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Tasting spoons: Assessing how the material of a spoon affects the taste of the food

Betina Piqueras-Fiszman [a,b,*], Zoe Laughlin [c], Mark Miodownik [c,1], Charles Spence [b,1]

[a] Department of Engineering Projects, Universitat Politècnica de València, Camino de Vera s/n, 46022 Valencia, Spain
[b] Department of Experimental Psychology, University of Oxford, South Parks Road, Oxford OX1 3UD, UK
[c] Physics Department King's College London, Strand, London WC2R 2LS, UK

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ABSTRACT

This study investigated the effect that the taste of certain metals has on the perception of food. Four spoons plated with different metals (gold, copper, zinc, and stainless steel) were used to taste cream samples having different tastes: sweet, sour, bitter, salty, and plain. The results revealed that the zinc and copper spoons, in addition to transferring a somewhat metallic and bitter taste, enhanced to a greater or lesser extent, each cream's dominant taste. Contrary to our expectations, the metallic taste of the copper and zinc spoons did not seem to affect the pleasantness of the samples significantly. These findings reveal that the effect that the metals from which cutlery can be made have on food perception differs from that found when the metal salts are added to the composition of the food itself.

1. Introduction

During consumption, many different factors affect, either directly or indirectly, how people interact with, and consequently perceive, food. Apart from the physical properties of the food itself, contextual variables also play an important role (e.g., King, Meiselman, Hottenstein, Work, & Cronk, 2007; King, Weber, Meiselman, & Lv, 2004; Reisfelt, Gabrielsen, Aaslyng, Bjerre, & Møller, 2009). In a direct way, and in most developed regions, people interact with food via the medium of cutlery, which is used while cooking, to serve, and eventually to move the food thus prepared from plate to mouth.

The wide variety of different cutlery designs available nowadays serves not only to meet the functional needs of consumers, but also to transmit certain feelings to the person who is using it. In many contexts, the physical food is just one of several elements that help to construct the intended eating experience for the consumer (Schifferstein, 2010). As Aldersey-Williams (2011, p. 257) reports: "*We know the lighter aluminium spoon is easier to use, yet we prefer the silver because it 'gratifies our taste*".

That such non-food implements can impact on us in a semiotic manner is hinted at by Ariely's (2008, pp. 159–160) finding that the containers in which the paraphernalia that often goes along with coffee (e.g., the sugar bowl, the milk flask or jug, the cinnamon and chocolate shakers, etc.) exert a significant influence on people's liking of coffee. Ariely argued that when higher quality containers were used (i.e., when made of glass-and-metal, set on a crushed metal tray, and accompanied by silver spoons and nice labels), people were more likely to report that they liked the coffee a lot and that they would pay more for it, than when the very same coffee was accompanied by the same condiments placed in Styrofoam cups with the labels written on with a felt-tip pen.

Similarly, in a pilot study, we recently demonstrated that consumers' quality and liking judgments concerning identical yoghurt samples differed significantly when tasted either with a plastic spoon having a metallic finish versus a stainless steel spoon, the latter resulting in significantly higher scores. However, it remains unclear whether these results were attributable to any differences in the physical properties of the spoons (i.e., in their weight, temperature, etc.) or to the overall semiotic appraisal (of plastic versus metallic spoon). Despite these two examples, little of the research on food perception that has been published to date has, as yet, placed much of an emphasis on the cutlery that people typically use while eating.

Throughout recent history, cutlery has been manufactured out of various materials. Historically, wood, bone, and ceramic spoons were commonly used because of the fact that the only metals that were affordable were iron, brass, bronze, and pewter, which, it is said, often gave an unpleasant flavor to food (Miodownik, 2008). According to Himsworth (1953, p. ix), stainless steel was introduced as a metal for cutlery in 1914. The subsequent success of this material resulted in a radical reduction in the range of materials

* Corresponding author at: Department of Engineering Projects, Universitat Politècnica de València, Camino de Vera s/n, 46022 Valencia, Spain. Tel.: +34669274990; fax: +34963636301.
E-mail address: bepifis@upvnet.upv.es (B. Piqueras-Fiszman).
[1] Joint third authors.

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used for cutlery, so that nowadays, stainless steel is by far the most commonly used material for cutlery.

The tastes (or sensations) of metals and their impact on food perception and quality judgments have been studied extensively (e.g., Epke, McClure, & Lawless, 2009; Hettinger, Myers, & Frank, 1990; Hoehl, Schoenberger, & Busch-Stockfisch, 2010; Keast, 2003; Lawless, Stevens, Chapman, & Kurtz, 2005; Lawless et al., 2004; Lim & Lawless, 2005; Schiffman, 2000; Stevens, Smith, & Lawless, 2006). However, the majority of these studies were performed on aqueous solutions, with metal salts that are usually incorporated in fortified foods, food supplements, and drinks, and hence easily soluble. To date, metallic tastes emanating from solid metals have not been studied in any great detail, especially metals that might come into contact with the mouth during eating (or, for that matter, drinking). The flavours of these metals might also have significant practical implications (i.e., when it comes to the materials out of which cutlery is made) and cannot be extrapolated directly from the data associated with the tasting of metallic solutions. Though most metals used as food utensils are chosen nowadays for their inertness and for being tasteless, the taste that other metals could transfer to food could act as an enhancer or inhibitor of a food's natural flavours, hence potentially modifying (that is, improving or lowering) a person's perception of the sensory-discriminative and/or hedonic attributes of the food in their mouth.

