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Short Communication

Health and quality of life in an aging population – Food and beyond ☆

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ABSTRACT

In Europe the percentage of citizens aged 65 and over is increasing at an unprecedented rate, and is expected to account for over 30% of the population by 2050. Coupled with an increase in life expectancy, this massive demographic change calls for a major effort to ensure quality of life in our older population. A thorough understanding of the elderly as food consumers, their nutritional needs, their food perception and preferences is increasingly needed.

The role of food in healthy aging was a prominent theme at the 6th European Conference on Sensory and Consumer Research, which had quality of life across the life span as a focal point. This short paper is based on a workshop held at the EuroSense meeting, focusing on research from sensory and consumer scientists. The workshop featured contributions focusing on food-related perception, needs and behavior of the elderly, and aimed at demonstrating the relevance of sensory and consumer scientists in promoting food-related well-being in an aging population. The workshop contributions are here reviewed and summarized three main themes: nutritional needs, food perception and aging, and behavioral drivers of food consumption.

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1. Introduction

Population aging—the process by which older individuals become a proportionally larger share of the total population—is one of the most important demographic events of our time. Initially experienced by the more developed countries, the process has recently become apparent in much of the developing world as well (Figs. 1 and 2). In the near future, virtually all countries will face population aging, although at varying levels and time frames. In the EU, the share of people over 60 is presently around 15%, but that figure is expected to reach 30% by 2050.

There is clearly a need for societal strategies to increase the number of healthy years as we age, and adequate dietary intake is one of the key factors in maintaining good health and in increasing the quality of life of the elderly. Population aging, coupled with a steady increase in life longevity also means an increasing demand for food and beverages targeted at older consumers, currently the fastest growing consumer segment worldwide (Goldman, McKay, Mojet, & Kremer, 2014). Therefore understanding of the elderly as food consumers, their nutritional needs, food perception and preferences are key areas for future research.

Accordingly, sensory research focusing on the elderly was featured prominently at the 6th European Conference on Sensory and Consumer Research (EuroSense) in Copenhagen. On September 8, 2014 a thematic workshop was held as part of the conference, bringing together researchers from several European countries. The objective of workshop was to highlight the contributions of sensory and consumer scientists to increasing food satisfaction among the elderly, ensure their nutritional needs are met, and generally help the elderly maintain their well-being as long as possible.

The workshop itself comprised seven oral presentations followed by a plenum discussion. Three important themes emerged

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from the contributions and the discussion throughout the workshop:

1. *Nutritional needs of the elderly*. Body weight and muscle mass tends to decrease in old people and this is associated with frailty and increased morbidity. There is a major need for health promoting foods ensuring adequate nutritional intake, and identification of feeding strategies that may be applicable at societal level.
2. *Changes in chemosensory function associated with the aging process*. Although it is well established that aging causes losses in sensory acuity, the degree to which different senses are affected, and its impact on liking and intake are far from understood. Understanding how aging changes food perception is an important question as it feeds into the increasing demand for food beverages targeting older consumers.
3. *Increasing awareness of specific food-related behavioral drivers in the elderly*. Physical barriers (e.g., tiredness.) and socio-psychological factors (e.g., loneliness) related to aging affect the way people prepare and experience meals. Understanding behavioral drivers of food consumption among elderly is therefore necessary to develop not only good products, but also public health policies and innovative services that effectively promote food intake and healthy aging.

2. Nutrition, physical function and well-being

The nutritional needs of the elderly and their relations to several age-related morbidities were one of the most important topics in the workshop. Viktoria Olsson's presentation reviewed the nutritional status of elderly in the EU, as well as existing dietary recommendations. Her presentation highlighted that people defined as elderly (i.e., 65 years or over) are a heterogeneous group with large variations in functional abilities, physical and mental health. Although recent studies show that the share of healthy and active elderly in later cohorts has increased compared to the past (Falk et al., 2014), in very old ages many lose the ability to live

