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Emotion, olfaction, and age: A comparison of self-reported food-evoked emotion profiles of younger adults, older normosmic adults, and older hyposmic adults

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ABSTRACT

This study compared the self-reported food-evoked emotion profiles of younger adults ($n = 80$, mean age 29.4 (years) ± 9.5 (SD)), older normosmic adults ($n = 84$, mean age 68.9 (years) ± 4.2 (SD)), and older hyposmic adults ($n = 70$, mean age 69.4 (years) ± 6.1 (SD)). The three groups evaluated gingerbreads and chocolates using the EsSense25 questionnaire. Our results demonstrated several differences in the self-reported emotion profiles of the participant groups, especially between those of the older groups and younger adults (*Rv*-coefficients of 0.39 and 0.42 for older normosmic/hyposmic adults and younger adults, versus 0.77 for older normosmic adults and older hyposmic adults). Firstly, the emotions as reported by the younger adults varied along the two dimensions valence and arousal, whereas the emotions of the older groups mainly varied along the valence dimension. Secondly, both older groups scored generally lower on a number of negative emotions, such as 'disgusted', and 'bored' ($p < 0.05$). Finally, compared to their younger counterparts, the two older groups were generally less extreme in their emotion scores (i.e. they reported lower scores for a number of emotions, $p < 0.05$). The influence of olfactory function was product dependent, as the emotion profiles of older normosmic and hyposmic adults differed only for specific products. In conclusion, participants' age and – to a lesser extent – olfactory function seem to impact on self-reported food-evoked emotions. Therefore, both factors should be taken into account when products are being tailored to the needs of older persons.

1. Introduction

Life expectancy is increasing, and older adults are becoming the fastest growing segment of the world's population (RIVM., 2013; World Health Organization., 2014). It is well known that aging comes with various physiological and psychological changes. One frequently encountered phenomenon is an age-related decrease in olfactory function (Doty & Kamath, 2014). In addition, as people age, their emotions seem to become more important during psychological processes, such as memory and problem solving (Ebner & Fischer, 2014; Fung & Carstensen, 2003). Since emotions are closely connected to odours (Herz & Cupchik, 1992), aging and the subsequent change in olfactory function may influence the perception of food-evoked emotions. To serve the senior population with foods that better meet their needs and expectations (Moschis, 2003; Reisenwitz & Iyer, 2007), it might be important to understand the interplay between age-related decline in olfactory function and perceptions of food-evoked emotions.

The close link between olfactory function and emotion perception has been described before, and smell has even been denoted as 'a sensory emotion' (Stevenson, 2009; Yeshurun & Sobel, 2010). For example Herz and Cupchik (1992) showed that odour-evoked emotional memories are highly vivid, specific, and relatively old. Another example is the strong evocation of nostalgic feelings on exposure to specific scents, such as apple pie or baby powder (Reid, Green, Wildschut, & Sedikides, 2014). These phenomena could be explained by the close anatomical location in the brain of the olfactory system and the systems for learning, memory, emotion, and language (Shepherd, 2006). The scientific and practical relevance of the relation between odours and emotions is underlined by the introduction of several tools to measure odour-elicited emotions by the research teams at Firmenich and the University of Geneva, such as the GEOS, ScentMoveTM, and

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UniGEOS (Chrea et al., 2009; Ferdenzi et al., 2013; Porcherot et al., 2010).

When persons age, olfactory function can decrease. A study performed in the US indicates that around 24.5% of the older population is olfactory impaired. The prevalence of olfactory impairment increases with increasing age, and the impairment is highest among men (Murphy et al., 2002). A recent Dutch study showed even higher prevalence rates of olfactory dysfunction, as in this study 35% of the vital older population and 93% of the geriatric older population had an impaired olfactory function (Toussaint, de Roon, van Campen, Kremer, & Boesveldt, 2015). Although earlier research suggests that food liking in healthy, independently living older persons is not affected by age-associated changes in sensory perception (Kremer, Bult, Mojet, & Kroeze, 2007), impaired olfaction may still influence consumer behaviour via unconscious emotional responses to a food product (Soudry, Lemogne, Malinvaud, Consoli, & Bonfils, 2011). Little has been reported about possible differences in food-evoked emotion profiles between persons with a good and an impaired sense of smell.

