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No evidence that consumption and reward words on labels increase the appeal of bottled water

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ABSTRACT

Many people consume too much sugar from sugar-sweetened beverages (SSBs) and would benefit from drinking water instead. Previous research has shown that taste and reward expectations play a key role in food and drink choices, and that thinking about drinks in terms of consuming and enjoying them (i.e., simulations) predicts desire and intake. Here, we examined whether labels using consumption and reward words increased the appeal of water. In three pre-registered experiments with regular consumers of SSBs ($N = 1355$), we presented numerous different labels of fictitious water brands with words related to the rewarding consumption experience of water (e.g., "refreshing", "cool"), with conventional descriptions of water that emphasised its origin and purity, or with brand names only. We assessed anticipated reward of water, desire for water (Exp. 1, 2, 3), simulations of drinking water, and water attractiveness (Exp. 2 and 3). Contrary to our expectations, waters with consumption and reward-focused labels were not rated more favourably than waters with conventional labels, but both were rated higher than brand-only labels. Our findings suggest that the appeal of water cannot easily be increased by emphasising the rewarding consumption experience through language only, possibly because consumers may have a relatively fixed representation of what water tastes and feels like. Future research could test interventions that include stronger sensory information such as images to increase the appeal of water among SSB consumers.

1. Introduction

Water is an essential element for human life. According to the European Food and Safety Authority (2010), the recommended amount of daily water intake is about 2 L of fluids for women and 2.5 L for men. Insufficient hydration is a risk factor for developing kidney and metabolic disease (Perrier et al., 2020), negatively affects cognitive functioning, for example by decreasing attention levels, and can lead to negative mood states (Liska et al., 2019). Many consumers, however, do not meet the recommended daily intake of fluids. For instance, Ferreira-Pêgo et al. (2015) showed that across 13 countries spanning three continents, about 50% of respondents did not drink enough fluids. In addition, plain water (bottled and tap) only constituted a minority of total fluid intake, while the majority came from other beverages such as coffee, tea, fruit juices, and sugar-sweetened beverages (SSBs) (Kant, Graubard, & Atchison, 2009; Vieux, Maillot, Constant, & Drewnowski, 2017). In particular, the consumption of SSBs has been associated with having a higher BMI, metabolic disease prevalence, and poor dental health because of the high sugar content (Hasselkvist, Johansson, & Johansson, 2014; Malik, Pan, Willett, & Hu, 2013; Schulze et al., 2004). Thus, many people would benefit from consuming more fluids, and from replacing SSB consumption with water consumption.

Research suggests that a lack of knowledge about its health benefits and a lack of availability are important barriers for water consumption (Rodger, Wehbe, & Papies, 2021; Wippold, Tucker, Hogan, & Bellamy, 2020). Nevertheless, attempts to increase water intake and decrease intake of SSBs through education or by increasing access to water have been relatively ineffective (Dibay Moghadam, Krieger, and Louden (2020); Vézina-Im & Beaulieu, 2019). Self-regulatory and motivational processes underlying water consumption remain understudied and could provide potentially powerful avenues for intervention. Here, we focused on such motivational processes and examined whether emphasising rewarding aspects of water would increase its perceived attractiveness and people's desire to consume bottled water. This is especially relevant in food service and retail settings where people can choose between bottled water and SSBs, such as in convenience stores, in travel or entertainment settings, or in vending machines.

Research on motivation for food and beverages indicates that reward

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processes play a determining role in how we think about foods, and in consumption decisions (Berridge, 1996; van Koningsbruggen, Stroebe, & Aarts, 2011). Survey data and in-the-moment assessments of eating motives reveal that taste and reward are the principal motives driving food and beverage choices (Block, Gillman, Linakis, & Goldman, 2013; Glanz, Basil, Maibach, Goldberg, & Snyder, 1998; Wahl et al., 2020). Indeed, people use more words referring to sensory features, such as a product's taste and texture, and to reward features, such as a product's satiating or refreshing nature, when describing attractive foods and drinks than when describing unattractive ones (Papies, 2013; Papies, Claassen, Rusz, & Best, 2021).

The grounded cognition theory of desire and motivated behaviour proposes that rewarding simulations, or re-experiences, of consuming a food or drink underlie the motivation to consume (Papies & Barsalou, 2015; Papies, Barsalou, & Rusz, 2020). Each time a person consumes a food or drink, they encode a memory of this experience that includes different elements of information such as its sensory properties, internal states associated with the consumption experience (e.g., thirst, craving, refreshment), and situation-independent information such as how healthy the product is (Papies et al., 2020). When they later encounter a stimulus related to the food or drink, elements encoded in this memory ("situated conceptualisation"; Barsalou, 2009) are activated and re-experienced or simulated. These simulations can motivate behaviour and impact consumption decisions, especially if the encoded information is positively valenced (Higgs, 2016).