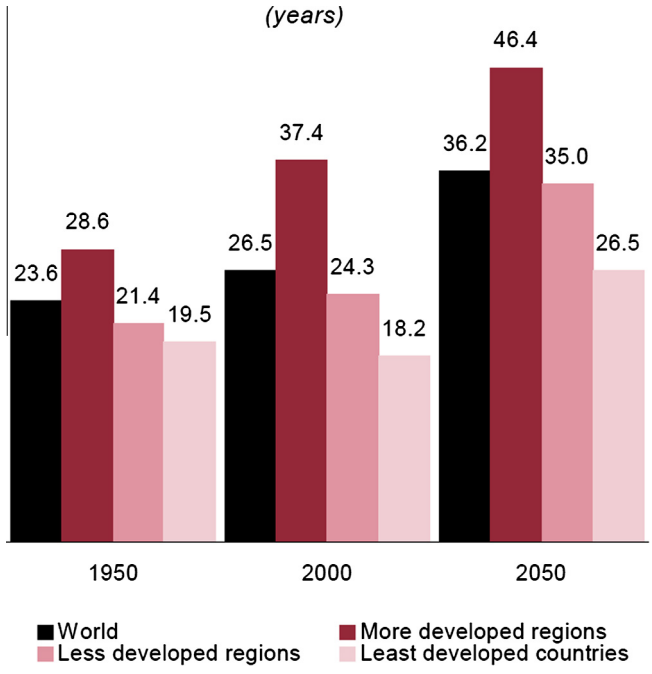

Fig. 1. Median age of the world population (world aggregate and breakdown by region). Source: United Nations, 2013.

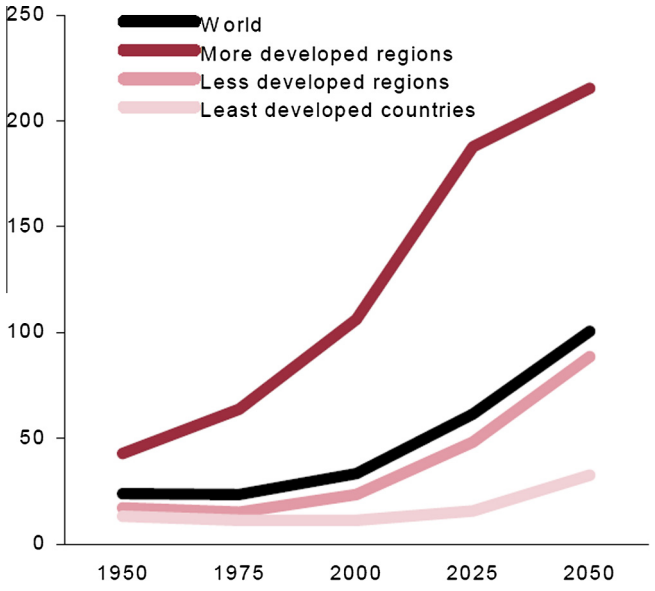

Fig. 2. Number of citizens aged 65 + per hundred children under 15 (world aggregate and breakdown by region). Source: United Nations, 2013.

independently because of impaired mobility, physical or mental health problems.

The healthy and active elderly often eat well but a recent study show that, overall, the diet quality among the EU elderly was both low on average and heterogeneous across individuals (Irz et al., 2014). In vulnerable groups malnutrition is an impending risk factor (Bauer et al., 2013), and eating difficulties adds on the threat (Maitre, Van Wymelbeke, Amand, & Vigneau, 2014).

In healthy elderly, requirements of energy decrease while the need for protein increases, owing to age-related changes in protein metabolism and declined anabolic response to ingested proteins (Bauer et al., 2013). The current recommended daily intake (RDI) is 1.0–1.2 g protein/kg body weight in healthy elderly, and 1.2–1.5 g/kg in individuals suffering from acute or chronic morbidities (Bauer et al., 2013). For vitamin D the RDI is 20 μg/d for individuals ⩾75 years (Lamberg-Allardt, Brustad, Meyer, & Steingrimsdottir, 2013). However, for many other nutrients, there is no evidence for specific recommendations for elderly. Elderly with limited appetite often do not meet these dietary requirements (particularly with regards to protein intake) and thus have problems in maintaining their body weight. Malnourished elderly rate their well-being as lower in comparison with other groups (Ödlund Olin, Koochek, Ljungqvist, & Cederholm, 2005), and indeed dysfunction in mobility resulting from inadequate food intake is a strong predictor for need of help and low quality of life (Stenzelius, Westergren, Thorneman, & Hallberg, 2005). More attention should be placed on energy and nutrient density with regards to meals targeted at the elderly, as portion sizes are small and should be served more frequently.

