olympus Imaging Corp, China) and lasted approximately 60-75 minutes. All audio interview files were saved and backed up to a password-protected external hard drive. To ensure participant confidentiality and anonymity, all participants were allocated a number and all files were saved under the numerical prefix (participant 1, 2, etc.). All interviews were transcribed *verbatim*.

Framework Analysis

Data was analysed thematically using FA conceptualised by Ritchie and Spencer [18]. For a detailed, stage-by-stage description of FA please refer to Gale et al. [19]. An abbreviated description of the analyses will follow.

The first stage was data familiarisation. During this stage the audio-files were replayed multiple times and the transcripts and AfN's competency document were reviewed to become acquainted with the data. The competency document and interview transcripts were combined as raw data and handled in Word. During stage two, initial codes were identified on a line-by-line and paragraph-by-paragraph basis for the dataset (participants and accreditation document). Semantic and latent themes were identified inductively and deductively as described by Braun and Clarke [20]. Inductive themes were identified using open coding and participant's words were used to generate *in-vivo* codes to remain true to the data, where appropriate. Deductive themes (psychological constructs and behaviour change techniques) were preselected from literature detailing the multidimensionality of weight management [12, 21]. Themes were identified semantically where information accurately reflected an area of knowledge. Latent themes were identified to explain the participant's experiences in the context of known information and were contextualised using literature definitions (provided in the results). Data was then imported into Nvivo to perform indexing (stage three). Text was transposed from the word document into themes and sub-themes (a preliminary framework) which were created as nodes within Nvivo. Using Nvivo's Framework Matrices tool, matrices were then created where each row represented a case (participants or accreditation document) and each column represented a theme or sub-theme, to chart the information (stage four), and tabulate each theme's data and source (participants vs. accreditation document). Data for each participant, criterion and theme was then summarised in the matrices by referring back to the indexed data. The matrices where then exported into Microsoft Excel 2010 (Microsoft Corporation, Redmond, WA) and printed off for interpretation (stage five). Rows (cases: participants vs. accreditation document) and columns (themes and sub-themes) were then compared qualitatively,

facilitated by the matrix structure, to identify patterns, similarities and differences between and within data for each theme and subtheme [19].

A separate numerical matrix (table 1) was created to determine where the majority of data resided for each case and theme. This was created using Microsoft Word 2010 and was similar to central labels chart that was used to determine associations in the study by Spencer and Whelan [21]. While the framework matrices of Nvivo would allow the researcher to determine the quality of associations between the themes [15], the numerical matrix provided a visual reference as to data clustering and served as supplementary information.

Verification

To reduce bias, the codes, themes, theoretical framework and analyses were verified by two colleagues at two time-points in the data management and analysis process (stages three and five). Both colleagues were noted authors in related fields with extensive research experience. To verify the analyses, meetings were organised and data and outputs were provided to the attendees prior to the meetings who were blind to the findings at each stage. During the meetings feedback was provided and the data analysis and interpretation was verified.

RESULTS

Core competencies 1 (Science), 3 (Social/Behaviour) and 4 (Health and Wellbeing) were frequently indexed into the themes during the analyses. An abbreviated summary of these AfN competencies is provided in table 2. Preliminary analyses revealed that AfN accreditation criteria did not specify any competencies that reflected weight management however one competency (CC1j) necessitated an understanding of conditions that require dietary manipulation or can affect physical activity, such as obesity and chronic disease.

Theme 1: Nutrition Knowledge and Education

Relevant competencies: CC1a – CC1q, CC2a -CC2e and CC3h

The participants (1-8) made 26 references to nutrition knowledge and education and suggested that increasing knowledge improved their eating habits. Knowledge was gained from studying, slimming groups and contact with health professionals; participants explained that understanding how food affects the body, the energy contents of food, the provenance of food and recipes and food choices meant that they were better-able to make informed decisions.

