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Perceived naturalness of water: The effect of biological agents and beneficial human action

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ABSTRACT

Perceived naturalness is an increasingly important aspect of consumer choice. A number of factors, including the involvement of human action, are known to influence perceptions of naturalness in the food domain. However, the effect of biological agents remains unknown. The first study, therefore, compared the effect of biological and human action on the perceived naturalness of treated spring water. Four strategies for adjusting the mineral concentration of spring water were proposed in the study: mineral addition, using acids and bases to adjust pH thereby re-solubilising precipitated minerals, pH adjustment by microbes already present in the water or by microbes brought in from another spring. Results showed that of the four treatments, microbes inherent to the spring water had the least negative effect on perceived naturalness when compared to the other three treatments, all of which involved some form of human action. This implies that biological agents have a less negative effect on perceived naturalness than human agents. The second study examined, based on the link between perceived naturalness and healthiness, whether human action would have a less negative impact on perceived naturalness if it improved the healthiness of the final product. We hypothesised that action that improved the healthiness of water would not reduce perceived naturalness. Our hypothesis was, however, disproved. Water with elemental concentrations adjusted to recommended levels was seen as healthier but less natural, suggesting that healthiness and naturalness are judged separately so that even where healthiness is increased, human action still results in lower perceived naturalness.

1. Introduction

Consumers, particularly in the developed world, display an increasing desire for natural products such that the mere inclusion of the word 'natural' seems to improve people's perceptions of whatever entity it is applied to, be it food, cosmetics, medicine or the environment (Román, Sánchez-Siles, & Siegrist, 2017). Rozin et al. (2004) categorised the beliefs underlying consumers' preference for naturalness as being either instrumental, or ideational. Ideational beliefs are largely hinged on the view that natural entities are morally and/or aesthetically superior because they represent the original state, or because they are untouched by human intervention. This would explain why wild types are perceived as more natural and better than varieties with genetic modifications. Ideational beliefs can be quite potent in directing consumers' preferences. For instance, even when the healthfulness of food, or the effectiveness of medicine were said to be identical for natural and synthetic exemplars, people with a preference for natural continued to prefer the natural exemplar (Rozin et al., 2004). Similarly, consumers rated additives said to be from a natural source as significantly more natural than nature-identical alternatives, and perceived no significant difference between synthetic and nature-identical additives (Siegrist & Sütterlin, 2017). Perceptions and acceptance of synthetic chemicals, therefore, seem impervious to evidence of chemical identity, leaving ideational preferences for naturalness to play a significant role in consumer choice.

Instrumental beliefs, on the other hand, have to do with functional or material superiority. In the food domain, for instance, natural foods are often described as having superior sensory characteristics in terms of taste, or as possessing higher nutritive value. An important aspect of naturalness beliefs in the instrumental category is that naturalness is diminished by human action or contact, because of the inherent malevolence of humans. In other words, natural entities are 'good', and human intervention almost always reduces this goodness.

1.1. Naturalness in the food domain

The preference for natural is quite considerable in the food domain where perceptions of naturalness are often linked to constructs as

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varied as healthiness, nutritive suitability, purity, safety and environmental friendliness (Bearth, Cousin, & Siegrist, 2014; Evans, de Challemaison, & Cox, 2010; Rozin et al., 2004; Scotter, 2011; Siegrist, Hartmann, & Sütterlin, 2016; Siegrist & Sütterlin, 2017). Studies also show that consumers perceive organic foods as more natural than conventionally-farmed produce. Verhoog, Matze, van Bueren, & Baars (2003) argue that perhaps this is due to the fact that organic farming techniques are seen as interfering less radically with nature e.g. avoidance of routine medication of livestock and biological pest control instead of synthetic pesticides. Production techniques perceived as natural therefore result in foods perceived as natural, and in turn, safer, healthier and better tasting (Bäckström, Pirttilä-Backman, & Tuorila, 2004; Gottschalk & Leistner, 2013; Siipi, 2013).

This strong preference for naturalness in the food domain also influences the acceptance of foods and food technologies. The less natural a food or food production technology is perceived to be, the less acceptable it is likely to be to consumers. Recent studies on cultured meat, for instance, show that consumers find the production process i.e. laboratory-based tissue culture, unnatural, and as a result, may not be receptive to the idea of consuming cultured meat (Siegrist & Sütterlin, 2017). Consumers prefer meat that is 'natural' in its production, which translates to not being heavy on technological intervention, in this case, laboratory culturing (Verbeke et al., 2015). Similar concerns also characterise foods containing genetically engineered material, because the technology is considered unnatural. Frewer, Howard, and Shepherd (1996) found that foods with genetically-engineered material were perceived as significantly less natural than conventional produce, and that this affected consumers' intentions to purchase. Similar effects have been reported with respect to synthetic food colouring and the use of E-numbers in food labels: both have been shown to reduce the perceived naturalness of foods, making some food items less acceptable to consumers (Bearth et al., 2014; Evans et al., 2010; Siegrist & Sütterlin, 2017).