The presentation by Davide Giacalone continued with the theme of nutritional strategies targeted at elderly, based on the ongoing Danish project "CALM – Counteracting Age-related loss of skeletal muscle mass through exercise and diet". CALM is a broad interdisciplinary project form the University of Copenhagen which focuses on the role of protein intake and physical activity for countering *sarcopenia* – the age-related loss of skeletal muscle mass. Sarcopenia, which starts around age 50 in healthy individuals, reduces muscle strength and function, and often leads to a decrease in a person quality of life and independence. In the coming decades, the number of elderly citizens over age 60 in Denmark will increase by more than 50%, making sarcopenia a very

significant societal challenge. As a consequence, public expenditures for health care and welfare services will rapidly increase unless new evidence-based measures are developed to counteract age-related challenges. Several studies have suggested that an increase in protein intake and physical activity can be a viable strategy to slow down sarcopenia (Bauer et al., 2013). The purpose of the CALM project is to provide knowledge concerning an optimal combination of these two factors that healthy elderly people can realistically implement in their daily life. In order to provide evidence-based recommendations, a year-long longitudinal study is currently being conducted involving 200 healthy Danish elderly divided into four experimental groups (Group 1: 40 g whey proteins a day + heavy training under supervision; Group 2: 40 g whey/d + light training in their own homes; Group 3: 40 g whey/d with no training; Control group: 40 g isocaloric carbohydrates/d). A broad spectrum of measurements will be applied to evaluate the effect on muscle size and quality, as well on self-perceived mental and physical well-being before and after the intervention. From a sensory scientific perspective, a relevant research question is how acceptance for the dietary supplements in the elderly develops over time as effect of repeated exposure. All participants receive two daily 20 g supplements in two flavor variants (chocolate or raspberry, with an equal amount of exposure to both). The likely decrease in pleasantness of the taste of the dietary supplements which will likely results from such frequent and repeated exposure – an effect known as long-term sensory specific satiety or boredom (Rolls, 1999) – might pose an obstacle to compliance within this type of interventions. Previous research has suggested that sensory-specific satiety is relatively less pronounced in older individuals (Rolls, 1999), which might facilitate the compliance with the dietary supplementation regime. However, extant research on the topic is restricted to specific food categories, and generally based on a relatively low amount of exposures. The length of the CALM intervention provides instead a unique opportunity to study trends of acceptance over a long period of time. On the other hand, it is expected that some of the participants will experience an increase in well-being due to the higher protein intake combined with an increased level of physical activity. It is hypothesized that such increase in well-being could be associated to the flavor of the supplementation which might lead to a conditioned increase in acceptance over time. If this holds true, we should observe a differential pattern between different treatment groups. In any case, boredom and flavor learning point at different directions, it will be the magnitude of the effect that will determine the net outcome, and the related implications for the expected compliance and applicability in the target population.

3. Food perception and relationship to liking among elderly consumers

Food products targeted at the elderly are not only required to deliver nutritional benefits but also to taste good and generally appeal to older consumers.

Current and extant research on this topic was reviewed by Stefanie Kremer from Wageningen University and Research Centre (WUR-FBR), in her talk entitled "meeting the sensory needs of the older consumers". In order to gain more insight into drivers of and barriers to food enjoyment, (nutritional) health and well-being of independently living older persons, WUR-FBR has set up a research program on "Older persons food needs and wants". The overall objective of this program is to find an effective, efficient and actionable basis for the successful commercialization of foods and/or meal concepts for the older consumer.

As mentioned previously, older persons are generally a very heterogeneous target group and this holds also true with regard to their gustatory and olfactory functioning. On average thresholds for taste identification and taste detection increase at older age (Mehtven, Allen, Withers, & Gosney, 2012). From the four basic tastes, sweetness perception is preserved best against detrimental effects of aging (Simpson et al., 2012). Still suprathreshold taste perception is less affected by age than olfactory perception (Mojet, Christ-Hazelhof, & Heidema, 2005). Older persons perceive food odors less intense (Schubert et al., 2012), and identify and discriminate less odors correctly (Cain, Reid & Stevens, 1990; Larsson, Finkel, & Pedersen, 2000). Furthermore, olfactory functioning may serve as valid indicator of the integrity of the aging brain (Dulay & Murphy, 2012; Hüttenbrink, Hummel, Berg, Gasser, & Hahner, 2013). The extent to which smell and to a lesser extend taste sensitivity decrease with aging (Rawson & Venezia, 2011) is characterized by large inter-individual differences (Koskinen, Kalviainen, & Tuorila, 2003). However neither for normosmic nor for hyposmic older persons, age-related changes in flavor perception have been linked to a general preference for real food products with increased overall taste or flavor (Koskinen et al., 2003; Kremer, Holthuisen, & Boesvedt, 2014; Kremer et al., 2007).