"I started to learn about what we needed as fuel and why we needed it" (6)

The competency document provided 23 criteria from core competencies 1-3 that reflected the participant's explanations. Core competency 1 (science) contained 17 competencies (CC1a-CC1q) in areas such as nutritional science, human physiology, metabolism and dietary analysis, and related mostly to this theme. Competency 3h (theories of nutrition health education and nutrition health promotion) recognised the need to understand educational theories, equipping Nutritionists with educational knowledge to educate client-groups with knowledge.

Theme 2: Exercise and Physical Activity

Relevant competencies:

CC1a, CC1j, CC1k: CC3f: CC4a:

The participants (1-4, 6-8) explained that exercise complemented their eating behaviours.

"I can exercise without dieting but I can't do dieting without exercising." (3)

Participants explained that exercise provided structure and discipline, that exercising punctuated reminders to eat well, that deviating from dieting would create the perception that exercise was wasted and that exercise provided goals and reinforced positive behaviours.

"If I go out for a run, which I enjoy doing, and I eat badly, I've ruined that hour that I've spent going out for a run" (3)

Exercise was also articulated to provide an energy expenditure safety net and as a mechanism for promoting flexible restraint. One participant in particular explained that exercise increased his appetite and that he had to manage his eating based on his exercise volume.

"You know, the more exercise I do the hungrier I become" (6)

The course accreditation recognises the requirement to understand, measure and estimate energy balance and physical activity (CC1a, CC4a), the nature of conditions that affect physical activity (CC1j) and how dietary needs change with physical activity levels (CC1k) however these criteria did not specify the need to understand the behavioural effects of exercise in weight management in the terms of hunger and satiety control. Competency CC3f: theories and applications of improving health, behaviour and change, might have some relevance to the behavioural dimensions of exercise however an understanding of this is not made explicit within the criteria.

Theme 3: Planning:

3.1: Diet Design

Relevant competencies:

CC1c - CC1g, CC1i - CC1k, CC3c - CC3e, CC3g, CC3i, CC4b, CC4h

The participants (1-8) manipulated their eating habits to accommodate their weight-management goals (20 references). Participants described that through trial and error and gaining new knowledge, they made adjustments such as calorie counting, carbohydrate manipulation, eliminating foodstuffs and reducing portion sizes to achieve their weight loss goals.

"Just trying to eat relatively healthy but keep under sort of 1,800 calories" (1)

Fourteen references from core competencies 1 (science), 3 (social/behaviour) and 4 (health/wellbeing) were interpreted to reflect relevant knowledge and skills required of Nutritionists in this area. These criteria were specific and focussed towards knowledge of nutritional requirements (CC1k, CC3c and CC4d) and reflected the participant's experiences well. This knowledge was specific and based on variables such as age, gender and activity (CC1k) and included knowledge of dietary, activity and nutritional status assessment methods (CC1e, CC1g and CC4e). The ability to design diets that meet clients' needs was explicitly articulated within the criteria (CC3i).

3.2: Self-Management

Relevant competencies:

CC3c: CC3e:CC3f:

The participants (2-8) suggested that organising and structuring their lives was important to ensure adherence (9 references) and that when that structure was challenged, adherence became difficult. A lack of structure, organisation and time management led to previous failures for some.

"The difference between now and perhaps in the past is that I was less organised and didn't do that". (2)

Participants devised weekly and monthly shopping lists, had set-meals/menus, cooked and prepared food ahead of time, stocked larders with foods and planned meals and exercise ahead of time. The participants explained that their behaviours needed to be purposefully flexible, to allow for situations that might require digression. This allowed for greater long-term consistency.

"My structure is flexible enough to say that's all right, that's fine. I'm not going to deprive myself of anything just because it's not perfect". (3)

The competency document made not references to self-management knowledge and skills however CC3c, CC3e and CC3f of core competency three (social/behaviour) might reflect the need to understand lifestyle circumstances and mechanisms to accommodate lifestyle circumstances, however this was not articulated within any criteria.

