Annals of Nutrition and Metabolism

Water and Behaviour Change

Ann Nutr Metab 2020;76(suppl 1):31–36
DOI: 10.1159/000515025

Received: April 7, 2020
Accepted: November 3, 2020
Published online: March 26, 2021

The Psychology of Desire and Implications for Healthy Hydration

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Keywords
Sugar-sweetened beverage · Water · Cognitive representations · Grounded cognition · Desire · Habits · Motivation · Health behaviour change

Abstract
This article discusses the cognitive mechanisms underlying the motivation to consume sugar-sweetened beverages (SSBs) and outlines implications for developing healthy hydration habits. While the detrimental health consequences of consuming SSBs are well understood, the psychological processes underlying the motivation to consume them are understudied. To address this gap, the current article applies a grounded cognition theory of desire and motivated behaviour, which can be used as a framework to understand and potentially change the motivation for SSBs and healthier alternatives, such as water. The grounded cognition theory of desire argues that people represent foods and drinks through potentially rewarding simulations, or re-experiences, of consuming them. These simulations, in turn, can increase desire and motivated behaviour. In line with this theory, research on eating behaviour shows that people think about attractive food in terms of what it feels like to eat it and in terms of relevant eating situations and that these simulations predict the desire to eat. Similarly, emerging research on SSBs shows that people represent these beverages in terms of the sensory and rewarding experiences of drinking them, more so than water, and especially if they consume them often. These simulations, in turn, predict the desire for sugary drinks and actual consumption. This has implications for attempts to increase healthy hydration: in order to facilitate healthy choices, the immediate pleasure to be gained from consuming a healthy beverage should be emphasized, rather than its long-term benefits. Repeatedly facilitating healthy drink choices in similar situations can ultimately contribute to the development of healthy hydration habits.

The Psychology of Desire and Implications for Healthy Hydration

The consumption of sugary drinks or sugar-sweetened beverages (SSBs) is very common but is associated with a number of negative health consequences. In the USA, for example, at least half of adults and two-thirds of US children and adolescents consume at least one SSB on a given day [1, 2]. In addition to negatively affecting dental health [3], this provides a large amount of sugar and discretionary calories. SSB consumption is correlated with body weight and weight gain over time, and it contributes to the development of metabolic syndrome and type II diabetes (e.g., [4–6]). Conversely, interventions that successfully reduce SSB intake typically lead to weight loss or prevention of weight gain [7–9]. In line with these findings, the Dietary Guidelines for Americans advise to consume beverages with no added sugar [10]. Therefore, it is

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important to understand what motivates SSB consumption, why people choose SSBs over water, and what can be done to support healthier choices.

Little research so far has addressed the question what drives SSB consumption, despite the negative health consequences. Among adolescents, SSB consumption is associated with other health behaviours such watching TV, high fast food consumption, and low fruit consumption [11]. Little is known, however, about the psychological factors underlying these associations. Factors like availability and pricing influence SSB consumption [12–15]. The exposure to soda commercials is associated with increased intake [16], whereas beliefs that drinking SSBs is harmful and contributes to weight gain are associated with decreased intake [17]. Qualitative research and surveys have further shown that adolescents and adults report drinking SSBs for their taste [18] because they quench thirst and make them feel healthy [19] and because of convenience and habits [18, 20].

These findings suggest that contextual factors as well as positive representations of drinks may play a key role in SSB consumption. However, the research so far has not systematically addressed what these representations are and how they lead to increased intake of SSBs. In other words, how do people think about SSBs, and how does this lead to the motivation to consume them? How is desire for SSBs triggered? Only once these mechanisms are well understood can we start designing the most effective interventions to facilitate healthier beverage choices.

Here, we introduce a cognitive science perspective to understand people's cognitive representations of SSBs and to establish which parts of these representations are associated with the desire and with SSB consumption. The remainder of this article will first outline the theoretical rationale for studying cognitive representations of foods and drinks. It will then present relevant findings in the domain of foods and alcoholic drinks and provide an overview of initial findings in the domain of non-alcoholic drinks, before discussing implications for researchers and health practitioners.

