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Perception of difficulties encountered in eating process from European elderlies' perspective

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Abstract

To maintain wellbeing, independence and nourishment of elderly population, one promising strategy is to provide home care by delivering food using 'meals on wheels' (MoW) system. Even when the food is home-delivered, the difficulties encountered by elderlies during the overall eating process can be a limiting factor. Hence, the objective of this self-reported study was to explore the difficulty perception in the entire eating process from opening up the package, reheating, hand manipulation and oral processing of the food to bolus swallowing in 405 elderly consumers from five European countries (Finland, France, Poland, Spain and United Kingdom) with three different levels of dependency (category 1: participants living at home with help needed for food purchasing; category 2: participants living at home who need help for meal preparation or meal delivery; category 3: participants living in nursing homes/sheltered accommodation). Frequencies of responses and cross tabulation test were calculated for the difficulties perceived. Results show that the most difficult package to open was the cap irrespective of country or dependency levels (at $p<0.05$). Although, glass was the most preferred packaging material, category ($p=0.034$) and country ($p=0.001$) had significant influence. Self-feeding dependency was correlated with the eating difficulties perceived, category 1 participants did not perceive difficulties in the meal preparation and reported minimal difficulties in the hand manipulation and oral processing (<30%), whilst the difficulties perceived by categories 2 and 3 were significantly higher (~60% of participants). The insights generated might be helpful for designing efficient MoW systems with appropriate user-friendly features.

Keywords (5): Ageing, independence, meals on wheels, survey, eating difficulty perception.

Practical Applications

Ageing population is in significant increment in Europe. For elderlies, who are unable to cook due to a various forms of functional incapability, ‘meals on wheels’ (MoW) is a promising approach to extend their independence. In this work, difficulties in the eating process (opening of packaging, meal preparation and self-feeding) of European elderly population with different levels of self-eating independency have been investigated using self-reporting from 405 participants. The most difficult packaging to open was the screw-cap. Individuals who needed help for only food purchasing did not perceive difficulties in meal preparation and oral processing. Dental status was driving difficulty perception during biting and chewing. It is expected that with the insights generated in this study, MoW operators will improve the packaging in the meals; provide adaptive cutleries and design food with suitable texture ensuring optimum and easy oral processing.

Introduction

Ageing population is in significant increment in Europe. Between, 2010 and 2060, the proportion of people aged 65 or above is projected to increase from 16% to 29% of the total population of the European countries (EUROSTAT, 2011). With age, the capacity to do physical work and skilled motor performances tend to decline (Newell et al., 2006), influencing the normal execution of daily activities such as eating. The eating process involves various activities, from the meal purchase and preparation to eating and swallowing (Laguna et al., 2015a; Laguna et al., 2015b). To execute eating, numerous actions need to be performed such as opening the package, heating the meal, manipulating the food by hand or mouth, chewing, masticating and finally bolus swallowing. From the start, opening a package is a difficult task for many individuals, especially in disabled and elderly consumers (Heinö et al., 2008). Other physical impairments also tend to interfere with their abilities such as difficulty in transporting food from the plate to the mouth in Parkinson's disease sufferers, mastication inefficiency in edentulous or denture wearers (Fontijn-Tekamp et al., 2000), or swallowing disorders without choking in dysphagia patients (Scialfa, 2006).

Individuals with difficulties performing eating actions generally eat less quantity of food due to the fatigue and time consumed to perform these actions (McLaren and Dickerson, 2000) and thus might lead to malnutrition. In fact, previous studies have showed that the common barriers among elderlies to eat adequately have been related to difficulties in eating as well as the inability to prepare fruit and vegetable based meals (Dittus et al., 1995). If the elderly population is healthy enough, they usually live independently. For elderly population, independence and taking care of oneself are both important aspects of wellbeing (Berg et al., 2006). In this regard, taking care by one's own meals is an essential part of everyday life, and is highly appreciated (Sidenvall et al., 2002; Gustafsson et al., 2003). Inability to execute the

overall process of meal purchasing, preparation and eating independently might influence the overall food energy intake (Andersson et al., 2003), nourishment and wellbeing. In order to extend their independency, support or home care for the elderly such as ‘meals on wheels’, cleaning services and personal care are available. In this way, the elderly can remain living independently for longer, avoiding relocating them to subsidized housing or nursing homes and thus the associated public healthcare cost can be minimized.