Theme 4: Psychological Constructs and Behaviour Change Techniques:

4.1: Dietary Restraint

Relevant competencies:

CC3c: CC3f:

This theme was created using Johnson and Wardle, [22], Polivy, Heatherton and Herman, [23], Ruderman, [24] and Teixeira et al. [25] who describe dietary restraint as a dichotomy of rigid and flexible restraint. The participants made 53 references to flexible and rigid restraint and warned that rigidity (for some) lead to obsessiveness, became unsustainable and could lead to disinhibited eating (1-7). The participants explained that flexible restraint allowed them to remain in control and also allowed them opportunities for digressing from their diets when needed.

"I suppose this is where the not going so far that I become obsessive about it comes in, but going far enough so that if I do have a bit of a blowout of a weekend that actually I can rationalise that " (3)

The accreditation document contained 2 references that might reflect this theme and CC3f of core competency three (social/behaviour) might relate mostly dietary restraint within the criteria. While this competency recognises the importance of knowledge of health behaviour and change, this competency did not stipulate the requirement to understand dietary restraint and how it impacts weight-related behaviours.

4.2: Locus of Control

Relevant competencies:

CC3c: CC3f:

This theme was created using Abusabha and Achterberg [27], Adolfsson and colleagues [28] and Balch and Ross [29] who describe locus of control as the extent to which an individual perceives they

can control the factors in their lives which affect them. The participants (1-8) provided 56 references to locus of control and suggested that an internal locus of control was important to motivation and adherence and was a precursor to success.

"Being in control is something I'm enjoying" (2)

The participants explained that an external locus of control prompted previous failures and that the sensation of control allowed them to make choices and decisions about their eating and exercise behaviours that reflected their wants and needs. Control could be challenged by environmental and circumstantial factors if sufficient coping mechanisms were not present however.

"And normally when I've done diets before; I haven't necessarily felt that in control" (7)

The course accreditation document provided two criteria that might reflect locus of control within the social/behaviour theme (CC3c and 33Cf) however knowledge of locus of control was not indicated within any criteria in the document.

4.3: Self-Efficacy

Relevant competencies:

CC3c: CC3f:

This theme was created using information from Abusabha and Achterberg [26], Bandura [29] and Zulkolsky [30] to define self-efficacy within weight management as an individual's belief in their ability to achieve and maintain weight loss. The participants explained that self-efficacy was connected to their eating (1, 2, 6-8), weight loss (1, 4) and exercise goals (3, 5 and 8) and behaviours. Self-efficacy was therefore revealed to be complex. High self-efficacy was related to successful completion or adherence to behaviours (low self-efficacy was not) and 64 references were made to self-efficacy within the interviews.

"And feeling like you're achieving something as well and that you can do it and it makes me feel more positive" (1)

The perception of efficacy promoted motivation and consistency and that efficacy within one area, such as exercise, prompted efficacy to achieve eating and weight-related goals elsewhere. However, some participants revealed that a lack of self-efficacy led to previous failures and might prevent current successes.

"I pretty much if I put my mind to something I can do it, and the only thing that I feel that I don't have that much success with is probably dieting and things that are related to that" (1).

The accreditation document contains two criteria that might be relevant self –efficacy within core competency three (CC3c and CC3f) however knowledge of self-efficacy or self-efficacy within weight management was not clearly articulated within any criteria.

4.4: Self-Monitoring

Relevant competencies:

CC3f: CC3h:

The participants provided 38 references to self-monitoring activities. Participants explained that they used food diaries and calorie counters to monitor their diets (1-8). This was facilitated with smart phone apps and mobile technology for some.

"I have my Fitbit bug tracker, whatever, what it is to track my steps on a daily basis and when I get on my bicycle I have my Scosche armband…So it's all sort of tracked and the food diary is done as part of My Fitness Pal." (6)

Participants explained that self-monitoring was used for self-regulation and educational purposes, that they weighed themselves; took measurements; assessed clothing fit, used subjective feelings and monitored exercise performance as indications of progress. Participants 1 and 4 explained that regular weighing could be discouraging if weight loss plateaued or was not as quick as desired.