A Grounded Cognition Approach to Desire

Why study cognitive representations of foods and drinks? The grounded cognition theory of desire [21, 22] suggests that people represent foods and drinks by simulating what it is like to consume them and that such consumption and reward simulations can lead to desire and motivated behaviour. Consumption and reward simulations can be understood as mental re-experiences, or re-enactments, of previous consumption episodes. Based on a grounded cognition framework that has been developed in cognitive science [23], the theory argues that any episode of consuming a food or drink is stored in memory as a rich, multifaceted representation containing information about taste and texture, visual appearance, pleasure, and other immediate consequences of consuming, as well as information about the external context (e.g., other people present, time setting, and location), and internal states (e.g., emotions, goals, and bodily states). These representations can later be activated by relevant cues, for example, by seeing the food or drink (e.g., an image of a drink in an advertisement), by thinking about a consumption context (e.g., meeting friends), or by the emotional state that one typically consumes it in (e.g., feeling tired after a long day at work). Importantly, the remaining, non-present aspects of the representation can then be filled in and simulated, providing a vivid re-experience of consuming the food or drink. This way, merely seeing a picture of a food, such as a piece of cheesecake, can trigger a rich and compelling simulation of what it would be like to eat it, for example, experiencing its fresh and sweet taste, its creamy and crumbly texture, the reward from eating it, and the setting one might enjoy it in. Such simulations can be functional for making food-related decisions, since they provide predictions on anticipated pleasure. At the same time, simulating the consumption and reward of consuming unhealthy foods can also lead to unwanted and potentially unhealthy desires [24].

Consumption and Reward Simulations for Food

Recent research in the domain of food and eating behaviour shows that people experience eating simulations in response to cues of attractive foods and that these simulations lead to desire. These findings lend support for the key hypotheses of the grounded cognition theory of desire. When asked to "list typical features" of a number of highly attractive and a number of neutral foods [25], participants listed words describing the taste, texture, pleasure, and eating situations associated with the food (e.g., crispy, salty, delicious, and TV), but especially for the attractive, tempting foods (e.g., crisps). Neutral foods (e.g., rice) were more likely to be described in terms of visual, production, and health features (e.g., white, long, grows in Asia, and healthy; see Fig. 1). This suggests that when people think about attractive foods, they spontaneously think about eating them in a relevant eating situation and about the sensory aspects of these re-experiences.

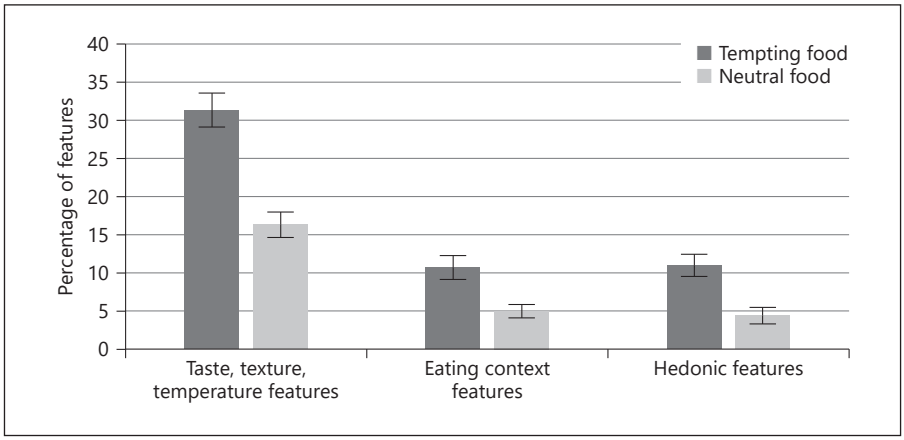

Fig. 1. Percentage of eating simulation features out of all features listed for four tempting foods (e.g., crisps and cookies) and four neutral foods (e.g., rice). Participants listed a higher percentage of taste (e.g., salty), texture (e.g., crunchy), and temperature features (e.g., warm); eating context features (e.g., Friday and TV); and hedonic features (e.g., delicious) for the tempting than the neutral foods. This figure is based on Papies (2013) and reproduced under a Creative Commons Attribution license.