Meals on wheels can be used to support those elderly who are unable to cook due to a variety of functional incapability. The concept of Meals On Wheels (MoW) arose in 1968, and an array of nutrition screening, education, and counselling services have been made available to adults of 60 years of age and above (Wellman et al., 2002). Due to its benefits, nowadays this system has been quite popular for elderly consumers globally. However, MoW needs to be specifically designed for fragile elderlies who might experience difficulties during the length scale of eating process i.e. any time in the eating process from opening the packaging to bolus swallowing. Kallio et al. (2008) concluded in their study with Finish elderly in order to enable elderly people to live independently at home as long as possible (especially lower socioeconomic groups), special attention to the meals and meals patterns is mandatory. If not, there is a potential risk to avoid eating the delivered food and thus the purpose of MoW to keep healthy elderlies at home with good nutrition status will remain unachieved. To design such MoW, it is necessary to optimize the food through exploration and understanding of the users ‘expectations and needs. To our knowledge, there is no study that has investigated the difficulties that elderly consumers perceive during the entire eating process.

Hence, this study aims to address this gap by generating insights on the package opening, preparation, reheating, feeding and oral processing difficulties that elderlies of different

levels of culinary dependency and countries of residence may experience during the overall eating process using a self-reporting study with European elderlies.

Materials and Methods

Recruitment and participants characteristics

This study was conducted within the frame of OPTIFEL project: Optimizing Food for Elderly Population (www.optifel.eu). A sample of 405 participants was interviewed from five European countries: Finland, France, Poland, Spain and United Kingdom (UK). Ethics approval was only needed and obtained for United Kingdom (MEEC 13-004 resubmission 2). Participants were recruited from local community centres, nursing homes, individuals private's houses and sheltered accommodations. To inform and engage participants in the study, different approaches were taken, such as distribution of leaflets in community centres, informative talks about the study in their social meetings and/or assistance of nurse and social workers in the nursing homes and sheltered accommodations.

Demographic characteristics of the participants divided in three categories are shown in Table 1, participants were segregated in these three categories during the recruitment. Participants were asked about their living place (at home alone, at home with family members, in sheltered accommodations, in care homes or in nursing homes). If they lived at home alone, participants were asked about any assistance they received in terms of meals-on-wheels, help for meal preparation, or help for purchasing. If there was no food delivery, no help for purchase or meal preparation: the person was not included.

If participants were on meals-on-wheels system they were asked about the number of times they received it (in terms of number of days per week). If somebody else was assisting them in the food preparation as well as food purchasing frequency was also asked. Finally,

participants were grouped into three different categories (cat.) according to their self-feeding dependency. Participants of cat.1 were living at home and needed help for food purchasing; cat.2 participants were living at home, but needed help for meal preparation or had the meal delivered (at least once per week) and cat.3 participants were living in nursing homes or in a sheltered accommodation with at least 50% of the meals taken in the communal restaurant.

All participants were between 65 and 98 years old. Inclusion criteria was the age (above 65), having a non-restrictive diet, to be able to answer a selection of three questions from the Mini Mental State Examination Test (year, month, season) and to delegate meal related activities.

[Table 1 here]

Initially, 100 participants per country were recruited to complete the survey. However, to ensure appropriate cognitive status, participants achieving a minimum score of 21 in the Mini Mental State Examination Test (MMSE) (Folstein et al., 1975) were included in the data analyses.

Quantitative consumer survey

Questionnaire

The survey interview was conducted in person and was divided into three sections. In the annex, the English version of the questionnaire is included that was translated by researchers in local languages in different EU countries. In the first section, participants were asked about their perception of difficulties encountered in handling packages (difficulties to open variety of package types: cap, tin can, can, easy to open and opercula/ring pull, see Figure 1) preference for commonly available packaging materials (e.g. metal, glass, and plastic, cardboard) and if they used special tools to open screw-caps. For better understanding,

pictures of each packaging material were shown to the participants. Difficulties were rated using a 4-point scale. For the statistical treatment, the answer was grouped into two groups: “Yes” and “Probably yes”; and in the other group “No”, and “Probably no”.