"My weight actually hasn't changed anything meaningful since last December, which is discouraging" (4)

Competencies CC3f, CC3g and CC3h of core competency three (social/behaviour) might be relevant to this theme however these criteria provided no explicit information about how to develop self-monitoring behaviours in others. Six competencies from science (core competency one) and health/wellbeing (core competency four) specified that courses must include knowledge of the assessment and evaluation of diet, body-composition and nutritional status (CC1e, CC1g, CC1n, CC1o, CC3g, CC4a and CC4e) which might also be relevant to this theme however these criteria did not appear to be directed towards developing self-monitoring activities in others.

4.5: Goal Setting

Relevant competencies:

CC3f: CC3h:

This theme was created using information from Sniehotta [31] to define goal setting as internalised representations of desired outcomes. The participants explained that creating and achieving goals improved motivation and self-efficacy and described goals that drove their behaviour (1-4, 6-8).

"I'm keen to make sure I have some definite goals for continuing my progress" (3)

The participants described weight goals, exercise-related goals, knowledge goals, health-related goals and life-events as motivators for their behaviours.

"Whereas if exercise plays a part then you can set yourself other goals as well" (8)

The competency criteria provided one criterion that might relate to goal setting on the basis of its recurrence in behaviour-change literature (CC3f), and one that may have indirect relevance (CC3h) to assisting with the development and counselling of weight-related goals from core competency 3 (social/behaviour). However, no explicit guidance about goal setting theories, methods or techniques and how to implement them with weight management client-groups was provided.

4.6: Coping Strategies

Relevant competencies:

CC3c: CC3f:

This theme was created using information provided by Elfhag and Rössner [32] and Stubbs and colleagues [33] that describe coping as cognitive and behavioural factors used to manage internal and external demands. The participants described situations that threatened their compliance and described coping strategies that allowed them to remain adherent given circumstances (36 references). Some participants revealed that stressful life events lead to binge-eating in the absence of sufficient coping mechanisms and comfort eating was problem from some. Social situations were revealed unanimously to threaten consistency (1-8) and the following examples were described as coping mechanisms for such occasions: driving instead of drinking, limiting food choices, flexible restraint and increasing exercise.

"Because I knew I was going away and food would be awful, Friday morning I made myself get up and go and have a run" (7)

The course accreditation criteria provided two criteria that might relate to coping from core competency three (CC3c and CC3f) which stipulate the requirement for knowledge of environments and applications of methods of improving behaviour however these criteria provided no information about coping strategies or factors that might require them within weight management contexts.

Theme 5: Determinants of Eating:

5.1: Environmental Determinants

Relevant competencies:

CC3c - CC3e:

This theme was created using Delormier and team [34], Gustaffson and Draper [35] and Pettoello-Mantovani [36] who describes environmental determinants as physical and perceived environmental factors that influence dietary choice. The participants explained how their environments impacted their food choices and behaviours and provided 38 references that described how their environments challenged or benefitted their weight-related goals. Common environmental challenges included the home (1-7), work (1, 5 and 7) and travel (5 and 6). Environments impacted the participants by affecting the availability of food choices, creating time constraints. Participant 6 described how his work required him to engage with business lunches and travel. Food choices in these situations were often high in calories and he felt pressured to eat in a certain way when in the presence of colleagues.

"I'm out with work colleagues and they want to go for two pints and an Indian or they want a fish and chip supper or they want to, you know. Or we're out at a restaurant and they all want three courses, what do you do" (6)

The home presented a number of challenges for participants too and the presence of non-diet foods and appetite stimulating cues in the house created temptations and issues that were described by some.

"There were lots of indulgent type treaty foods knocking around the house, whilst I'm not offering up excuses, but that's sort of tough" (4)

Participants 1 and 2 revealed that their work and home environments were beneficial however and for both participants, the structure of these environments facilitated or reinforced their weight-related behaviours positively.

"The things that led to my success right now have been environment changes" (2)

The course accreditation document provided 3 criteria from core competency three (CC3c, CC3d and CC3e) that reflect an understanding of environmental determinants of food choice and eating which might reflect the participant's experiences within this theme.