Indeed, activation of such eating simulations in experimental settings has been shown to increase desire for attractive foods (Cornil & Chandon, 2016; Elder & Krishna, 2012; Muñoz-Vilches, van Trijp, & Piqueras-Fiszman, 2019). Researchers have also made healthy foods more attractive to consumers by emphasizing rewarding consumption experiences. For instance, labelling vegetables with words referring to sensory and reward features increased the perceived tastiness of the vegetables as well as the choice for these vegetables, compared to labels that emphasised the health aspects of the vegetables (Turnwald, Boles, & Crum, 2017; Turnwald & Crum, 2019). Similar results have been found in a recent study in which the attractiveness of novel, plant-based foods was increased by describing them with words that evoke consumption and reward simulations (e.g., "crunchy", "aromatic", "pub favourite", "warming"; Papies, Johannes, Daneva, Semyte, and Kauhanen, 2020). These descriptions increased the degree to which participants spontaneously thought about eating the foods, which in turn increased the attractiveness of the foods.

Applying this reasoning to the domain of water, a promising way to increase the motivation to drink water may thus be to increase the degree to which people think about water in terms of its sensory and rewarding properties, or in other words, the degree to which they simulate drinking and enjoying it (see also Krishna & Schwarz, 2014; Piqueras-Fiszman & Spence, 2015).

1.1. Overview

Here, we present three experiments testing whether labels for fictitious water brands that emphasise consumption and reward experiences increase the appeal of bottled water. We used fictitious brands to rule out any effects of pre-existing attitudes or associations. We focused on labels, given that visual information is the first point of reference for consumers and has been shown to affect taste perceptions and reward expectations of water (Cho, 2019; Risso, Maggioni, Olivero, & Gallace, 2015). We only showed the label text, without a bottle or other visual information. More specifically, we examined whether adding words related to rewarding consumption experiences on water labels (i.e., simulation-enhanced labels), increases anticipated reward and desire (Exp. 1, 2, 3), as well as sensory and action simulations of drinking the water (e.g., to what extent one can imagine its taste and mouthfeel) and attractiveness of the water (Exp. 2 and 3), compared to labels that mention only the brand name, or conventional descriptions of water that emphasise the origin and purity of the water (Wilk, 2006). In addition, we examined possible pathways linking simulation-enhanced labels with increased perceptions of attractiveness and desire for water through increases in anticipated reward of water.

Across all experiments, we targeted participants who consumed SSBs at least once a week. This allowed for more precise conclusions regarding the effectiveness of water labels as a behaviour-change intervention among people who may perceive water as not very rewarding and who would benefit most from switching from SSBs to water.

All experiments were sequentially pre-registered on the Open Science Framework where all materials, data, and analysis scripts can be accessed (see https://osf.io/d82h6/?view_only=b7900061b90c4946a4d2e1fe7206430a). Hypotheses were specified before any data was collected. In our analyses, we clearly distinguished between confirmatory analyses to test our hypotheses and exploratory analyses. Our main drink of interest was bottled water, and we used SSBs as filler drinks. We also pre-registered supplementary analyses for SSBs, compared label types between water and SSBs, and examined possible covariates. All the results of these exploratory tests as well as additional information about stimuli can be found in the Supplementary Online Material (SOM), and they do not bear on the main findings of the paper. We report all measures, manipulations, and exclusions. Sample sizes were determined prior to data collection and collection was discontinued prior to data analysis. All analyses were conducted in *R* (R Core Team, 2020).

2. Experiment 1

In Experiment 1, we tested the hypotheses that presenting water with a simulation-enhanced label would increase anticipated reward (Hyp. 1) and desire (Hyp. 2) for water compared to a control label or a brand-only label. In addition, we predicted that presenting water with a simulation-enhanced label would increase desire for water compared to a control label through increased anticipated reward (mediation; Hyp. 3).

2.1. Method

2.1.1. Participants

Based on a power analysis and data simulation, we calculated that we needed a minimum sample size of $N = 450$ to detect a small-to-medium effect size with 90% power for the indirect pathway linking label type with desire through anticipated reward. To account for possible exclusions, we aimed to collect data from 500 participants.

Participants participated at a location of their choosing through the online platform Prolific (www.prolific.co) if they 1) were living in the UK, 2) were between 18 and 70 years old, 3) consumed SSBs at least once a week, and 4) did not report any reason for which they could not consume SSBs (e.g., allergies/medical reasons).

We collected data from $N = 502$ participants. Based on our pre-registered exclusion criteria, we excluded participants who did not participate on a laptop or desktop computer ($n = 17$). The final sample consisted of $N = 485$ participants of which 57.7% identified as female, 41.6% as male, and 0.70% as nonbinary or other. The mean age was 31.9 ($SD = 10.1$) years.

2.1.2. Experimental design

The design was a 3 Label Type (brand-only vs. control vs. simulation-enhanced) between-participants design. Participants were randomly shown the text of one of the three bottled water labels (see Table 1), and were asked to rate anticipated reward and desire for the water. As a filler drink, participants were also presented with a label of the same type for an orange soda. The order of bottled water and orange soda was counterbalanced. Brand-only labels included only a brand name, while control labels included additional information about the drink's natural origin, and simulation-enhanced labels included additional words related to the sensory and rewarding experience of consumption. See

Table 1
Experimental Label Type conditions used in Experiment 1.

	Water	Orange soda
Brand-only	San Perrio, a mineral water	Orange Pop, an orange soda
Control	San Perrio, a mineral water. Carefully drawn from Alpine springs on organic protected land	Orange Pop, an orange soda. Carefully crafted in the Mediterranean from sun-ripened organic oranges
Simulation-enhanced	San Perrio, cold and refreshing. An invigorating mineral water that gives your body a new feel, wherever you are	Orange Pop, sweet and happy. A fruity, energizing orange soda to share come rain or shine

Table 1 for the descriptions of each drink in each label type condition.