[Figure 1 here]

Secondly, participants were asked about the difficulties encountered in meal preparation such as re-heating difficulties using heating plates, microwave, oven, gas (oven top) and steamer etc. Also, there existed the possibility that participants were not re-heating any food.

The last section of the questionnaire was focused in the difficulties experienced during manipulating food by hand (cutting, peeling, penetrating with a fork, bringing the food from plate to mouth) and oral processing (bite, chewing and swallowing). Also, participants were asked about their teeth status.

Survey data analysis

The data received from the consumer survey questions were coded by assigning a number to each scale. The numerical values, mean values, standard deviations (SD), frequencies of response, percentages, cross-tabulations and Chi-square for independence between difficulties and countries/categories were calculated using SPSS (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp). Z-score test for one proportion was used to study the significance of Yes/No questions using XLSTAT-Pro 2014 (Microsoft, Mountain View, CA, USA).

Results

1) Package related difficulties

Opening difficulties. In Figure 2, the total number of participants who affirmed to encounter difficulties during opening different package closures is plotted.

As it can be observed in Figure 2, the number of participants who affirmed to have difficulties opening package, was statistically significant according to the one-proportion z-test ($p<0.05$). The most difficult closure type to open was the cap. Other closures such as can, tin can lids, easy to open and opercula were cited as difficult to open by less than the half of the interviewed population.

[Figure 2 here]

In order to study in depth, the influence of country and category, Chi-square test between the different packages were performed. As shown in Table 2, there was significant association between package closure category and country for "can" X^2 (4, n=353) = 7.00, p=0.023; 7.03, p=0.013. Country had a significant effect in "opercula" X^2 (4, n=353) = 15.81, p=0.003 and "cap" X^2 (2, n=353) = 41.01, p=0.001; whilst category had a significant influence ($p<0.05$) in the response in "tin can" X^2 (4, n=353) = 7.43, p=0.024.

Hence, it can be recognized that for "cap", "can" and "opercula" closures, there was a country factor that might be linked to a cultural component, with Spain being the only country where participants found it to be more difficult. At the same time "can" and "tin can like" was category dependent, so, people from different categories, even in the same country, had different perception on this difficulty.

[Table 2 here]

Preferred material. Considering all the respondents for this question (N=396), it can be observed in Figure 3, that the most liked packaging material was glass, followed by plastic, cardboard and metal. "Other" packaging materials, which were preferred, were named to be biodegradable material, paper, film, or food without any packaging material (1% respondents).

In Figure 3, the preference is shown per country and category, both variables were statistically significant (category X^2 (10, n=396) = 19.57, p=0.034; country X^2 (20, n=396) = 134.67, p=0.001). In France and Spain, participants preferred glass whilst in Finland the most preferred material was plastic. British and Polish participants had different preferences depending on the category. UK cat.1 participants preferred the plastic whilst cat. 3 participants preferred cardboard. Polish cat. 1 participants preferred glass, whereas, for cat. 2 and 3 participants, glass preference was shared equally between cardboard and plastic.

[Figure 3 here]

Use of special tools to open caps. Among those participants who actually opened/tried to open caps (cats. 1 and 2), there were significantly (according to z-test, $p<0.05$) less participants who did not use tools (n=138) as compared to those who used tools (n=179). As it can be seen in Figure 4, there was a strong effect of the country (X^2 (4, n=317) = 14.29, p=0.006) and of the category (X^2 (4, n=317) = 14.68, p=0.005). Majority of UK participants affirmed to use tools to open caps, contrary to participants from rest of the countries.

