Accessing hospital packaged foods and beverages : the importance of a seated posture when eating

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Published version

BELL, Alison, TAPSELL, Linda, WALTON, Karen and YOXALL, Alaster (2017). Accessing hospital packaged foods and beverages : the importance of a seated posture when eating. Journal of Human Nutrition and Dietetics, 30 (3), 394-402.

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"The authors declare that they have no conflict of interests"

This research was funded by a University of Wollongong Early Career Researcher Grant.

Abstract

Background

Hospitalised and community dwelling older people (65 years and over), have difficulties opening food and beverage items such as cheese portions and tetra packs served in public hospitals. Previously, the role of hand strength on successful pack opening has been explored in a seated position. However, as many people in hospital eat in bed, this laboratory study examined the differences between participants opening a selection of products both in a hospital bed and a chair.

Methods

This study used a qualitative method (satisfaction) and quantitative methods (grip and pinch strength, dexterity, time and attempts) in two conditions (bed; chair) with a sample of well older community dwelling adults (n=34). Packs tested included foil sealed thickened pudding, foil sealed thickened water, tetra pack, dessert, custard, jam, cereal, honey sachet and cheese portions.

Results

Honey sachets, cheese portions, foil sealed thickened pudding and tetra packs were the most difficult packs to open, with 15% of cheese portions unable to be opened in either the bed or chair posture. While grip strength was consistent for each posture, pinch grips and dexterity were adversely affected by the bed posture. Lying in a hospital bed required greater pinch strength and dexterity to open packs.

Conclusions

Eating in a seated position while in hospital has been shown to improve intake. This study demonstrates that eating in a seated posture is also advantageous for opening food and beverage packs used in NSW hospital food service and supports the notion that patients should sit to eat in hospital.

Keywords: hospital food; packaging; older adults; access.

Introduction

Food and beverages in public hospitals are routinely served in a packaged format to deliver standardised portion sizes and cost effective nutrition [1]. The population is rapidly ageing [2] and meeting their nutritional needs is challenging in hospitals where patients are 'unwilling customers' [3], often malnourished [4]; and experience physical, organisational and environmental barriers to eating [5]. A great deal of research has been undertaken to suggest and test interventions to improve the situation, such as changes to food service [6]; food fortification [7]; and volunteer feeding programmes [8].

Positioning patients to eat by sitting them in a chair is one of the strategies shown to increase intakes by older people in the hospital environment [9]. However, despite the importance of eating in a chair, many patients continue to eat in bed due to absence of dining areas and the low priority of nutrition in nursing and medical care [10].

Previous studies have demonstrated that hospital food and beverage packaging is difficult to open in a seated posture and that the importance of grip and pinch strength in efficient pack opening is limited, postulating that dexterity was likely to be the critical aspect of efficient pack opening [11].

Standardised testing for grip and pinch strength is conducted in seated postures [12]. The few studies that have examined grip strength in other postures have had conflicting results and no other research was identified that examined pinch strength or dexterity in any posture other than sitting [13; 14]. As hospital food is mostly served in sealed packaging and many patients eat in bed, it is important to examine the use of food and beverage packaging by the older person and the way in which it is accessed in the hospital environment. The aim of this laboratory study was to compare the openability of a selection of hospital food and beverage items in both lying in a hospital bed and sitting, and to examine the role of grip strength, pinch strength and dexterity in successful and efficient pack opening by older people.

Methods

This research was conducted in a simulated hospital laboratory setting. Quantitative data collection included demographic data; time and attempts to open packs; grip and pinch strength; as well as dexterity measures. Qualitative measures included ratings and questions on ease of opening (satisfaction). All measures were conducted in both lying and seated postures with each participant and the order of posture was randomised throughout the sample. Using a mixed methodology approach such as this has been found to be advantageous when addressing health and human service research [15]. Ethics approval was obtained through the University of Wollongong.

Participants

This study involved a non-probability convenience sample of well older adults living in the Illawarra region of NSW, Australia. Criteria to participate included being 65 years or older, well and living independently in the community. Written consent was obtained from all participants. Participants who normally wore reading glasses were asked to wear them for the study. A biostatistician was consulted regarding suitable sample size and 30 participants were deemed appropriate for statistical power as we expected dexterity to have a large effect for opening packs ($p<0.05$ and 80%).

Setting

The study was conducted at the University of Wollongong in Nursing Simulation Laboratories. The facilities allowed for 2 simulation rooms, one set up with a table and chair and the other with a hospital bed and table. In-situ recording devices are installed in each room with the control centre located between the two rooms, (see Figures 1and 2).

Insert Figure 1 here

Insert Figure 2 here

Posture

Bed Posture

Bed angle and bed table height were standardised for the study. The distance between the mattress and top of bedside table was 27cm to enable leg clearance and reasonable eating height. The bed angle was set at 60% - a 'modified' Fowler's bed position [16] with two standard hospital pillows. In this way, participants were given the optimum posture for eating in bed.