2.1.3. Procedure and measures

Participants could participate online between 12 PM and 9 PM. Participants were first asked for consent and to report their current level of thirst ($M = 54.5$, $SD = 21.7$) on a 0–100 Visual Analogue Scale (VAS) with the anchors 0 = *not at all*, 50 = *somewhat*, and 100 = *definitely*.

Participants were then presented with the descriptions of the drinks and asked to rate each on three measures responding on a 0–100 VAS with the anchors 0 = *not at all* to 100 = *Definitely/Very much*. They were first asked to rate anticipated reward for the drinks: “When I read the description of this drink… a) I imagine that it would be refreshing, b) I imagine that it would taste very nice, c) I imagine that I would really enjoy drinking it.” The Cronbach’s alpha of these items for water was $\alpha = 0.89$ so they were combined into mean scores. Then, they rated the drinks on sensory and action simulations ($\alpha = 0.83$ for water): “When I read the description of this drink… a) I imagine drinking it, b) I imagine what it would taste like, c) I Imagine what it would feel like in my mouth.” Lastly, they rated to what extent they desired the drinks: “How much would you like to drink this drink right now?”

Participants were then asked to report their consumption frequency of bottled water and orange soda (any kind or brand) on a 0–100 VAS with anchors 0 = *never*, 50 = *sometimes*, 100 = *very often*. Next, we measured how healthy participants thought bottled water and orange soda (any kind or brand) were (0–100 VAS with anchors 0 = *not healthy at all*, 50 = *somewhat healthy*, 100 = *very healthy*), and we assessed their intentions to change their behaviour with regards to (1) increasing their water consumption, (2) decreasing their SSB consumption, and (3) drinking more water instead of SSBs (0–100 VAS with anchors 0 = *strongly disagree*, 50 = *neither agree nor disagree*, 100 = *strongly agree*). Cronbach’s alpha for these items was $\alpha = 0.79$, so answers to items were combined into a ‘healthy drinking intentions’ score ($M = 72.1$, $SD = 19.8$). Finally, we collected self-reported demographic information, including age, country of residence, height, body weight, and whether there was any reason for which they could not currently consume any of the drinks featured in the survey.

2.1.4. Analysis plan

Two-sample *t*-tests (Welch method) were used to examine the effect of Label Type on the dependent variables. We adjusted our alpha level from $p < .050$ to $p < .025$ in order to control for multiple comparisons. For the mediation analysis we used the *lavaan* package (Rosseel, 2012). We based our plots on the code provided by Allen, Poggiali, Whitaker, Marshall, and Kievit (2018).

2.2. Results

2.2.1. The effect of label type (Hyp. 1–2)

In contrast to our hypotheses, there was no difference in anticipated reward or desire between the water with a simulation-enhanced label and the one with a control label. Compared to the water with a brand-only label, the water with the simulation-enhanced label was anticipated to be more rewarding, but not more desirable. See Table 2 for the statistics and Fig. 1 for an overview of these results.

2.2.2. The mediating role of anticipated reward in the effect of label type on desire (Hyp. 3)

Although there was no effect of the simulation-enhanced label on desire compared to the control label, we conducted the pre-registered mediation analyses in accordance with current practices which allows this even in the absence of a direct effect (Imai, Keele, & Tingley, 2010; MacKinnon, Krull, & Lockwood, 2000; Zhao, Lynch, & Chen, 2010). Results from these analyses revealed no significant indirect effect of label type on desire through anticipated reward ($b = -0.04$, $p = .971$).

2.3. Conclusion

Contrary to our hypotheses, we found no evidence that a simulation-enhanced label increased anticipated reward of or desire for water, compared to a conventional label advertising its origin and purity. However, compared to water with a label that consisted only of a brand name, water with a simulation-enhanced label was anticipated to be more rewarding to consume.

3. Experiment 2

Experiment 2 was designed to test the same hypotheses with more statistical power. Thus, we now opted for a within-participants design. We also used a larger set of labels to rule out label-specific effects. Lastly, we added a measure of water attractiveness as an additional measure of the rewarding aspect of water that may be more sensitive than a measure of desire for water.

We specified four hypotheses, namely that simulation-enhanced labels would increase sensory and action simulations (i.e., simulations of drinking the water and experiencing it with one’s senses; Hyp. 1), anticipated reward (Hyp. 2) attractiveness (Hyp. 3) and desire (Hyp. 4) for water compared to control and brand-only labels. We also predicted that simulation-enhanced labels would increase attractiveness of water compared to control and brand-only labels through increased anticipated reward (mediation; Hyp. 3b) and that simulation-enhanced labels would increase desire for water compared to control and brand-only labels through increased anticipated reward (mediation; Hyp. 4b).

3.1. Method

3.1.1. Participants

Sample size was determined with a power analysis for linear mixed effects models using PANGEA (Westfall, 2016). Considering the combination of limitations in regards of stimuli creation (i.e., a high number of water labels) and number of participants needed, we settled for a design with 30 stimuli and a minimum of $N = 335$ participants in order to detect a medium-sized effect of label type on desire ($d = 0.30$) with 80% power.