[Figure 4 here]

2) Preparation difficulties and context of the re-heating

As shown in Table 3, 100% of cat. 1 participants (needing help for food purchasing) confirmed to have no difficulties in the meal reheating process. This percentage decreased significantly for cat. 2 participants, X^2 (1, n=273) = 17.20, p=0.001). It might be worth noting that cat. 2 participants are those who need help for meal preparation or have their meals delivered. Among countries, there was no significant difference (according to X^2 (4, n=273) = 7.01, p=0.14) in help needed for meal preparation. The highest number of cat.2 participants who confirmed needing help for meal reheating was from Poland (22%).

[Table 3 here]

In Figure 5, the kitchen devices used by elderlies of different countries to re-heat food are shown. Participants living in nursing home did not answer this question (121). As it was mentioned earlier, participants were allowed to select as many devices as they use or to not select any device. In general, among the different devices, the least used device was the steamer (14 participants in total) and the most used was the microwave (196 participants) followed by the oven (142), gas heater (100) and heating plates (86). The devices used were significantly dependent of the country and the category ($p < 0.05$). Heating plates as a re-heat system was heavily used in UK for both categories and also in Finland. In the rest of the countries, the percentage of population who confirmed to use hot plates remained under the 20%. The microwave was used in the majority (comparing yes/no response) of all the countries except in Poland, where gas re-heating seemed to be the most dominant system, as in Spain. Finnish elderly followed by Spanish and British elderly mostly used the oven.

[Figure 5 here]

3) Self-feeding process difficulties

Hand manipulation difficulties

Difficulties found in executing self-feeding actions by hand (cutting using cutlery or hand, peeling and penetrating food with the fork) are presented in Table 4. Results show that except for cutting meat with the knife, around the 80% of participants from cat. 1 confirmed to have no difficulties in the self-feeding process. As expected, this percentage was significantly lower for cat. 2 and 3 (around 58.9-77.3%) except for the actions to penetrate food with fork (cat 2: 83.7%-cat 3:78.5%). Chi-square test showed significant differences among categories when cutting food such as pie or boiled potatoes, peeling vegetables or fruits and penetrating food with fork. The relation among hand manipulation difficulties and difficulties opening packaging was studied and no correlation was found ($p<0.05$, data not shown). Furthermore, no significant relationship was found among difficulties and countries (at $p<0.05$, data not shown).

[Table 4 here]

Oral processing difficulties

In Table 4, difficulties experienced by respondents while biting the food with the incisors, chewing during the mastication process and bolus swallowing are shown. To execute the first bite in hard solids was the most difficult action perceived by elderlies of cat. 2 (46.10% affirmed having difficulties) and cat.3 (42.98%) while a smaller number of respondents confirmed to perceive difficulties in chewing and masticating. For example, for both categories, the percentage of the participants who affirmed to not have problems was higher

than 68.05%. Similar to hand manipulation difficulties, the percentage of elderlies who confirmed to have difficulties in oral processing were higher in cat. 2 and 3 than cat. 1. The first bite was found to be significantly different among categories ($p<0.05$). However, differences for chewing and bolus swallowing were rather not statistically significant.

Elderly people were also asked about their teeth status (Table 5). As expected, participants without teeth encountered highest levels of difficulty in biting and chewing, although, they did not seem to find it more difficult to swallow (no statistical significant difference recorded, data not shown).

[Table 5 here]

Discussion

As expected, the results showed that the self-feeding dependency is linked with the eating difficulties perceived. In general, elderlies living at home without need of help for meal preparation, but for purchasing (cat. 1) perceived less difficulty in the meal preparation, self-feeding or package opening difficulties, whilst elderlies from cat. 2 (living at home with help for meal preparation or meal delivery) and cat. 3 (living in a nursing/residential home and using its restaurant) were similar in their extents and types of difficulties perceived. This highlights the real independency for the self-feeding process of the cat.1 participants, and that elderlies living at home with help for meal preparation or meal delivery had many if not most similar kinds of difficulties as those living in a nursing/residential home.