5.2: Social Determinants

Relevant competencies:

CC3c - CC3e:

This theme was created using the descriptions of Delormier and colleagues [34], Gustaffson and Draper [35] and Pettoello-Mantovani [36] of social and sociocultural factors that influence dietary choice. The social determinants theme described incidences of where social influences, social environments and situations impacted food choices and behaviours. Participants described in detail parental and social influences (1-8), which could be either positive or negative. Social eating, drinking, family life and family members impacted eating and weight-related choices beneficially or destructively.

"Whenever there's any kind of social thing going on that I find it really difficult to stick to an eating plan" (1)

The course accreditation document provided 3 criteria (CC3c, CC3d and CC3e) from core competency three that related to the social determinants theme. These criteria specified an understanding of religious, cultural and social eating determinants that shape food choice and behaviour and these criteria might therefore reflect the participant's experiences of social determinants within this theme.

Theme 6: Social Support

Relevant competencies:

CC3c - CC3f:

This theme was created using information from Bakz and team [37] who describe social support as a range of factors including the physical and perceived availability of supportive significant others. The participants (1-7) revealed that social support was an important contributor to their successes, provided 39 references to social support and suggested that weight loss would be impossible without it.

"You can't do a diet I don't believe of any type unless you've got the support of those who live around you" (6)

The participants described that having supportive partners, friends, families and work colleagues benefited them by providing support and guidance. One participant in particular revealed that becoming part of slimming club provided her with moral support which had previously been

lacking. Participants explained however that weight loss could foster social isolation and described how family members and spouses could be destructive and act as saboteurs through actions such as offering and/or eating forbidden foods in their company. A lack of support was revealed to create social problems, antagonistically.

"If you don't have that structure or that support I suppose within the family environment, whatever environment that you're in, then it's a lot, it is just something that just consumes you" (7)

Competencies CC3c, CC3e and CC3f were indexed into this theme from core competency three. While it is possible that CC3f might reflect knowledge of social support, no explicit information about social support in the context of weight management was specified within any criteria.

DISCUSSION

One initial finding from this study was that the competency criteria contained no references to weight management. One of the competency criteria (CC1j) did reflect the requirement for courses to include information about conditions that may require dietary manipulation or affect physical activity such as obesity and chronic disease however this was the only criterion that made any reference to a weight-related issue. This was surprising considering that weight management and overweight are important and well-researched diet-related issues [(33)] and that dietary counselling and nutrition education are implicit components of weight management interventions and programmes [(38)]. Indeed, Public Health Nutritionists and Sport and Exercise Nutritionists registered with the AfN might work with people with weight-management needs [(2, 40-41)] and require specialist weight management knowledge and skills. This initial finding is of particular importance in light of substantive population increases in obesity: it is forecasted that by 2030 over half of the UK population will have become obese [(39)] which carries important health and economic implications for future society [(39)]. Future revisions of the competency framework might need to reflect a burgeoning obesity problem. The analyses revealed that the nutrition knowledge and education and diet design themes demonstrated parity between the participants and the competency document however; clear criteria were provided for these themes that addressed the participant's experiences. Unsurprisingly, it might be expected that courses develop learners with scientific knowledge and practitioner skills to design bespoke diets.

Of all themes identified psychological constructs and behaviour change techniques were referenced most by the participants but referenced fewest by the criteria. Dietary restraint, locus of control and self-efficacy are all factors that have been identified in the literature [(32, 33, 42-43)] and were discussed repeatedly by participants. Self-monitoring, goal setting and coping have also been identified elsewhere [(33, 44)] and were described by participants too. The accreditation document made few