Based on our pre-registered inclusion criteria, we first ran a demographic screening survey on Prolific ($n = 1000$) to select participants who 1) were living in the UK, 2) were between 18 and 70 years old, 3) consumed SSBs at least once a week, and 4) did not report any reason for which they could not consume SSBs (e.g., dietary restrictions or allergies). Eighty-four percent met our inclusion criteria and among those, $N = 379$ completed the final survey. We excluded participants who did not fill in the survey on a laptop or desktop computer ($n = 39$), reported a reason for which they could not consume SSBs ($n = 2$), provided the same answer on 90% of trials ($n = 1$), or had an implausibly short (i.e., <1/4 of the average) or long (i.e., >4 times the average; $n = 1$) completion time. The final sample consisted of $N = 337$ participants of which 58.5% identified as female, 40.7% as male, and 0.80% as non-binary/other. The mean age was 32.9 ($SD = 10.7$) years.

Table 2
Means and test statistics comparing water with a simulation-enhanced label to water with a control label and to water with a brand-only label.

	Brand-only	Control	Simulation-enhanced	Brand-only vs. simulation enhanced		Control vs. simulation-enhanced	
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*t* (df)	*p*	*t* (df)	*p*
Anticipated reward	58.1 (23.4)	64.1 (22.1)	64.0 (21.6)	−2.35 (319)	0.019	0.04 (320)	0.971
Desire	50.1 (26.6)	55.8 (27.4)	54.7 (28.0)	−1.51 (318)	0.133	0.36 (319)	0.723

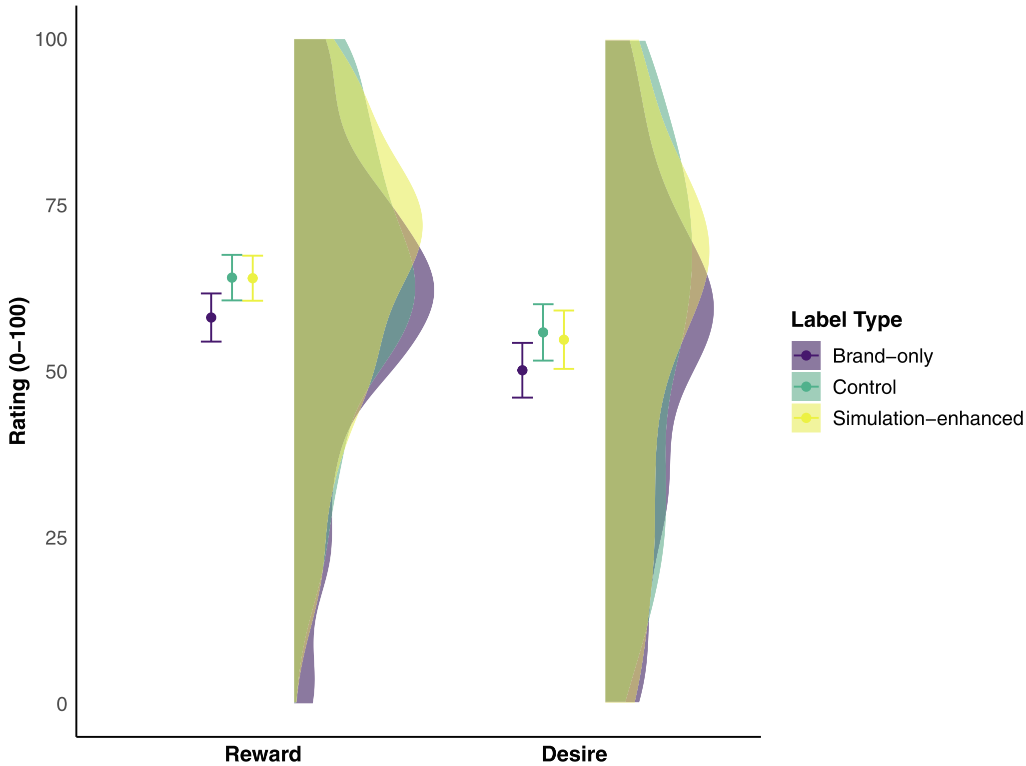

Fig. 1. Anticipated reward and desire ratings for waters with different label types in Experiment 1. The density plots represent the distribution, the point and error bars represent the means and 95% confidence intervals.

3.1.2. Experimental design

The design was a 3 Label Type (brand-only vs. control vs. simulation-enhanced) within-participants design. Participants were presented with multiple labels of bottled waters and were asked to rate them on the following dependent variables: 1) sensory and action simulations, 2) anticipated reward, 3) attractiveness, and 4) desire. As filler drinks, participants were also presented with multiple SSB labels and were asked to rate them on the same measures.

3.1.3. Stimuli

We created 30 water drink items across the three Label Type conditions: 30 brand-only labels, 30 control labels and 30 simulation-enhanced labels (see Table 3). Brand-only labels were again created using fictitious brand names. The other labels included the same brand names but contained additional words: control labels were created by including words referring to the origin of the product, its content (e.g., “organic”, “minerals”) or its long-term positive health consequences (e.g., “stay healthy”); simulation-enhanced labels included words related to immediate positive consequences of consumption (e.g., “refreshing”), hedonic features (e.g., “delicious”), or sensory features (e.g., “cool”, “smooth”). A smaller set of 12 drinks was created for SSBs (filler items). Across label types, labels contained an average of four critical features. See the SOM for more details.