In a recent study WUR-FBR explored the liking/acceptance of protein enriched yoghurt drinks in a combination of three different flavors (Kremer et al., in preparation). Protein fortification of foods can alter the sensory characteristics which may lead to the so called "taste challenge" (i.e., reduced palatability). Normosmic and hyposmic older persons differed significantly in their acceptance of the protein enrichment with the different flavors. The results suggest that in order to ensure product acceptance in foods, hyposmic and normosmic older persons may require the use of different types of flavorings rather than different concentrations of the same flavor. All in all, aging clearly takes a toll on human (food) perception. Product developers have to keep the sensory losses older consumers experience in mind when (re)formulating their foods and beverages, while at the same time realizing that not all senses and consumers are affected in the same way and consequently, one size will not fit all! More systematic research into the relationship between sensory losses, food liking and/or dietary intake is urgently needed to be able to meet the sensory needs of the older consumers.

4. Behavioral drivers of food consumption among elderly

The third theme addressed in the workshop dealt with social and psychological conditions related to aging, and the need to take this into consideration when developing nutritional recommendations, product and services targeted at the elderly.

The presentation by Marie Otto and Signe Skjoldborg dealt with how participants in the CALM project (described at § 2.) experience the dietary supplementation regime. The presentation is based on an ongoing ethnographic fieldwork started in February 2014, conducted at the homes of the elderly participants. The core of the investigation is to explore the everyday practices of the participants and the different ways they treat, taste and assign meaning to the supplements that they are given in CALM. The aim is to use qualitative insights together with data from the sensory and clinical data to formulate recommendations for how individuals can transform their everyday practices in order to counteract age-related conditions such as, in this case, sarcopenia. From an ethnographic standpoint routine practices, such as preparing and consuming meals, or tasting dietary supplement are considered to be complex phenomena worthy of close scrutiny and explanation. An ethnographic approach to everyday practices often strives to explain and explore significance of such practices for the study participants, as well as their culturally, materially and historically situated emergence. The following examples are taken from three interviews with different research participants. All show that the participants' ability to taste or evaluate food or the food in

everyday life cannot be considered as fixed properties: "*I like the chocolate the best. That fruity thing... I don't know really, it tastes a bit synthetic. It could be strawberry or raspberry, or just nothing natural. Sometimes I mix the chocolate with my coffee, I really like that taste... Do you know if I'm even allowed to do so*?" (*Participant 1, male*). To this research participant, the supplement must be recognizable in both taste and texture in order to be drinkable. In mixing the supplement with coffee he is creatively seeking to add the pleasure of food into the dietary intervention. On the contrary, another research participant tries to avoid tasting at all. To her, it is important that the supplement should stay a supplement, in order to make its intake a routine: "*Is it food or is it a supplement of some kind*? *I drink it in the morning with my vitamins. That's the best way for me to remember taking it. It seems to me that that I could be like taking fish oil.*" (*Participant 2, female*). In the CALM-project the participants are given a shaker which could be used for mixing the supplement with water, however for this third research participant, the shaker is not relevant. To her the supplement should be served cold as drink in order to be drinkable at all: "*I never use the shaker, it doesn't work for me. It works better for me to use a spoon. Then I pour it into a cognac glass and let it cool in the fridge. It is like having a drink. The taste isn't quite as pungent when it's ice cold, it's much more a sense of something.*" (*Participant 3, female*). The ongoing ethnographic fieldwork in CALM is beginning to unfold the heterogeneity of practices in which participants incorporate the dietary supplement intake into their daily life, and eventually suggest directions for food product development targeted at this specific elderly population in the future.