Alongside the decrease in olfactory function, aging itself might result in different emotion responses. For example, as people grow older, emotionally meaningful goals (e.g. balancing emotional states or sensing that one is needed by others) become more important, and they tend to invest greater resources in emotionally meaningful activities (Fung & Carstensen, 2003; Perry & Wolburg, 2011). Taking into account the important role of emotions in food choice (Gibson, 2006; Macht, 2008), it seems plausible that older persons therefore also rely more on their emotions when it comes to their food choice and meal experience. Additionally, building on the dimensional work of Russell, Weiss, and Mendelsohn (1989), the food-evoked emotion responses of younger adults can often be differentiated into the orthogonal dimensions valence (i.e. pleasure-displeasure) and arousal (i.e. sleepiness-activation) (Dalenberg et al., 2014; Spinelli, Masi, Dinnella, Zoboli, & Monteleone, 2014), whereas for seniors few food-related results have been reported. Although seniors tend to rely more on their emotions and heuristics during various psychological processes, Svärd, Fischer, and Lundqvist (2014) have shown that older persons tend to report emotions with a lower level of valence and emotional arousal than their younger counterparts. However, Svärd et al. (2014) did not study food-evoked emotion responses. Several explanations come to mind for these expected differences in reported emotional associations between the age groups. For example, emotions are formed upon experience and memory (Hamann, 2001). Older adults most likely have a longer history with food products and might therefore differ from younger adults in the intensity of their food-evoked emotions. Furthermore, May, Rahhal, Berry, and Leighton (2005) reported that for older individuals emotional associations (e.g. safety, happiness, and satisfaction) may be more important than cognitive associations (e.g. location of an item). That is, in their study the recall of emotional information did not decline when source memory (i.e. memory of recent events; Glisky, Rubin, & Davidson, 2001) declined.

Taken together, it seems plausible to expect differences in food-evoked emotion profiles between older and younger adults, and it could even be that persons with an impaired sense of smell (hyposmic persons) experience different food-evoked emotions than their unimpaired counterparts (normosmic persons). So far, little attention has been paid to the impact of aging itself and olfactory decline on food-evoked emotions. Therefore, in the current study, we investigate whether (and if so how) younger adults, older normosmic adults, and older hyposmic adults differ in their self-reported food-evoked emotion profiles.

2. Materials and methods

2.1. Participants

Two hundred and thirty-four Dutch participants enrolled in the current study: 80 younger adults (aged between 18 and 45 years old), 84 older normosmic adults (TDI-score >30.3, age >65 years old), and 70 older hyposmic adults (TDI-score <30.3, age >65 years old). Table 1 provides the participants' characteristics.

The younger adults were all members of Panelnet, a database initiated by Wageningen UR containing potential study participants. Since the prevalence of olfactory impairment in younger adults is reported to be low (approximately 2–5%, Brämerson, Johansson, Ek, Nordin, & Bende, 2004; Landis, Konnerth, & Hummel, 2004), it was not deemed necessary by the authors of the current study to assess the actual olfactory status of this group. Consequently, since their olfactory status is assumed rather than measured, we will refer to this group as 'younger adults' throughout the current paper.

The older participants were all members of the SenTo panel (Dutch abbreviation of *Senioren van de Toekomst*: Seniors of the Future). The SenTo panel is a panel, initiated by Wageningen UR, of around 800 healthy community-dwelling Dutch older persons. The criteria for membership of the SenTo panel are: being at least 55 years old, being capable of working online with a computer, being able to go out independently (for example, to do their grocery shopping), and being fluent in Dutch. We consider vital community-dwelling older adults an important part of the Dutch senior population, as approximately 70% of the total Dutch 65+ population live independently and receive no form of professional care (CBS Statline., 2011). The older participants were recruited based on their TDI score, as measured using Sniffin' sticks (Burghart, Wedel, Germany). A TDI-score is a measure of nasal chemosensory function (Kobal et al., 1996) and is composed of an odour threshold measure, an odour discrimination measure, and an odour identification measure. The TDI score reflects the summed scores of these measures, each ranging between 0 and 16. A TDI-score of 30.3 or lower indicates impaired olfactory functioning; i.e. hyposmia (Hummel, Kobal, Gudziol, & Mackay-Sim, 2007). The TDI scores of the SenTo panellists are measured on a regular basis in the sensory lab of Wageningen UR, the Netherlands.

All participants were consumers of gingerbread and chocolate, and were included only if they had no allergies or intolerances for milk, gluten, or lactose. The social ethical committee of Wageningen University approved the current study.

Table 1
Participants' demographic characteristics and TDI-scores.

		Younger adult (n = 80)	Older normosmic adults (n = 84)	Older hyposmic adults (n = 70)
Age (years)	Mean ± SD	29.4 ± 9.5	68.9 ± 4.2	69.4 ± 6.1
Gender [%(n)]	Male	22.5 (18)	40 (34)	54.3 (38)
	Female	77.5 (62)	60 (50)	45.7 (32)
TDI-score*		n.a.	36.1	27.2

* A TDI-score is a measure of nasal chemosensory function and is composed of an odour threshold, discrimination measure, and identification measure. A TDI-score of 30.3 or lower indicates impaired olfactory functioning.