Chair Posture

A standard waiting room style chair was used for the study (see figure 2). The chair had no arms, allowing participants to sit close to the table for dexterity testing and opening of products, as well as complete the standard protocol for grip and pinch strength testing with the chair at right angles to the table and away from it to ensure good elbow clearance.

Hand function testing

Grip and pinch strength

Grip and pinch strength testing was conducted on each participant using a standardised protocol [17] with the Jamar Grip Strength Dynamometer (Lafayette Instruments, Indiana, USA) and the B&L Pinch Gauge (B&L Engineering, California, USA). Both instruments were calibrated prior to the study. For standardisation, the dynamometer's adjustable handle was set on the second handle position for all participants with single effort and hand dominance recorded. The B&L pinch gauge measured tip, 3 point, and lateral pinch strength for a single effort. These two hand assessment tools are commonly used and considered to produce the most reliable and valid measurements of grip and pinch strength [18].

Dexterity

The dexterity of participant's hands was analysed using the Purdue Pegboard Test [19]. This test was initially developed to assess suitability to factory assembly tasks but is now used for a variety of purposes including assessment of brain impairment and learning disabilities. The test consists of a battery of 4 different tasks administered in a standardised protocol with the participant seated at a table. The sum of tests 1, 2 and 3 determine a macro-dexterity score. Macro-dexterity was used in this study to correlate with opening time and attempts, as this measure has been identified as the critical dexterity component related to successful pack opening [20].

Food and beverage packs

Nine packs were sourced from a local hospital for testing. These included: foil sealed items (thickened pudding, thickened water, custard); tetra packs; condiment packs (jams, marmalade); individual honey 'squeeze' sachets; single serve cereal boxes; sealed desserts and cheese portions. These items were selected as previous studies had found them to be difficult to open, participants had reported the packaging as 'fiddly' with poor correlations between faster opening times and grip strength indicating that dexterity may have been the key factor in openability [21]. Due to the range and numbers of products supplied by the hospital, each participant opened seven of the nine in the two postures. Products were consistent in the 2 postures for each participant in order to ensure each participant was their own control. The participants had no choice in pack selection.

An example of a participant's tray can be seen in Figure 3. The range of products tested is shown in Figure 4.

Insert Figure 3 here

Insert Figure 4 here

Video capture (timing and attempts)

Researchers independently reviewed video footage of 3 participants to jointly determine consistent criteria for the beginning and end of opening as well as number of attempts. Opening the pack was measured from the time of gripping the tab or pack; end of timing was the release of the tab/pack from grasp. The number of attempts to open the pack was determined by changing grips, orientations and manipulations of the pack.

Interview

Participants were interviewed with a questionnaire previously used in packaging research by the authors [21]. Ratings of opening ability were organised by answering 'yes' or 'no' followed by a scale of 'no difficulty/easy', 'some difficulty', 'moderately difficult', 'very difficult', and 'impossible', as well as general comments on the pack.

Data analysis

Data for all phases were analysed using the Statistical Package for the Social Sciences V 21 [22]. Questionnaires and sample meal tray recordings were analysed with descriptive statistics. Correlations using Spearman's rho were performed to determine whether or not a relationship existed between participant's hand function elements (grip, pinch strengths and dexterity) and time taken to open the items in the lying down and seated postures. Significant differences between the 2 postures for hand function tests and time taken to open the products were analysed using Paired Samples T-tests and Wilcoxon Signed Rank Tests. The effect size of the differences between the two postures for hand function on the Paired Samples T-tests was determined using the eta squared statistic. Cohen [23] states that an eta squared value of .01 is a small effect; .06 a moderate effect; and .14 a large effect. Effect size for the Wilcoxon Signed Rank Test items was determined by r [24], whereby .1 represents a small association; .3 a medium association; and .5 a large association.

Results

Participants

There were thirty-four participants aged between 65 and 86 years with a mean age of 73 years (SD 5.4). 23 females and 11 male.

Hand Function Tests: Bed vs Chair

Grip and Pinch Strength

Grip and pinch strength scores for the total study population were normally distributed in both postures with the exception of dominant three point pinch strength in the bed posture, and non-dominant grip and non-dominant lateral pinch in the chair posture. Mean grip strength for the bed and chair posture are shown in Table 1. No significant differences were found for grip strength between the two postures.

Insert Table 1 here

Significant differences were found for all pinch grip measures, with stronger pinch grips in the chair posture. Table 2 contains the dominant and non-dominant pinch strength data and significance values (2-tailed) between the postures and outline the effect size. Less pinch strength was able to be exerted by participants in the bed posture compared to the chair, with a large negative effect for all pinch grips except the dominant 3 point pinch grip, which had a medium negative effect (z= -2.93, p= .003, r = -.36); and the non-dominant lateral pinch grip with a medium negative effect (z=-2.82, p=.005, r= -.34).

