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Sensitivity, hedonics and preferences for basic tastes and fat amongst adults and children of differing weight status: A comprehensive review

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ABSTRACT

It is likely that variation in individual responsiveness to taste stimuli plays a pivotal role in food choice, however the importance of this role in relation to weight status is not yet known. This comprehensive review sought to determine if sensitivity, hedonics, and preference for the basic tastes and fat characteristics of food differs between normal and overweight/obese individuals. We identified 25 human studies (1980–2013) that sought to measure one or more variables' relationship to weight status. There is no clear evidence of a negative association between fat taste sensitivity and weight status, and little evidence of a relationship between sweet, salty, sour or bitter tastes and weight status. There was some evidence for an association for fat hedonics and a preference for fat and increased weight status. Amongst children there was suggestive evidence for a positive relationship between salt, dietary intake and weight status. There is a need to clearly define and adopt a hypothesis-led approach, using more rigorous measures of sensory characterisation and dietary intake to better understand whether the sensory characteristics of diet influence food choices and weight status.

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Introduction

Poor diet is a key modifiable determinant of obesity and other lifestyle related diseases. Changing food choices and improving diet quality is a priority in addressing the problem of obesity and

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improving population health. Particular dietary patterns, namely those that are high in energy density and added sugars, and low in fruits and vegetables, may contribute to a higher kilojoule intake and increased risk of weight gain and obesity (NHMRC, 2003). Conversely there is some evidence that suggests other dietary patterns, for example the Mediterranean dietary pattern, may be protective (Buckland, Bach, & Serra-Majem, 2008). Particular dietary patterns have different sensory characteristics that appeal to individuals differently. Sensory preferences and acceptance of dietary patterns are likely to be through exposure, availability and cultural norms. However, there is a need for a greater understanding of the determinants of food choice, and, as a contribution to furthering that understanding in this review we focus on the role of gustation (taste).

There are many known drivers of food choice including physical factors such as access, availability, and time; social factors such as family and cultural norms; economic factors such as cost and income; and individual psychological factors such as stress, mood and attitudes; and biological factors such as appetite and taste (European Food Information Council, 2004/2005). Taste, used in a colloquial sense to mean all aspects of the sensory perceptions of foods or overall palatability, is reported as a major reason for eating particular foods (Nasser, 2001), and within the complexity of food choice "the importance of taste cannot be overstated" (Sobal, Bisogni, Devine, & Jastran, 2006).

Basic tastes (sweet, sour, bitter, salt and umami), scientifically defined, are one of the sensory characteristics of food, along with texture, pungency, aroma, appearance and sound (Lawless & Heymann, 1998). An innate liking for sweet and dislike for bitter and sour (Steiner, 1979; Ventura & Mennella, 2011), and, after a maturational lag, an innate liking for salt (Beauchamp, Cowart, & Moran, 1986; Mattes, 1997) are well established. However, these taste hedonics can also be modified or developed through experience and learning, and are thought to account for considerable variation in individual food choices (de Houwer, Thomas, & Baeyens, 2001; Eertmans, Baeyens, & Bergh, 2001). Basic tastes are located within a complex matrix of sensory characteristics; however tastes are often the dominant sensory modality facilitating the classification of foods (e.g., sweet, bitter and salty foods). There is evidence that taste acts as an important signal for macronutrient content, particularly in low or moderately processed foods (Viskaal van Dongen, van den Berg, Vink, Kok, & de Graaf, 2012). Furthermore, there has been debate within public health nutrition over the role of particular foods labelled by their taste perception. Such foods (e.g., sweet carbohydrates) or beverages (e.g., sugar sweetened) are innately preferred, are supported by extensive marketing (Ventura & Mennella, 2011), and are often 'blamed' for contributing to overweight and obesity. While it is established that taste plays a pivotal role in food choice (Drewnowski, 1997), the extent of specific taste perception in relation to weight status is not yet known.

A previous review describing the relationships between taste, food intake and obesity took a narrative rather than a comprehensive approach, concluding that taste contributes to palatability and promotes food intake, which may in turn lead to over-consumption of energy and possibly obesity (Nasser, 2001). That review also explored other mechanisms associated with taste and weight status and may have prematurely dismissed taste *per se* as an influence.

The lack of an evidence base is partially due to the heterogeneity in methods used to measure taste and dietary intake. Because dietary intake assessment is difficult and resource intensive, most sensory research has examined the influence of taste on correlates of intake, as opposed to using measures of dietary intake itself. These precursors of intake have included taste sensitivity and perception to taste attributes; hedonics or liking; and preference for certain foods (Fig. 1). Therefore the aim of this review was to conduct a comprehensive review of the literature to examine the extent to which the sensory attribute of taste determines sensitivity, hedonics, preference and dietary intake in overweight/obese individuals compared to normal weight individuals. A greater understanding of the sensory characteristics of foods and the interaction with dietary intake could provide insight into a potential driver of food choice and dietary patterns, and improve our understanding of one of the determinants of overweight and obesity.

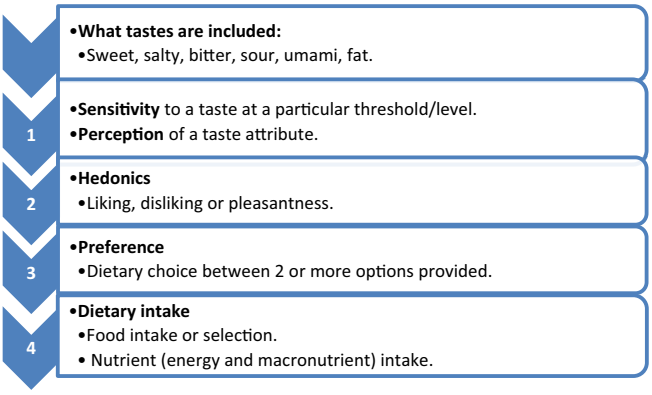

Fig. 1. Conceptual model of the relationship between variables (and their definitions) described in this review.

Methods

A comprehensive review using a systematic approach review focused primarily on the sensory modality of taste and links with nutrient or food intake and weight status was undertaken. Sweet, salty, bitter, sour and umami (taste of monosodium glutamate, or 'savoury') are the basic tastes detected by humans. It should be recognised that many studies (reviewed here), particularly amongst free living consumers, do not control for other sensory modalities that create overall flavour, hence do not follow the strict definition of taste as gustation (Nasser, 2001) but tend to refer to taste/flavour stimuli. Also recent studies have found that fatty acids can be detected by human taste receptors (Fukuwatari & Hiroaoka, 1997; Gaillard, Laugerette, & Darcel, 2008; Matsumura, Mizushige, & Yoenda, 2007; Moskowitz & Krieger, 1995; Nasser, 2001; Stewart et al., 2010). Whilst the descriptor *fat taste* is not strictly accurate (Stewart et al., 2010), nor was fatty acid taste perception known when many of the studies reviewed here were published, fat perception was included in this review because of recent knowledge and a body of literature that has focused on fat.

Four main interconnecting outcomes, or themes, will be covered in this review in an attempt to summarise the relationship between taste and the four outcome variables (Fig. 1), and how the relationships vary by weight status. The majority of the literature has focussed on one or two outcome variables using a range of different methodologies, hence this review has been structured accordingly. The review will discuss the relationship to dietary intake and weight status where applicable.

Criteria for considering studies for this review

Selection of studies

The original search was conducted as part of a broader research program in September 2012 and was repeated in February 2014 for the purpose of this publication. Three databases were searched PubMed, PsychINFO and ProQuest Dissertation search with filters