Package opening issues seem to be the most cited problems perceived by all the three categories of elderlies, especially with the screw caps. Based on this study, it can be confirmed that many elderly consumers in Europe experience difficulties opening packaging, which is in line with a previous UK study where a survey of shoppers included complaints

and food-package-related injuries (Winder et al., 2002). Furthermore, this difficulty often leads to use of improper tools to open packaging, being a frequent cause of packaging-related accidents. The majority of the interviewed participants did use tools for opening packages, but there was still a significant proportion of participants who did not, this can be due to the lack of practicability of these tools (Yoxall et al., 2010). Dittrich and Spanner-Ulmer (2010) found that the main reasons for the opening problems were the high forces required to opening the packages, the tear being too small and the poor visibility of the opening mechanism.

During this work, it was demonstrated that how country could influence in the packaging preference rather than category. Previous authors have shown that packaging design, such as colour, shape, pictures or message about a product influence purchase decisions and expectations of elderlies (Deliza and MacFie, 1996; Ares et al., 2010)

To our knowledge, no literature on elderlies' preference for packaging material across different EU countries is available. However, it is worth noting that to introduce a product in an international market, there has to be a multifaceted approach for packaging design, with appropriate understanding of colour, visual communication with right sensory cues, link between advertisements and the package, personal experience of the package or referral of a product to drive buying decisions. Furthermore, in a recent study with the same participants being interviewed (Mingioni et al., 2016), a high degree of differentiation in degree of selectivity between countries was demonstrated, with the most selective participants being from Finland, these cultural association should be taken into account in order to address the food to different European elderlies. However, it has to borne in mind that increasingly, products are faced with multicultural consumers and thus a consistent packaging type, visual communication in packaging design can reduce the time spent searching for a particular product in the shelf (Velasco et al., 2014).

Duizer et al. (2009) studied the ageing consumers' requirements for packaging in New Zealand population. They found that packages with peelable inductions seal that are found under closures on bottled drink were most difficult to open. Interestingly, our results of European elderlies and that of the New Zealand respondents highlight similar difficulties in terms of hand force/coordination. Comparing the packaging materials, the New Zealand respondents preferred the glass bottles and jars. However, in Switzerland, (Marks et al., 2012), population with hand disorders and their difficulty in opening a package was studied and authors found that glass jars were the most difficult containers followed by peeleable packaging. It is worth recognizing that the similar preferences have been found in our study with European respondents. Thus, we can hypothesize that glass might be the globally preferred packaging material among elderly due to the perception of being safer and having higher quality associated with it. One might also argue that this is associated with the fact that elderlies have been using glass since their young age as compared to modern plastic based packaging materials. Further study is needed in this aspect to understand the specific use of different package and rationale of such use in elderly population. Langley et al. (2005) proposed to look for "inclusive" packaging or packaging that can be used by an individual with limited strength ensuring usage by majority of the society. Other options for food manufacturers can be to re-design easily manipulative tools to help the package opening.

Meal preparation at home is determined by a multitude of factors, such as the kitchen equipment, the degree of self-reliance and personal preferences. With respect to difficulties in re-heating of food, our results showed that less than 10% of cat. 2 respondents perceived difficulties (except in Poland where this percentage was 22.2%). However, when asked about food manipulation by mouth and by hand, the percentage dramatically increased up to nearly 50% of the population. This might be attributed to the second set of actions such as cutlery manipulation and food oral processing, the later involves numerous, prolonged as well as

coordinated actions whilst the re-heating is usually an action executed by a machine and one just has to press a button (for example in case of a microwave). So it seems that higher involvement of the person in actions requiring higher coordination-related activities might imply more difficultly in performing the actions.

The percentage of European elderly people who confirmed to have difficulties during the self-feeding process in some cases was nearly 50% of the population interviewed, which is an issue requiring urgent solution. Regarding food manipulation by hand, nowadays there are huge variety of adaptive eating utensils available such as nosey cup to avoid bending the neck in case of dysphagia, cutleries for people with grasping problems, plate guards to avoid spillage in people with low vision, and a weighted mug for those with tremor problems (Gillen, 2000). A potential strategy of the MoW to help the elderly with the self-feeding process could be to provide some of these adapted utensils when needed.