Insert Table 2 here

Dexterity

Dexterity measures were normally distributed for the bed posture. Dominant and non-dominant dexterity was not normally distributed in the chair posture. The bed posture had a large negative effect on macro dexterity (M=32.36, SD=5.59) compared to the chair posture (M=35.29, SD=5.54), z=-4.15, p<.001, r=-.71.

Food Products

The time taken to open the products by each participant in each posture was calculated. The item with the maximum opening time was the honey sachet in the bed posture (144 sec) followed by the cheese portion in the chair posture (133 sec). Figure 5 shows the median time to open each product

in each posture. The thickened water, custard and condiments are the only products with a longer median opening time in the bed posture. No significant differences in opening times between postures were observed.

Insert Figure 5 here

Attempts to open products in each posture

The number of attempts to open each product was also calculated from the video footage to further explore the interaction of the person and package (Table 3). The differences in the maximum amount of attempts in the bed and chair posture reflect the median time differences for the postures in Figure 5 for the thickened water, custard and condiments but not for other items such as the thickened pudding, honey sachet and cheese portion. The packages that took the longest time to open in each posture (cheese, honey and tetra pack) also demonstrate a large number of attempts to open. For example the cheese portion mean number of attempts to open in the bed posture is 5 attempts, with a maximum of 30 attempts to open the pack.

Insert Table 3 here

A number of participants were unable to open the honey sachet and cheese portion in either posture as follows: Honey 18% (bed), 24% (chair); Cheese 15% (bed and chair).

Questionnaire

Ratings were consistent between the two postures, with the cheese portion, thickened pudding, honey sachet and tetra packs found the more difficult packs to open, scoring 'some difficulty-moderately difficult'. Participants were also asked to comment on their experience with the packs and reasons for any difficulty.

Packaging and hand function

Grip and pinch strength

A significant correlation only was found for non-dominant grip strength and the opening of thickened foil sealed water in the bed posture [r=-.71, n=9, p=.032]. No other significant correlations were found for grip strength and time to open the packs. A significant correlation was found between a shorter opening time for the thickened water and the dominant tip pinch grip in the bed posture only [r=-.71, n=9, p=.031]. No other significant relationships between pinch grips and more efficient opening times were found.

Dexterity

Significant negative correlations were found between macro-dexterity (Right, Left, Both on the Purdue pegboard test) and time taken to open for six of the nine packs in both postures as shown in Table 4. A negative correlation indicates that macro-dexterity was associated with shorter opening times. Consistent relationships are demonstrated in both postures for dexterity and the custard and the tetra pack. Macro-dexterity has a stronger relationship with efficient pack opening in the bed posture for the thickened pudding [r=-.46, n=19, p=.047]; condiments [r=-.63, n=34, p=.001]; and cereal inner bag [r=-.54, n=33, p=.002]. Conversely, macro-dexterity is strongly correlated with faster opening of the honey sachet in the seated posture [r=-.65, n=34, p=.000].

Insert table 4 here

Discussion

The purpose of food service in hospitals is to deliver the nutrition required for recovery and to encourage patients to eat [25]. This is a challenging proposition with cost pressures from government and large numbers of patients, who are increasingly older people with complex medical issues [26]. Additionally, food service is conducted in an environment where there are conflicting priorities of medical procedures over meal times, lack of meal choice, increasing use of cook-chill options and lack of assistance to eat and open packaging [27]. Previous research has examined the association between grip and pinch strength and time taken to open hospital food and beverage items and highlighted that dexterity was likely a critical aspect of hand function for 'openability' of these items and yet to be measured [21]. This paper explores the role of dexterity to open the items found to be 'fiddly' in these previous studies [11; 21] by testing the packs with well older people (aged 65 years and above) in a controlled laboratory setting. The study also reviews the impact of a bed posture on hand function and time to open packs, attempts to open packs, and satisfaction with a selection of pack types.

Studies into postural differences in grip strength are very limited and have conflicting results [13; 14]; and no studies were found that examined pinch strength or dexterity in different postures such as

undertaken in this research. No significant difference was found for grip strength between the bed and chair postures in this study. It is likely that grip strength was unaffected as the participant was seated in a supported and almost upright posture with the trunk stable in the bed as determined by our protocol, and therefore able to exert maximum effort in comfort. However, this study demonstrated that a bed posture negatively affects both pinch grips and macro-dexterity, both elements of hand function required to successfully open packaging used in hospitals. Future research is warranted to examine the strength and dexterity of older hospital patients and comparing them to well community dwelling populations for whom packaging is designed.