Research on salivary responses to foods corroborates these patterns with different methods and further shows that eating simulations increase salivation, which may reflect the desire to eat a food. Keesman and colleagues [26] instructed participants in one condition to merely look at a food, and participants in the other condition to vividly simulate eating the food in front of them. For all participants, the amount of saliva produced and self-reported eating simulations were measured. Participants produced more salivation and reported stronger eating simulations in response to the attractive food (crisps) than the neutral food (bread with cheese). In addition, participants salivated more when instructed to simulate eating the food, and this effect was particularly pronounced when the food was attractive. This suggests that eating simulations can increase desire, especially for attractive food.

Recent work also suggests that increasing eating simulations through highly scaleable means, such as food labels and descriptions, can increase a food's attractiveness. Labeling healthy foods with words that refer to sensory characteristics (e.g., sweet and tangy) increased taste expectations and healthy choices, compared to labeling the same foods with health features (e.g., vitamin-rich and protein-packed; [27, 28]). These effects seem to be driven by increased eating simulations, as was shown in experiments manipulating the labels for meat-based and plant-based foods [29]. Here, food descriptions that contained words referring to sensory, hedonic, and eating context features increased eating simulations and perceived attractiveness of both plant-based and meat-based foods, compared to food descriptions that listed ingredients and visual features [29]. The effects of these simulation-based labels on food attractiveness were mediated by eating simulations ("I imagine what the food would taste and feel like"). Thus, food labels can be designed such that they trigger eating simulations, even for relatively unknown foods, which, in turn, can increase the attractiveness of a food.

Similar findings have been reported for other scaleable cues that increase consumption simulations. Showing images of a food, for example, in such a way that they facilitate eating simulations (e.g., showing yoghurt or pie with the spoon or fork ready to be picked up by one's dominant hand) has been found to increase desire through increased consumption simulations [30]. Similarly, showing a food (e.g., soup) in a matching eating context (e.g., kitchen) compared to a non-matching context (e.g., cinema) has been found to increase desire and expected liking through consumption simulations (Papies, van Stekelenburg, Smeets, Zandstra, & Dijksterhuis, unpublished data; see also [31]).

Consumption and Reward Simulations for Drinks

What can this approach tell us about why people consume sugary drinks? Research on the desire for drinks has produced initial findings that are consistent with the effects of simulations on desire for foods. As in the domain of food, the general pattern of findings suggests that drinks are represented through consumption and reward simulations and that these predict desire. Keesman and colleagues [32], for example, again using the feature listing method, found that alcoholic drinks are heavily represented in terms of drinking simulations, and especially in terms of the social context of drinking. The tendency to think about alcohol in terms of social drinking situations was further associated with alcohol cravings, with having intrusive alcohol thoughts in daily life, with finding alcohol highly tempting, and with choosing a voucher for an alcoholic drink over a voucher for a non-alcoholic drink as an additional reward for

the study. The same study also assessed representations of SSBs and found that these, too, were heavily represented in terms of consumption simulations, especially sensory features (e.g., sweet, cold, and sparkling), and more so than water.

In recent, unpublished work, we have focused on gaining a more detailed understanding of these representations of SSBs and water [Papies, Claassen, Rusz, & Best, unpublished data]. Across several experiments, we found that participants represent SSBs (cola and orange soda) more in terms of consumption and reward simulations than both bottled water and tap water. When describing cola, for example, participants listed words like *cold*, *sweet*, *bubbly*, *nice*, and *delicious*, while they described water in terms of *boring*, *convenient*, *clean*, and *available*. Notably, features describing positive immediate bodily consequences (e.g., *thirst-quenching*) were more pronounced for water than for sugary drinks. Participants' consumption and reward simulations were associated with the frequency of consuming the drinks in their daily lives; they, in turn, predicted the desire to drink, and they predicted actual intake when participants were thirsty. Notably, consumption and reward simulations predicted desire and intake more than thirst. Furthermore, participants listed very few long-term health consequences for the various drinks (e.g., healthy, unhealthy, and high in sugar), and these did not predict intake. Thus, while most participants are probably aware that water is healthier than SSBs, this was not very salient when they freely and spontaneously described the drinks.