The interviewed gender difference from this study, is a reflect of the known fact that in all developed countries and most undeveloped ones, women outlive men, sometimes by a margin of 10 years (Perls et al., 1997). Regarding food, there is a difference among individuals and also gender differnces cannot be excluded (Falk et al., 1996; Drewnowski and Shultz, 2001; Bisogni et al., 2002; Payette and Shatenstein, 2005). So, it might be argued that including more male participants in the sample, the average perceived difficulty would have decreased taking into account that seeking for help is negatively perceived in males as compared to females (Rosette et al., 2015)

Food oral processing (in especial the first bite) represented more difficulties for participants from the cat. 2 and 3 than those in case of cat. 1. Cross tabulation (data not shown) of elderlies and their teeth showed similar teeth distribution status among the three categories. However, a part of the dentition status, and therefore the biting force also influenced the muscle strength (the jaw-closing muscle) (Tortopidis et al., 1998) , which is

expected to reduce with the age (van der Bilt, 2012). Furthermore, as the participants of cat. 2 and 3 were more dependent, it could imply that they were not strong enough to execute certain actions that will be reflected also in less biting force. It is known that irrespective of the food product given, the muscle activity per chew is lower for elderly population (Kohyama et al., 2002), the majority of the elderly population interviewed did not consider chewing/swallowing as a difficulty, probably because in most of the cases, such oral processing capability loss is rather progressive.

It is worth recognizing that the effect of having difficulty to masticate is not only linked to inefficient digestion, but also it influences the choice of food eaten in first place. Previous authors reported that individuals with dentition problems avoid eating difficult-to-chew food items that are usually high in vitamins A and C, proteins and other micronutrients such as thiamine, iron, and folic acid. (Ranta et al., 1988). In this context, food preparation needs more pre-processing to be suitable for elderly population. For example, some fruits and vegetables need to have their skin removed and if necessary slightly overcooked to facilitate their mastication, which might lead to nutritional loss of the food (Walls and Steele, 2004).

Difficulties in the bolus swallowing process seemed to be least numerous in the respondents interviewed. However, for cat. 3 participants, up to the 25% of the interviewed population reported swallowing difficulties. Thus, considering some of the consequences such as aspiration, pneumonia (Cabre et al., 2010), or malnutrition (Matsuo and Palmer, 2008), special attention has to be given for elderly consumers suffering from swallowing disorders. The number of participants with swallowing difficulties was lower than previous studies, which highlights that swallowing problems are the major health problem in elderlies arriving to the 50% of the nursing home residents (Park et al., 2013). Some limitations of the present study should be addressed. This study is conducted taking into account the elderly's perception, which includes psychological as well as social biases and it may differ from the

reality they face. For the same reason, separate study has been carried out with instrumental measurement of physical and oral processing forces (Laguna et al., 2015a; Laguna et al., 2015b) and future studies are planned to study the execution of eating actions. It is noteworthy that till date there has been no study addressing the expectancy of 'meals on wheels' food quality of elderly population. To our knowledge, this study is the first report to highlight different elements of the eating process in which elderlies find difficulties and provides holistic insights for designing interesting MoW business models for elderlies so that they can manipulate food themselves.

Conclusions

This study, designed with different categories of meal preparation dependency, shows that the elderly people are not a homogeneous group; they perceived different levels of eating difficulties including difficulties in opening a package, reheating food, manipulating food in a dish as well as orally in different ways. Overall, the difficulties were perceived in a similar way across the studied European elderlies, where the participants of cat.2 and 3 confirmed to experience more difficulties especially with the self-feeding actions such as manipulating food in the dish with the hand and manipulating food in the mouth including swallowing.

With the generated insights, MoW operators should look for innovative strategies to simplify the meal preparation such as use of easy-to-open packaging in the meals; provide adaptive cutleries and design suitable texture of food ensuring optimum and easy food oral processing. Furthermore, regarding meal preparation (re-heating), MoW companies should provide more specific information about the procedure and include visual demonstrations. These design principles (if adapted) by MoW might support elderly consumers to retain their independence especially for those who claim to suffer from more difficulties.

Future work will involve an intervention study in the EU countries with tailored made meals-on-wheels based on the insights generated by this study in terms of food design, packaging, texture and taste.

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