Table 3
Examples of labels used in Experiment 2.

	Water	Sugar-sweetened beverage
Brand-only	St. Moulin water	Sunkiss soda
Control	St. Moulin brings you water from organic plains of Tuscany. Original in nature	Only the best berries go into Sunkiss: An all-natural soda from Tuscany
Simulation-enhanced	Indulge in refreshment: A cool splash of St. Moulin water will instantly restore your body and mind	Celebrate life with the bubbly goodness of a cold can of Sunkiss soda: Made for your pleasure

3.1.4. Counterbalancing

In total there were 90 water items. To prevent participant fatigue, we assigned the items randomly across six counterbalanced sets of 15 items each, which participants were randomly assigned to. Each participant thus rated 15 different water items (five for each Label Type) and six different SSB filler items. Counterbalancing was done in such a way that no participant would rate an item or brand twice, and all the items were shown equally often.

3.1.5. Procedure and measures

Participants could access the online survey between 2PM and 5PM on weekdays. Participants were instructed to complete the survey on a laptop or desktop computer, and not to consume any food or drink while participating. Participants were first asked to provide consent and rate their thirst ($M = 54.5$, $SD = 23.3$).

The procedure was identical to Experiment 1 except for the following changes: 1) We changed the order of the main dependent variables and added one, namely, attractiveness. Participants were now asked to first answer questions about sensory and action simulations ($\alpha = 0.94$), then anticipated reward ($\alpha = 0.95$), then attractiveness (i.e., "How attractive does this drink sound to you?" 0–100 VAS), and finally desire. 2) Instead of asking consumption frequency and healthiness ratings of orange soda specifically, we asked participants to assess these questions in relation to SSBs in general. Healthy drinking intentions ($\alpha = 0.80$) were assessed as in Experiment 1 ($M = 71.6$, $SD = 21.2$).

3.1.6. Analysis plan

Our within-participants design allowed us to use a maximal random effects structure (Barr, Levy, Scheepers, & Tily, 2013) through inclusion of a random intercept and slope for participant and for drink item. We tested our hypotheses by specifying models using the *lmer* function of the *lme4* package (Bates, Mächler, Bolker, & Walker, 2015). We specified each model twice in order to compare (1) simulation-enhanced labels vs. control labels and (2) simulation-enhanced labels vs. brand-only labels, and adjusted alpha levels accordingly from $p < .05$ to $p < .025$. We assessed mediation with the *mediation* package (Tingley, Yamamoto, Hirose, Keele, & Imai, 2014) which relies on a quasi-Bayesian Monte Carlo method for variance estimation with 1000 simulations. Using this method, we could only specify one random effect and we selected the one that explained most variance. We again adjusted the alpha level to $p < .025$ for these analyses.

3.2. Results

3.2.1. The effect of label type (Hyp. 1–4)

Contrary to our hypotheses but in line with our findings in Experiment 1, participants did not report more sensory and action simulations, anticipated reward, attractiveness, or desire for waters with simulation-enhanced labels compared to waters with control labels. However, simulation-enhanced labels induced more sensory and action simulations and anticipated reward, and were rated as more attractive and desirable compared to brand-only labels. See Table 4 for test statistics and Fig. 2 for an overview of the results.

3.2.2. The mediating role of anticipated reward in the effect of label type on attractiveness (Hyp. 3b)

As reported above (section 3.2.1), there was no significant difference in attractiveness ratings between simulation-enhanced labels compared to control labels. Nevertheless, there was a significant negative indirect pathway linking this Label Type comparison with attractiveness through anticipated reward, suggesting that contrary to our hypothesis, control labels led to increased attractiveness through higher anticipated reward, compared to simulation-enhanced labels. This effect was likely driven by a highly significant relationship between anticipated reward and attractiveness: waters that were anticipated to be more rewarding were also perceived as more attractive.

In addition, there was a significant positive indirect pathway, which showed that the higher attractiveness of simulation-enhanced labels compared to brand-only labels was also explained by anticipated reward. The direct effect of Label Type on attractiveness remained significant, suggesting that the higher attractiveness of waters with simulation-enhanced labels compared to brand-only labels was only partially mediated by increased anticipated reward (see Table 5).

3.2.3. The mediating role of anticipated reward in the effect of label type on desire (Hyp. 4b)

As reported in section 3.2.1, there was no significant difference in desire ratings between simulation-enhanced labels and control labels. Nevertheless, again there was a significant negative indirect pathway linking this Label Type comparison to desire, again suggesting that, contrary to our hypothesis, control labels led to increased desire through higher anticipated reward, compared to simulation-enhanced labels.

Comparing simulation-enhanced labels to brand-only labels revealed a significant positive indirect effect on desire. Moreover, the direct effect of Label Type on desire was no longer significant, suggesting that anticipated reward mediated the higher levels of desire for waters with simulation-enhanced labels compared to brand-only labels (see Table 5).