The presentation by Einar Risvik reported on a similar approach with regards to investigating everyday life of elderly consumer, adopted in a series of studies conducted in Norway with active home living elderly to monitor their habits, preferences for foods and their drivers for behavior. The major focus of these studies has been to get an understanding of the role and importance of food for healthy home-living elderly people in Norway, and the way in which public health measures can be useful to modify behavior. An example from the studies presented at workshop focused on dietary habits regarding salt and sugar among elderly, based on an interview-based investigation. All study participants reported that they are aware that they need to reduce their salt consumption, and that their perception is that they also do so. The message of salt reduction seems to have penetrated quite well to this group as almost 75% report that they do use less salt. The problem is only that salt perception also is reduced for a large part of this population. This emerged from a sensitivity study conducted on the same individuals, and in particular for the segment 81 years and higher where almost all have a reduced sensitivity. Some qualitative findings confirm this impression, for instance as described by the following informant: "*I don't know if it has anything to do with salt, but I fell that I must use more salt to achieve the same taste. I am not sure, but I think so*" (*Female, 76 years old*). Similar attitudes regarding sugar reduction were found, but only half of the sample said that they believe that they have reduced their sweetness level in food. Again the same underreporting when they are asked to rate liking for products was found. Liking for sweet increase with decreasing sensitivity, which makes it likely that what they report is a reduced sensitivity for sweet, rather than a reduced usage. Interestingly, women participants tended to be more aware than men on these issues, suggesting that they may be more receptive to traditional public health campaigns.

Another important issue touched upon in the workshop was the need for innovative solutions for delivering nutritious food to the elderly, since it is well known that physical barriers (motoric difficulties, tiredness, etc.) and socio-psychological factors related to aging (e.g., loneliness) can severely impede people's motivation in preparing and consuming food (Ödlund Olin et al., 2005). Ulla Lindberg's presentation reviewed in particular the issues connected to packaging and distribution of food for the elderly. Refrigeration technology and the cold-chain will play an important role in it preserves the safety of foods and makes it possible to prepare specific types of foods that meet the demand of the elderly, as well as with regards to maintaining quality and safety – another important aspect as elderly persons who are more prone to foodborne illnesses than younger persons (Coulomb, 2008). It will be extremely important in the future to develop concepts for the ordering, distribution and delivery of cold meal/food. In particular for the elderly consumers that would like to eat at home and decrease their independency and overall quality of life. It is also important the cold value chain and concept for the business model must be flexible and taking into account needs from the elderly consumers at all stages, starting from ordering the meal/food, to handling in the household and disposing of the packaging material. An interdisciplinary approach – combining knowledge of ICT – Technology, food quality, packaging, logistic, sensory, and waste/return systems for the food that is distributed is increasingly necessary. Packaging will have impact on the food quality during transport, in order to maintain a high sensory quality. In addition to being well-designed, food packages for products targeted at elderly should be especially easy to open, provide all necessary information, and be easy to recycle and/or return. For many elderly it could as well be a wish to be able to eat from the package itself. As the demand for food for the elderly is on the rise, the development of new products, models and services might be facilitated by collaborating with SMEs and other business partners interested in delivering solutions for the elderly consumers.

5. Conclusions and perspectives for research and society

All presenters emphasized that promoting healthy aging through food is a complex endeavor that involves several aspects (nutrition, sensory quality, distribution, social aspects, etc.) and is therefore intrinsically interdisciplinary. Government and funding institutions are increasingly aware that research programs are needed in order to successfully face the challenges connected to the population aging. Accordingly, attention and funding opportunities with a thematic focus on elderly are central in national and European research and innovation programs. Exemplifying this, Karin Wendin's presentation focused on the Swedish government's effort to establish a research agenda for dealing with the increasing proportion of senior citizens in the country, which presents both challenges and opportunities for society, business and researchers. The long-term vision is to develop an age-friendly society adapted to the changing demography. The strategy to do so is to employ research knowledge to facilitate creation and development of 'senior-citizens-centered' products and services in line with the needs and demands of elderly people. In Sweden, the majority of senior citizens are healthy and live independent lives, but there are also those who are frail and sick and in considerable need of care and assistance, particular among those in very old age. Most important, as an increasing proportion of the population is aging with chronic disease and/or disability, also people in earlier phases of life are facing challenges similar to those in more advanced age. The work within the agenda has been conducted on a multidisciplinary basis to identify new interactions. The goal was to establish collaboration through a series of meetings and workshops, where ideas and innovation chains with an embedded holistic approach could be discussed. This goal was achieved and approximately 30 organizations could identify four priority areas: housing, food and nutrition, health and mobility. To achieve the vision, it is important to work with prevention by adopting a holistic perspective. It is further important is to make use of evidence-based results. Interdisciplinary collaboration is needed to create product

and services that cater to the elderly's needs, and the welfare technologies to make them accessible, thereby bringing us closer to realizing that vision (Wendin, Kylefors, & Mjörnell, 2014).

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