422 references to information that could be directly interpreted to reflect these concepts. Core
423 competency three (social/behaviour) was most related. Within the sub-components of this
424 competency the only guidance to reflect these issues were criteria CC3F: theories and applications
425 of methods of improving health, behaviour and change and CC3G: design and implementation of
426 intervention projects and programmes. No explicit references to any of the theories, constructs or
427 tools discussed by the participants were provided in any criteria. While it is possible that the
428 competency framework is purposefully brief, the weighting of the document appears to be shifted
429 towards the sciences of food and nutrition rather than the social-science concepts of nutrition and
430 health-related behaviour. Nutrition encompasses many conditions that require sound knowledge of
431 science [43] and weight management is only one small aspect of Nutritional knowledge. The lack of
432 detail about psychological and behavioural concepts contrasts markedly from core competency one
433 (science) and core competency three (health and wellbeing) which specified multiple and specific
434 knowledge and skills to be embedded into curricula. Further evaluation via a larger explorative
435 study is required to verify these findings. Such research might facilitate the revision of the current
436 AfN criteria to provide a more comprehensive account of the psychological and behavioural
437 dimensions of Nutrition and weight management.

438 While this ambiguity might also indicate that courses introduce a broad range of theories and tools
439 within social and behavioural contexts, issues with the evidence might necessitate that more explicit
440 guidance is provided to education providers. Behaviour-change interventions are complex and
441 consist of interacting interventions and variables and it is not always clear which interventions are
442 effective [45]. Reporting practises within studies are sometimes inconsistent and interventions are
443 sometimes only partially reported [45]. Study findings are sometimes unpredictable and some of the
444 literature is ambiguous and lacking replicability [45]. Importantly, it also seems that the linkage
445 between behaviour change techniques to their theoretical underpinning and mode of action is also
446 unclear [31]. It has been suggested by some [31, 45] that many behaviour theories do not specify which
447 techniques lead to behaviour changes and that there is uncertainty about how to match behaviour-
448 change techniques onto their underpinning theory [45]. Considering the controversy and ambiguity
449 surrounding behaviour-change research and the important role that it plays in weight management
450 [46], there is an obvious need to identify the most optimal and efficacious behaviour-change
451 interventions and their appropriate theoretical underpinnings. The lack of specificity within the
452 core competency framework might indicate that these tools and theories are not identified and
453 appraised appropriately within education programmes. Education providers might therefore require
454 clearer guidance from the AfN about which theoretical behaviour models and behaviour-change
455 techniques to embed within curricula.

Schubert and colleagues [8] suggest that social knowledge within nutrition has been biased towards structural concepts that shape food choice and lacks agential understanding. Within this study the clearest guidance relating to social knowledge for accredited courses was demonstrated within competencies CC3c, CC3d and CC3e, which were mapped against the environmental and social determinants themes. These criteria appeared to reflect structural factors that shape food and eating behaviour [34]. While the competency criteria appears to embrace some social knowledge this research indicates that knowledge and understanding of behaviour and the behavioural dimensions of exercise and self-management appears to be lacking, perhaps reflecting Schubert and team's suggestions [8]. A holistic understanding of diet-related issues is perhaps essential to the effective treatment and prevention of many modern dietary challenges [8]. Overweight and obesity are important societal issues that are impacted by food choice and behaviour [43, 46]; food and eating are intertwined with behavioural and social factors that affect the antecedents and outcomes of consumption [8, 34, 42-43].

It should be recognised that the responsibility to embed and evidence the core competencies rests with the education providers and that the goal of this research was to provide a constructive evaluation of the existing AfN criteria. If Nutritionists are to fully understand weight management, based on the AfN's core competency framework only, then it is possible that education providers might be providing learners with insufficient information. It should also be recognised that the possession of an accredited Undergraduate Nutrition degree entitles registration as an Associate Nutritionist only [4] and that full registration requires the evidencing of three years' experience when applying to the UKVRN [4]. It is therefore possible that registered Nutritionists might obtain deeper knowledge of weight management after graduation, during the years prior to achieving full registration.