Perceived naturalness is, therefore, a pervasive and significant concept of naturalness in the food domain. Notwithstanding, it is not fully defined. Nevertheless, significant contributions to describing the concept have been made by Rozin and his colleagues (Rozin, 2005, 2006; Rozin et al., 2004; Rozin, Fischler, & Shields-Argeles, 2009; Rozin, Fischler, & Shields-Argelès, 2012), by delineating what seems to destroy or reduce naturalness in entities. It shows that in judgements of perceived naturalness:

(i) More weight is assigned to a product processing history compared to its final content. Spring water with minerals subtracted and then added back (two processes) is perceived as less natural than water with minerals subtracted in one step, even though the former is chemically more similar to the original (content) (Rozin, 2006). Thus, the more processes a product undergoes, the less natural it becomes;

(ii) Physical transformations are less destructive of perceived naturalness than chemical transformations. Removing fat from milk to produce skim milk has a greater effect on perceptions of naturalness when compared to squeezing oranges for juice (Rozin, 2005); even though it could be argued that both are physical processes;

(iii) Additivity dominance. This concept describes the fact that addition of an entity seems to diminish the perceived naturalness of a products, as compared to removal. So skim milk (fat removed) is perceived as more natural than milk with added vitamin D (Rozin et al., 2009);

(iv) Human contact significantly reduces perceived naturalness.[1] This seems to be underpinned by notions of the superiority of nature and the malevolence of human nature (Rozin et al., 2004). According to this view, natural entities are better, simply because they are natural, and human action only destroys or diminishes this inherent goodness. In other words, human action on entities seen as natural diminishes the inherent merits of the latter and reduces their perceived naturalness. Such ideational preferences are thought to be behind the opposition to genetic modification, a process seen as tampering with nature (Scott, Inbar, & Rozin, 2016; Sjöberg, 2000, 2004).

(v) It is defined, largely, by the absence of negatives so that consumers are more likely to explain it in terms of what it precludes e.g. 'no chemicals', 'no additives' and 'no processing'.

What is not known, however, is how human actors compare to biological entities. So in the case of water, for example, although Rozin's work (Rozin, 2006) showed that addition of minerals to spring water (human action) reduced its perceived naturalness, what the effect would be if the mineral adjustment had been achieved using a biological entity is unknown.

Also unclear is whether human action reduces perceived naturalness even where it results in a healthier product, especially considering the strong link between healthiness and perceived naturalness in the food domain (Lockie, Lyons, Lawrence, & Grice, 2004; Scotter, 2011; Verhoog et al., 2003). This is particularly interesting because previous research on the effects of human action on perceived naturalness were either unclear about the benefit of the action e.g. (Rozin, 2006), or had benefits that may have been deemed less important by consumers such as longer shelf life (Bearth et al., 2014; Evans et al., 2010; Siegrist & Sütterlin, 2017).

Using opinions on drinking water treatment, this work examines the effects of four different processes designed to restore mineral concentrations of spring water, on the perceived naturalness of the resulting water. The treatments involve the use of microbes, as well as the addition of minerals, and acids or bases. We expected that due to the association between biological entities and perceived naturalness, water treated using microbial agents would be perceived as more natural than that treated by addition of minerals or acids and bases. We also expected that this superior position of biological agents would hold even when the microbes were extraneous, especially if this alternative source was also perceived as natural e.g. another spring.

The second study investigated the effect of human action on perceptions of product naturalness where the action resulted in a healthier product. Groundwater was described as containing minerals (fluoride, calcium and magnesium) at concentrations above or below recommended levels. In one condition, human intervention to correct the concentrations was suggested and respondents were asked to rate the healthiness and their perceptions of naturalness of the water. In another condition, similar inappropriate concentrations were implied but no intervention was suggested. We hypothesised that, based on the link between naturalness and healthiness, action to increase the healthiness of the water would not reduce perceived naturalness of the treated water.

2. Study 1

2.1. Methods

Data for this study were collected via online experiments with participants recruited from the online participant tool (Amazon's Mechanical Turk). Mechanical Turk serves as a resource for scientific investigations and has been found to provide reliable data similar to those generated from online panels by conventional survey companies. In addition, Mechanical Turk samples more diversely compared to e-mail recruitment or college student samples. The experiments were advertised on the Mechanical Turk website as being about opinions on drinking water treatment.

Respondents in this study (N = 295) were 45.2% male and 54.8% female. The mean age was 45.4 (SD = 18.8) years, ranging from 18 to

[1] See Abouab and Gomez (2015) for a different view