3.3. Conclusion

Overall, simulation-enhanced labels increased sensory and action simulations, anticipated reward, attractiveness, and desire for water compared to brand-only labels, but not compared to conventional labels that emphasised the origin and purity of water. This was contrary to what we expected but provided a direct and highly powered replication of the results of Experiment 1.

Mediation analyses showed a positive indirect effect of simulation-enhanced labels on attractiveness and desire for water compared to brand-only labels, partially through increased anticipated reward. In addition, there was also a significant negative indirect effect of simulation-enhanced labels on attractiveness and desire compared to control labels, suggesting that although the direct effect of this label type comparison was not significant, anticipated reward, here induced by control labels, plays a role in determining a water's appeal.

Our results so far suggest that labels that emphasise the rewarding aspects of water are equally attractive to participants as conventional labels that emphasise the origin or purity of water, and are both more attractive than brand-only labels. When considering water, information about its origin and purity may be equally important as expectations regarding taste and reward. Even more, these features may contribute to making water seem rewarding as suggested by the results of our mediation analyses. Thus, Experiment 3 was designed to test whether increasing the salience of water's sensory and rewarding features can further increase its attractiveness in addition to the conventional way of advertising water emphasising origin and purity. For this purpose, we created new "combined" labels that used *both* words related to consumption and reward, as well as origin-related words. We compared these combined labels to both simulation-enhanced and control labels as well as to brand-only labels.

4. Experiment 3

We hypothesised that combined labels (i.e., labels including both simulation-enhancing and origin-related words) would increase sensory and action simulations (Hyp. 1), anticipated reward (Hyp. 2), attractiveness (Hyp. 3), and desire (Hyp. 4) for water compared to simulation-enhanced, control, or brand-only labels. In addition, we predicted that combined labels would increase attractiveness of water compared to

Table 4
Means and test statistics comparing waters with simulation-enhanced labels to waters with control labels and to waters with brand-only labels.

	Brand-only	Control	Simulation-enhanced	Brand-only vs. simulation- enhanced		Control vs. simulation-enhanced	
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*b* (*SE*)	*p*	*b* (*SE*)	*p*
Sensory and action simulations	44.2 (25.0)	56.6 (24.1)	56.0 (23.9)	11.8 (1.17)	<0.001	−0.61 (0.92)	0.513
Anticipated reward	47.4 (24.4)	61.2 (22.9)	59.8 (22.9)	12.0 (1.08)	<0.001	−1.45 (0.80)	0.079
Attractiveness	44.2 (26.9)	59.8 (24.8)	58.0 (24.8)	13.8 (1.17)	<0.001	−1.85 (0.94)	0.056
Desire	43.4 (27.4)	56.7 (26.5)	55.1 (26.6)	11.7 (1.17)	<0.001	−1.59 (0.85)	0.068

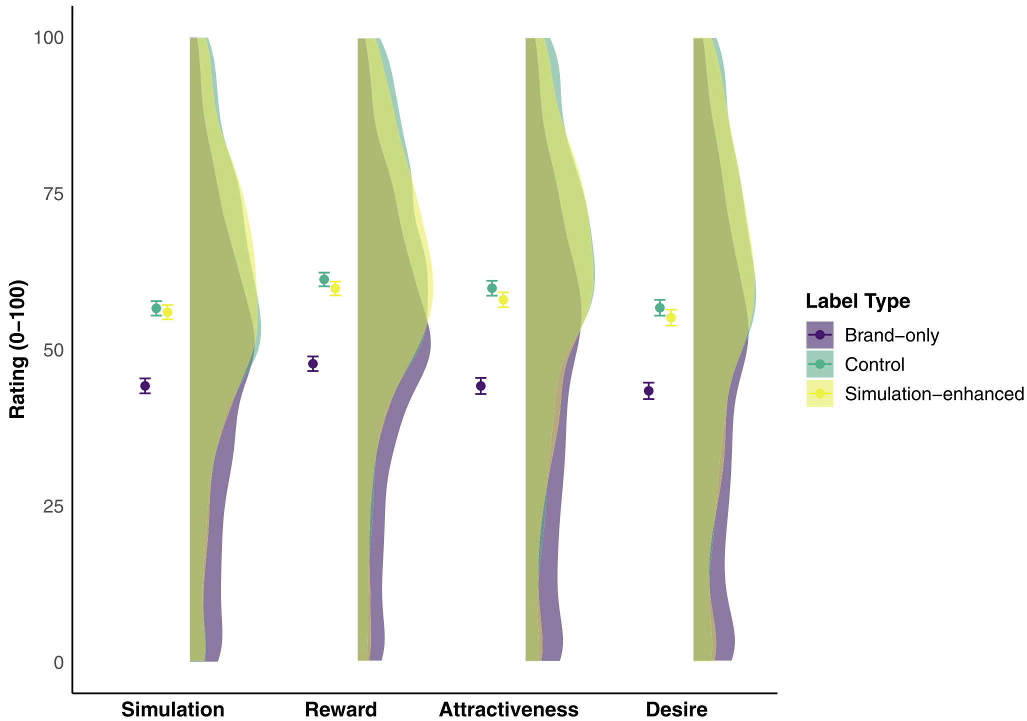

Fig. 2. Sensory and action simulations, anticipated reward, attractiveness, and desire ratings for waters with different label types in Experiment 2. The density plots represent the distribution, the point and error bars represent the means and 95% confidence intervals.