The correlations between hand function elements and efficient pack opening suggest that the bed posture required recruitment of more elements of hand function to open packs when compared to the seated posture, and that macro-dexterity was more important than strength. For example, stronger non-dominant grip and dominant tip pinch grip were associated with faster opening times for the thickened water in the bed posture. This is likely due to the need for greater stabilisation of the pack with the non-dominant hand and greater tip pinch strength to pull the tab with the dominant hand compared to opening the pack in a seated posture. Macro-dexterity was associated with efficient pack opening in the bed posture for thickened pudding, condiments and the cereal inner bag. Similarly, macro-dexterity was associated with faster opening times for the honey sachet in the chair posture. However, macro-dexterity was associated with efficient pack opening in both postures for thickened pudding, custard, tetra pack, condiments, honey sachet and cereal inner bag, illustrating the importance of macro dexterity in opening packs generally.

This study has found that the seated posture facilitates better pinch grip strength and macro-dexterity ability than lying in a hospital bed. Nutrition researchers have found that being seated for meals in hospital is beneficial and improves intake as well as improving the eating experience for patients [9; 10]. Sitting to eat requires less 'effort' (in terms of hand function) to open packs, and this supports the notion that it should be the preferred posture for the patient to eat in as less effort is better when the person is feeling unwell and the effort of eating itself can be a burden [9] . While sitting is the optimal posture for eating, it is not always possible as patients may be too unwell. Additionally, positioning patients to eat in an optimal posture requires a coordinated multidisciplinary approach, which may take time for an organisation to implement.

As in the previous studies [11; 21], the tetra and cheese portions were found to take a long time to open, required repeated effort and were rated more poorly on the 'ease of opening' scale. Again, as in the previous papers, a number of participants could not open the cheese portion (15%). Interestingly, this was unaffected by posture, indicating that the cheese portion is poorly designed for 'openability'. Cheese portions are an important source of protein, a quick and easy (once opened) way for the patient to access valuable nutrition and is served as a between meal snack for this

purpose. Tetra packs are provided in hospitals to deliver supplements to frail and unwell older patients who are malnourished or at risk of malnourishment. Further research is required to investigate the impact of packaging on intake in older people as these products are routinely used in hospitals, care facilities and the community.

There are a number of limitations to this research. Firstly, for study efficiencies, the sampling approach and testing location were controlled by the researcher. The participants were recruited using a purposive sampling approach with researcher-directed inclusion and exclusion criteria [28]. As such they were not a random sample and may not represent the wider population. No formal assessment was made of cognition, vision or health, relying on participants to self-select. However, as participants were required to attend the university, making their own way to and from the venue, they may in fact represent a more 'able' group than the general population. Indeed, the participants in this study were able to use both hands to access the packs, while hospitalised older adults may experience medical conditions or interventions such as an in-situ cannula impeding their hand function. However, the artificial setting of the simulated hospital laboratory could have affected the results through central location bias [29]. Ideally, this study would be conducted in a hospital setting with larger subject numbers. However such a study would require greater resources and administrative organisation and be difficult to access patients due to medical conditions, medical interventions and nursing activities. Secondly, while the bed posture was controlled by maintaining the bed angle and table height, participants varied their posture by sitting further forward or removing a pillow for greater comfort. This may have affected the results in the bed posture. Finally, many participants were unfamiliar with the honey sachet pack type and this may have affected the time to open the pack. This could have been overcome by providing a 'practice' pack as used in the European technical specification for packaging ease of opening [30].

Conclusion

This research has two key findings. Firstly, pinch grip strength and macro-dexterity ability for the older adult are better in a seated position than a semi-recumbent hospital bed posture. Secondly, macro-dexterity ability is associated with faster opening times for a range of hospital food and beverage items routinely served in hospitals and care facilities. These findings support the advice from nutrition experts: older patients should sit to eat to maximise intake and meal-time enjoyment.

Improvement of pack design for the cheese, an important protein snack source; as well as the honey sachet and the most importantly, the tetra pack, which is routinely used to provide supplementary nutrition, is indicated. Involvement of older consumers and understanding the capacities and abilities of this population is integral to better design. Within the broader hospital foodservice literature, this

research has highlighted the need to consider not only pack design and procurement but also how the patient is positioned, assisted and encouraged to eat.

The implications for effective food service delivery in hospital is clear – food is an essential 'treatment' in hospital, delivering the nutritional elements necessary for recovery and is best delivered in an environment allowing a seated eating position, promoting social interaction, and wherever packaged food and beverages are used, presented in more easily accessible pack formats.

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396 Figure Legends

397 Figure 1: Simulation Room 1: Bed Posture

398 Figure 2: Simulation Room 2: Seated Posture

399 Figure 3: Participant and example testing tray in bed posture

400 Figure 4: Range of products in the study; each participant tested 7 of the 9

401 Figure 5: Median time taken to open product in the Bed and Chair postures

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