Limitations of this study are that a small sample of white, middle-class UK adults was obtained, that the experiences described might not reflect the breadth of weight management needs and experiences of all populations, and that the sampling methods are insufficient to ensure generalizability. Future research might look to employ larger, more diverse samples from a range of social and ethnic backgrounds using multiple and iterative sampling methods to accommodate these limitations. An additional limitation is that the AfN's core competency document was the only estimate of undergraduate Nutritional knowledge used within this research and that this might not fully reflect what institutions are delivering. Indeed, this explorative study provides in depth information and is sought to generate hypotheses, future studies might look to evaluate accredited and non-accredited course curricula directly to determine if and how weight management is being addressed within Nutrition education directly. To our knowledge this is the first study that provides

490 a detailed comparison of lived experiences of weight management (loss and maintenance) with an
491 educational framework. This research should serve as a catalyst for further evaluation and
492 modification, reflecting the demand for new strands in nutrition education [7, 8].

493 **Table 1: Numerical Matrix**

Key Theme	Sub-Themes	Participants References	AfN Document References	Total References
1. Knowledge and Education	None	26 (1-8)	23	49
2. Exercise and Physical Activity	None	35 (1-4, 6-8)	5	40
3. Planning	3.1. Diet Design 3.2. Self-Management	20 (1-8) 9 (2-8)	14 3	34 12
4. Psychological Constructs and Behaviour Change Techniques	4.1. Dietary Restraint 4.2. Locus of Control 4.3. Self-Efficacy 4.4. Self-Monitoring 4.5. Goal Setting 4.6. Coping	53 (1-8) 56 (1-8) 64 (1-8) 38 (1-8) 23 (1-4, 6-8) 36 (1-8)	2 2 2 2 2 2	55 58 66 40 25 38
5. Determinants of Eating	5.1. Environmental determinants 5.2. Social determinants	38 (1-7) 60 (1-8)	3 3	41 63
6. Social Support	None	39 (1-7)	3	42

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496 **Table 2: Abbreviated Core Competencies**

Abbreviated Competencies		
CC1: Science	CC3: Social Behaviour	CC4: Health and Wellbeing
a. The human body and its functions. b. Mechanisms for the integration of metabolism. c. Nutrients. d. Metabolic demand for nutrients. e. Nutrient usage by the body; deficiency; assessment. f. Non-nutrients. g. Nutrient analysis. h. Digestion, absorption, transportation of nutrients and non-nutrients. i. Nutrition in health and disease. j. Nature of conditions that require dietary manipulation such as obesity and chronic diseases. k. How nutritional needs change. l. Plan, conduct, analyse and report on investigations. m. Carry out sample selection in accordance with basic principles of good clinical practice. n. Obtain and record, collate, analyse, interpret and report nutrition-related data. o. Prepare and process, interpret and present data. p. Health research methods, dietary nutrition methodologies; nutritional epidemiology. q. Practical skills in communication and learning.	a. Food and Nutrition health policy. b. Nutrition in public health agenda. c. Factors that affect nutritional needs and practices. d. Religious and cultural beliefs that impact diet and health. e. Financial/social and environmental circumstances that impact diet and nutritional intake. f. Theories; methods; applications of improving health, behaviour and change. g. Intervention projects and programme design; monitoring and evaluation. h. Nutrition health education and promotion. i. Diet design for a stated situation for an individual, human or animal, or group of humans or animals.	a. Measurement and estimation of energy balance; energy expenditure physical activity and fitness; body mass; body composition; control of body mass and energy balance. b. Theory and methods of investigating diet, nutrient and activity patterns. c. Scientific basis of the safety and health properties of nutrients and non-nutrients based on metabolic effects of nutrients, anti-nutrients, and other agents; nutrient-nutrient interactions, nutrient-gene interactions, 'nutri-ceuticals', functional foods and other dietary constituents d. Measurement and estimation of nutritional requirements, dietary reference values for the general population e. Principles underpinning, strengths and limitations of nutritional status assessments. f. Efficacy, health attributes; claims, safety, and legality of foods, drinks and supplements. g. Ability to critique dietary, nutrition and health research methods. h. Integrate knowledge and propose solutions to improve human health, welfare and/or productivity of animals, food production and sustainability.

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