Table 5
Results of mediation analyses Experiment 2.

Impact of label type on attractiveness mediated by anticipated reward				
	Control vs. simulation-enhanced		Brand-only vs. simulation-enhanced	
	b **(95% CI)**	***p***	***b*** **(95% CI)**	***p***
Total effect of	−1.85 (−3.04, −0.67)	0.004	13.8 (12.5, 15.0)	<0.001
Direct effect	−0.50 (−1.26, 0.25)	0.178	2.39 (1.62, 3.15)	<0.001
Indirect effect	−1.35 (−2.27, −0.45)	0.004	11.4 (10.3, 12.4)	<0.001
Proportion mediated	0.73 (0.41, 1.23)	0.004	0.83 (0.77, 0.88)	<0.001
Impact of label on desire mediated by anticipated reward				
	Control vs. simulation-enhanced		Brand-only vs. simulation-enhanced	
	b **(95% CI)**	***p***	***b*** **(95% CI)**	***p***
Total effect	−1.58 (−2.73, −0.47)	0.006	11.7 (10.4, 13.0)	<0.001
Direct effect	−0.28 (−1.07, 0.44)	0.492	0.68 (−0.15, 1.48)	0.110
Indirect effect	−1.30 (−2.18, −0.43)	0.006	11.0 (9.96, 12.0)	<0.001
Proportion mediated	0.83 (0.44, 1.58)	0.004	0.94 (0.88, 1.01)	<0.001

simulation-enhanced, control, or brand-only labels through increased anticipated reward (mediation; Hyp. 3b), and we predicted the same pattern for desire (mediation; Hyp. 4b).

4.1. Method

4.1.1. Participants

Sample size was determined with a power analysis for linear mixed effects models using PANGEA (Westfall, 2016). We settled for a design with 24 stimuli and a minimum of $N = 348$ participants in order to detect a medium-sized effect ($d = 0.30$) with 80% power for the indirect pathway linking label type with desire through anticipated reward.

We ran the same demographic screening survey on Prolific as for Experiment 2 to select participants that met our inclusion criteria, excluding participants of Experiment 1 and 2 from this survey. One thousand participants (63% of the pre-screened sample) met our inclusion criteria and among those, $N = 397$ completed the final survey. We excluded participants who were under 18 years of age ($n = 1$), reported a reason for which they could not consume SSBs ($n = 1$), or provided the same answer in 90% of trials ($n = 3$). The final sample consisted of $N = 392$ participants of which 58.4% identified as female, 40.8% as male, and 0.08% as other. The mean age was 34.4 ($SD = 11.6$) years.

4.1.2. Experimental design

The design was a 4 Label Type (brand-only vs. control vs. simulation-enhanced vs. combined) unbalanced design. Participants were randomly assigned to one of three conditions that each consisted of a different combination of three label types:

- o Condition 1: Brand-only, Control, Simulation-enhanced
- o Condition 2: Brand-only, Control, Combined
- o Condition 3: Brand-only, Simulation-enhanced, Combined

Participants were presented with multiple fictitious bottled water labels and asked to rate 1) sensory and action simulations, 2) anticipated reward, 3) attractiveness, and 4) desire. As filler items, participants were also presented with multiple SSB labels.

4.1.3. Stimuli and counterbalancing

We used 96 water labels across the four Label Type conditions. These were counterbalanced across 9 blocks of 12 waters. For SSBs, this totalled 36 labels which were counterbalanced across 9 blocks with each 4 labels. Participants were randomly assigned to one block of each drink type and thus rated 16 labels in total.

We used the labels from Experiment 2 to create the labels in this study. Based on the random slopes of the models tested in Experiment 2, we examined which features made simulation-enhanced labels most attractive compared to control labels and used this information to create combined labels. Based on this, we decided to create labels referring to 1) immediate consequences of consumption (e.g., "brighten your day with the refreshment" and "instantly restore your body and mind") and 2) the origin of the water (e.g., "from organic plains" and "naturally distilled from Scandinavia's finest mountain water"). In other words, we avoided references to long-term positive health consequences and hedonic features of consumption, but we kept words referring to the sensory experience of consumption. See Table 6 for an example of the labels and see the SOM for more details.

4.1.4. Procedure and measures

The procedure and measures were almost identical to those of Experiment 2. Participants were again asked for consent, and their level of thirst (M = 52.1, SD = 23.4). Then, for each label, they were first asked to report sensory and action simulations (α = 0.95) and anticipated reward (α = 0.94). For this measure, we sightly changed the items of our dependent variable anticipated reward to better match the critical features in our new labels. The changed question now read: "When I read the description of this drink… a) I imagine that it will be refreshing, b) I imagine that it will be energizing, c) I imagine that it will be good to drink this." Participants then rated the attractiveness of and their desire for each water, as well as consumption frequency, healthiness of the drinks, and healthy drinking intentions (α = 0.74; M = 68.8, SD = 20.1).

4.1.5. Data analysis plan

Analyses were identical to those of Experiment 2. In Experiment 3, each model was specified threefold in order to compare (1) combined labels vs. simulation-enhanced labels, (2) combined vs. control labels, and (3) combined vs. brand-only labels, so we adjusted alpha levels to p < .017.