Recently, Laughlin, Conreen, Witchel, and Miodownik (2011) investigated the sensory-discriminative and hedonic effects of metallic tastes arising from seven spoons plated with different metals: gold, silver, zinc, copper, tin, chrome and stainless steel. Whilst wearing blindfolds, participants evaluated the taste of each of the spoons (note that there was nothing actually presented on the spoons) and rated the following attributes on a 7-point scale: cool, hard, salty, bitter, metallic, strong, sweet and unpleasant. Laughlin et al.'s (2011) results demonstrated that the gold, chrome, tin, silver, and stainless steel spoons did not differ significantly for any of the rated attributes, but they were significantly different from the zinc and copper spoons. Gold and chrome were rated as the least metallic, least bitter, and least strong tasting of the spoons, whereas zinc and copper spoons had the strongest, most metallic, most bitter, and least sweet taste. However, to the best of our knowledge, no studies have as yet reported whether the taste of the cutlery is sufficiently strong that it can affect the perceived flavour of the food tasted using that cutlery (nor the taste interactions that might occur; Keast & Breslin, 2003).

Considering the fact that the perceived flavour of a food or beverage results from the combination of olfactory, gustatory, somatosensory, auditory, visual, and trigeminal cues (Auvray & Spence, 2008; Stevenson, 2009), and that our perception of food also depends on the way in which that food or beverage is consumed (and the utensils with which we interact with it), the primary aim of the present study was to explore the influence of the taste of the metals that can be found in cutlery on the gustatory and hedonic perception of food of consumers. Specifically, our aims were: (1) To test the influence of the different metals on the perception of bitterness, sweetness, saltiness, and metallic sensation of five creams (bitter, sour, salty, sweet, and plain), under blindfolded conditions; (2) To evaluate the hedonic responses to these combinations; and (3) To determine whether the visual appearance of the spoons affected the perception of the food (that is, when the participants had their eyes open and hence could see the spoons). This was investigated using a gold-plated and a stainless steel spoon which, according to Laughlin et al. (2011), did not have significantly different tastes (when assessed blindfolded), but have a strikingly different visual appearance.

2. Materials and methods

2.1. Subjects

Thirty participants (nine male) ranging in age from 18 to 50 years (M = 27 years: SD = 7.4) took part in this study. The participants were randomly recruited at the Department of Experimental Psychology (University of Oxford) and other public places, based on their interest in taking part. At the recruitment stage, no information about the specific aims of the study were provided. All of the participants confirmed that they had no cold or flu, that their senses of smell and taste were not impaired, and that they did not suffer from any allergies to dairy products. The procedures were explained to all participants in detail and informed consent was obtained prior to participation. The experimental procedure was approved by the Ethics Committee of the Department of Experimental Psychology, University of Oxford. The experiment lasted for approximately 15 min and the participants were given a 5 GBP gift voucher in return for taking part in the study.

2.2. Stimuli

2.2.1. Spoons

The spoons used in this study were the same as those used in Laughlin et al.'s (2011) study, each of exactly the same size, shape, and texture. Given Laughlin et al.'s results, four of the same teaspoons were used: three stainless steel spoons electroplated with either gold, zinc, or copper to a thickness of 10 microns (0.01 mm), and a fourth spoon that remained as stainless steel (see Fig. 1). According to Laughlin et al., 10 microns provides a homogeneous layer with no possibility of exposure to the stainless steel lying beneath the electroplating. Thus the spoons had almost exactly the same weight, since the electroplated layer is thin enough to contribute very little extra weight to the spoons. These metals were selected on the basis of their non-toxic status, suitability for contact with human skin and mucus membranes, their susceptibility to electroplating, and the ease with which they could be sterilized.

2.2.2. Food stimuli

Four creams were prepared by adding 20 g of table sugar (sweet), 5 ml of freshly squeezed lemon juice (sour), 5 g of lemon pith (bitter), and 5 g of table salt (salty) per 100 g of extra thick double cream (50.5% fat; Tesco, UK) to obtain creams of distinguishable tastes/flavours. Plain cream was also used as a "control" sample.

2.3. Procedure

The participants were seated in front of a screen and were given the instructions orally and in written form prior to the start of the study. The experiment followed a full-factorial (4×5) design, resulting in a total of 20 tastings with the participants' eyes closed during tasting. The order in which the spoons were presented was randomized between participants, and the order in which the samples were presented was also randomized for each of the spoons. At the start of the experiment, participants were asked to rinse their mouths with still spring water (Harrogate Spa, UK) served at room temperature. After the instruction screen, a three digit random number appeared on the screen, indicating to the experimenter which sample and spoon to give to the participant. Approximately five grams of cream were served during each tasting. The participants were instructed to close their eyes. Once they had done this, the handle of the first spoon was placed in their hand. Note that the participants were not informed that spoons of different materials would be given to them. The participants