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The influence of olfactory impairment in vital, independently living older persons on their eating behaviour and food liking

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ABSTRACT

These two studies investigated eating behaviour and food liking of independently living Dutch older people with and without olfactory impairment. In the first study, an internet survey was conducted in relation to their olfactory status ($n = 512$; age 55–91). Hyposmic older people reported eating the same meal more often within a week than their unimpaired peers, and they also differed in some of the types of foods they reported eating as snacks (i.e. fewer cookies and nuts, more candy). In the second study, various strategies to increase food liking among older consumers were investigated, as well as their liking of reformulated foods with an expected reduced palatability. The strategies included (1) combined visual enrichment and flavour enrichment of mashed potatoes, (2) enhancement of taste intensity and thickness of gravy, and (3) flavour enrichment of stews. The reformulation encompassed (1) salt reduction of meatballs and (2) protein enrichment of bread. Thirty-eight young consumers (age 32.3 ± 8.9 y), 41 normosmic older consumers (age 65.1 ± 5.2 y), and 43 hyposmic older consumers (age 68.5 ± 5.9 y) assessed food liking on a 100 mm visual analogue scale. Both older groups increased their food liking in response to the changes made in the mashed potatoes and gravies, decreased their food liking in response to the salt reduction in the meatball and increased their product liking once information was given on the reduction. In conclusion, older persons – regardless of their olfactory status – may respond positively to multi-sensory enrichment in warm meal components. At the same time, certain types of foods may still appeal more or less to hyposmic older persons which in turn may lead to the development of different dietary intake patterns.

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Introduction

Worldwide, populations are rapidly growing relatively older. According to current estimates, the proportion of people over 60 will almost double by 2050 (United Nations, 2010). Consequently, there is a growing need to develop strategies that enable older persons to maintain their health and quality of life for as long as possible. The occurrence of both obesity and malnutrition in older people is thought to negatively impact their quality of life via an increased risk of disease, disability and mortality (Bollwein et al., 2013; Meijers, Halfens, Wilson, & Schols, 2012; Salihu, Bonnema, & Alio, 2009). Ensuring sufficient food intake plays an important role in counteracting malnutrition and frailty since both appetite and body weight tend to involuntarily decrease as people age, resulting in the so-called anorexia of aging (Bollwein et al., 2013; Morley, 2001). This anorexia of aging is thought to be caused by

multiple underlying factors, i.e. physiological, medical, social and psychological (De Boer, Ter Horst, & Lorist, 2013; Hickson, 2006), that in turn might influence an individual's eating behaviour.

One frequently discussed physiological factor is the age-associated decline in olfactory function (Bartoshuk, 1989; Boyce & Shone, 2006; Schiffman, 1997). For example, in older patients, it has been observed that 29% of those with olfactory dysfunction eat less (Aschenbrenner et al., 2008). It has been recommended by some (Griep, Mets, & Massart, 1997; Griep, Mets, & Massart, 2000; Schiffman & Warwick, 1993) that such people should eat flavour-enhanced foods in order to compensate for the decline in olfactory function. However, their actual olfactory ability was not measured in any of those studies. In contrast, in studies in which the olfactory function was actually assessed, there was no direct connection observed between poor olfactory performance and preference for flavour-enhanced foods (Forde & Delahunty, 2004; Issanchou, 2004; Koskinen, Kalviainen, & Tuorila, 2003; Kremer, Bult, Mojet, & Kroeze, 2007). Two possible explanations for this observation come to mind. Firstly, the age-related deterioration

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of the olfactory system starts gradually, and therefore people may continuously habituate to their diminished perception and in this way not experience a noticeable decrease in food liking (Wysocki & Pelchat, 1993). Since pleasantness judgments are guided by previously acquired product concepts, it seems plausible that older people are able to compensate for sensory losses with the help of those mental images (Mojet, Christ-Hazelhof, & Heidema, 2005). Secondly, in most cases, there is not a linear relation between sensory and hedonic judgments. As a result, even though intensity perception may vary between olfactory impaired older people and the young, the hedonic aspects may remain largely stable with increasing age (Koskinen et al., 2003; Mattes, 2002, 2012). Therefore, currently, the strategy of compensating for olfactory loss with flavour enhancement of foods lacks sufficient scientific support.

In general, an individual's food intake can be influenced by internal (flavour perception, appetite, hunger, thirst, satiety and so forth) and external (e.g. social environments, economics, time of the day, visual presentation) signals. In infants, food intake is thought to be mainly regulated by internal signals. Later in life, as internal signals seem to become less prominent, external signals are thought to play a more dominant role (De Castro, 1993; Roberts, 2000; Zandstra, Mathey, de Graaf, & van Staveren, 2000). It seems therefore plausible that compensation strategies that rely on multisensory rather than unisensory (i.e. flavour enhancement/enrichment in the same sensory modality) signals might prove successful in increasing the food liking of older consumers. For example, practitioners in the field of catering for older people frequently recommend that, in addition to tasting good, foods should be presented in an attractive way and/or that special attention should be paid to food texture and how to communicate about the foods being served (Cassens, Johnson, & Keelan, 1996; Kremer, Derks, Nijenhuis, Boer, & Gorselink, 2012; Nijis et al., 2006; Withers, Gosney, & Methven, 2013). To our knowledge, scientific data on strategies to increase food liking and/or food intake among older consumers – other than flavour enhancement – are scarce.