These initial findings suggest that when describing beverages, participants simulated drinking them based on their previous consumption experiences, and these simulations predicted desire and intake. This interpretation is also consistent with neuro-imaging research among adolescents, which shows that tasting cola, as well as merely anticipating tasting it, activated gustatory and reward regions [33]. These neuro-imaging findings thus also suggest that when anticipating the drink, participants spontaneously simulate the taste and pleasure of drinking it.

Implications for Healthy Hydration

What are the implications of these findings for healthy hydration? How people think about drinks influences their drinking behaviour, and these representations, in turn, are heavily influenced by previous consumption experiences. Thus, people who frequently consume sugary drinks heavily represent them in terms of how good they taste and feel, which feeds into their desire to consume them again. However, experiences are not the only influence on cognitive representations. Research in the domain of food has shown how language and images can be used to trigger rewarding consumption simulations even for relatively healthy foods such as yoghurt, vegetable dishes, and fully plant-based meals. Thus, scaleable health communications and advertising can potentially be used to change the cognitive processes influencing desire. Crucially, however, desire is increased by increasing expectations of short-term reward, rather than by focusing on long-term health consequences. Applying this principle to hydration, increasing healthy hydration choices is likely to work better by making healthy drinks seem more rewarding in the moment than by emphasizing their purity or long-term health benefits.

Studying cognitive representations also reveals which kinds of product features can be used to boost short-term reward or desire. For some food products [25], for example, rewarding situational cues are very salient (e.g., evening, sofa, and TV). For alcoholic drinks, social context cues (Friday, fun, and friends) predict desire on a variety of measures [32]. For SSBs, we found that taste and texture features were more salient in participants' representations than their thirst-quenching properties, whereas the reverse was true for water. In other words, the perceived reward of a drink can come from all kinds of features, not only its taste. Carefully studying cognitive representations of drinks among a specific target group will be helpful for deciding which features to emphasize in order to increase the attractiveness of healthy drinks.

Can this approach be used to create healthier hydration habits? Changing cognitive representations of drinks through external cues, such as advertising, may increase the chances that people consider healthy alternatives when choosing a drink. To the degree that this leads to a consumption episode that is experienced as pleasant, more rewarding representations of healthy drinks will be consolidated in memory. As a result, rewarding consumption simulations may be triggered when again encountering the drink later, which, in turn, will increase the chances of repeated healthy choices. This is crucial to habit formation.

It is important to note, however, that drinking behaviour is highly susceptible to habit formation not only because it is performed with high frequency but also because it is performed in a relatively stable context [34], that is, in very similar situations across each day [35].

Therefore, to make healthy hydration choices habitual and to effectively counter unhealthy habits, interventions should try to trigger healthy choices with high frequency in several, stable contexts (e.g., always when waking up, at every office lunch, and with every cup of coffee; [35]). Once healthy drink choices have become habitual through frequent repetition in stable contexts, the emerging habits may also reduce the temptation of SSBs and therefore make healthier behaviour less effortful in the long term [35, 36].

Acknowledgements

The author is grateful to Maisy Best, Dorottya Rusz, and Lawrence W. Barsalou for useful discussions of the topics of this article.

Statement of Ethics

This article does not report original research, so ethics approval was not required.

Conflict of Interest Statement

E.K.P. received travel expenses and registration fee from Danone Research to attend the 2019 Hydration for Health Scientific Conference, the European Federation of the Associations of Dietitians 2019 Conference, and the 2020 European and International Congress on Obesity (online).

Funding Sources

The writing of this article was supported by the ESRC (Research Grant ES/R005419/1).

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