Food products that specifically target an older population are required not only to taste good but also to be nutritious, healthy and ideally deliver a functional benefit. For example, increased protein consumption in this age group is thought to be beneficial in promoting health and independence (Wolfe, Miller, & Miller, 2008) as it counteracts loss of muscle mass, i.e. sarcopenia. As a direct consequence, there is currently a need for non-medicinal, protein-enriched foods that fit well in the dietary habits of older people. Similarly, a dose response relation between salt intake and blood pressure has been noted (He & McGregor, 2000), and current levels of sodium intake are known to exceed human physiological needs in Western populations (WHO, 2007). Since processed foods are the main sources of salt in the human diet (RIVM., 2012), there is currently also a need for reduced-salt foods that fit well in the dietary habits of older persons. However, both protein fortification and salt reduction are known to alter the sensory characteristics of (re)formulated foods, associated very often, but not always, with a decrease in consumer acceptance (Bolhuis et al., 2011; Breslin & Beauchamp, 1997; Verbeke, 2006). Possible effects of decreased olfactory function on the liking/acceptance of these health-promoting products, which often entail a so-called taste challenge (i.e. reduced palatability), have to our knowledge also not yet been explored. On the one hand, Mattes (2012) has recently argued that an olfactory loss in older people may also diminish their neophobic responses and their detection of undesirable flavour notes, which in turn could be potentially beneficial as frail older people must very often adjust to new food providers (meals-on-wheels, nursing home canteen, ready-to-eat meals, and so on). On the other hand, it is also possible that they might become pickier and reject a wider range of (familiar) foods (Maitre et al., 2013).

In order to gain more insight into the eating behaviour and food liking of olfactory impaired but otherwise vital, independently living older people, two studies were performed. Study 1 aimed to explore the current eating behaviour of Dutch older people in general and the possible impact of olfactory status (normosmic vs hyposmic) on this self-reported eating behaviour. In study 2, possible differences in food liking were investigated among young consumers, older normosmics and older hyposmics, making use of real foods: mashed potatoes, gravies, stews, (reduced-salt) meatballs and protein-enriched breads. It was hypothesized that olfactory impaired older persons would respond with an increase in product liking to strategies that try to compensate olfactory loss via other sensory modalities (visual/textural enrichment) or external signals (product communication) and not solely to flavour enhancement/enrichment. It was also hypothesized that our target group would not detect taste challenges in reformulated foods (reduced-salt meatball and protein-enriched bread) and in turn would express an equal liking for both the standard and the reformulated product.

Methods

Participants

To gain insight into drivers of, and barriers to, food and meal enjoyment in community-dwelling older people in the Netherlands, a panel of healthy, independently living individuals over 55 y of age was set up in 2011, called SenTo (*Senioren van de Toekomst*: Seniors of the future). The SenTo members were recruited via posters, newspapers, mail shots, Twitter and databases of other panels in a 60 km radius around Wageningen, the Netherlands. As part of the enrolment procedure, participants filled out a demographic questionnaire about relevant health and social factors. The SenTo panel consists currently of 850 members (42.0% male and 58.0% female). Roughly half of the SenTo members have been extensively tested for olfactory function by means of Sniffin' Sticks, which measure the detection threshold, discrimination and identification of odours (Burghart, Wedel, Germany). The scores of these tests (possible range for each 0–16) are presented as a composite TDI score – i.e. the sum of results obtained for threshold (T), discrimination (D) and identification (I) measures. A TDI score of 30.3 or lower is thought to indicate hyposmia (impaired olfactory functioning) (Hummel, Kobal, Gudziol, & Mackay-Sim, 2007). Of the olfactory-tested SenTo members ($n = 395$; 187 male and 208 female), 30.4% had olfactory impairment.

The two studies reported in the current paper used SenTo members. In study 1, a total of 693 questionnaires were sent to the members of the SenTo panel, of which 512 (73.9%) questionnaires were received back in time. In total, there were 213 male (41.6%) and 299 female (58.4%) respondents. Of the total respondents, 321 had been tested previously on their olfactory performance. One hundred and eight of these respondents were found to be olfactory impaired (see Table 1 for more characteristics). In study 2, 43 olfactory impaired SenTo members, 41 SenTo members with normal olfactory function and 38 young people (age 32.3 ± 8.9 y; 16 male, 22 female) participated.

Both studies were pre-examined by the medical-ethical committee of Wageningen University and exemption from full review was granted since the research falls well in the category: non-invasive consumer studies with legally competent participants. All consumers signed an informed consent and received a fee for participation after completion of the study.

Food samples

In study 2, various real foods were studied. Firstly, microwaveable mashed potatoes, gravy (and potatoes), and stew. For each of

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