4.2. Results

4.2.1. The effect of label type (Hyp. 1–4)

Participants did not report more sensory and action simulations, anticipated reward, attractiveness or desire for waters with combined labels compared to control labels. However, combined labels did increase anticipated reward, attractiveness and desire compared to simulation-enhanced labels, although the difference in desire did not hold when controlling for multiple comparisons (p < .017). Moreover, combined labels did not increase sensory and action simulations compared to simulation-enhanced labels. Combined labels were rated higher on all measures compared to brand-only labels. These results were only partially in line with our hypotheses. See Table 7 for test statistics and Fig. 3 for an overview of the results.

Table 6
Examples of labels used in Experiment 3.

	Water	Sugar-sweetened beverage
Brand-only	Sierra Nueva water	Classic Orange soda
Control	Sierra Nueva water from Spanish springs: A gift from the land to your youth	Take care of your health with Classic Orange soda: Made from oranges sun-ripened on the French Riviera
Simulation-enhanced	Taste the divine Sierra Nueva. This crisp and cool water will instantly invigorate you	Make your taste buds go crazy with Classic Orange: A sweet and fun soda to put you in a good mood
Combined	Sierra Nueva water from Spanish springs: This cool water will instantly invigorate you	Try Classic Orange: A fun soda made from oranges sun-ripened on the French Riviera

4.2.2. The mediating role of anticipated reward in the effect of label type on attractiveness (Hyp. 3b)

Comparing combined labels to control labels revealed no significant indirect effect on attractiveness of water. However, comparing combined labels to simulation-enhanced labels showed a significant positive indirect effect. The direct effect was no longer significant, suggesting that higher ratings of attractiveness of combined labels compared to simulation-enhanced labels were mediated by perceptions of higher anticipated reward.

Finally, comparing combined labels to brand-only labels also showed a significant positive indirect effect through anticipated reward. The direct effect of Label Type on attractiveness remained significant, suggesting a partial mediation (see Table 8).

4.2.3. The mediating role of anticipated reward in the effect of label type on desire (Hyp. 4b)

Comparing combined labels to controls labels revealed no significant indirect effect on desire. However, comparing combined labels to simulation-enhanced labels again revealed a significant positive indirect effect of Label Type on desire through anticipated reward. Moreover, the direct effect was no longer significant, suggesting that waters with combined labels were rated as more desirable because they were anticipated to be more rewarding than waters with simulation-enhanced labels.

Finally, comparing combined labels to brand-only labels also showed a significant positive indirect effect of Label Type on desire for water through anticipated reward. The direct effect of Label Type on desire remained significant, suggesting that anticipated reward only partially mediated the increased desire ratings for waters with combined compared to brand-only labels (see Table 8).

4.3. Conclusion

The results of Experiment 3 showed that overall, labels that used both consumption and reward words and origin words made the waters appear as attractive as control labels, which emphasised origin and purity. Specifically, combined labels led to higher ratings of anticipated reward and attractiveness compared to labels with only simulation-enhanced features and brand-only labels, but not compared to control labels. Similarly, combined labels induced more sensory and action simulations and desire compared to brand-only labels, but not compared to the other types of labels.

In line with these direct effects, mediation analyses revealed positive indirect effects linking waters with combined labels to higher attractiveness and desire through higher anticipated reward, compared to waters with simulation-enhanced labels. When compared to brand-only labels, this mediation was partial, but it was inexistent when compared to control labels. Thus, on a variety of measures and on a variety of tests, combined labels outperformed simulation-enhanced labels, but did not outperform control labels.

In summary, there was no evidence that adding sensory and reward words on water labels increased the appeal of water. On the contrary, the additional information about a water's origin and purity on combined labels made these waters seem more attractive than those that only included consumption and reward aspects. This is contrary to our main predictions across the experiments that words referencing consumption and reward experiences would increase the appeal of water for SSB consumers.

5. General discussion

5.1. Summary

Three well-powered experiments did not show that describing water in terms of consumption and reward aspects increased its appeal to regular consumers of SSBs compared to conventional descriptions

Table 7
Means and test statistics comparing waters with combined labels to waters with brand-only labels, waters with control labels, and waters with simulation-enhanced labels.

	Brand-only	Control	Simulation-enhanced	Combined	Brand-only vs. combined		Control vs. combined		Simulation-enhanced vs. combined	
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*b (SE)*	*p*	*b (SE)*	*p*	*b (SE)*	*p*
Sensory and action simulations	39.4 (25.4)	54.0 (25.4)	52.0 (25.0)	54.3 (25.1)	14.8 (1.24)	<0.001	0.19 (1.29)	0.884	2.04 (1.25)	0.108
Anticipated reward	44.2 (24.5)	60.2 (23.3)	56.8 (23.8)	60.6 (23.3)	16.2 (1.16)	<0.001	0.59 (1.37)	0.667	3.40 (1.18)	0.005
Attractiveness	39.1 (25.9)	56.4 (26.3)	53.5 (26.3	57.5 (25.7)	18.4 (1.41)	<0.001	1.12 (1.42)	0.433	3.97 (1.31)	0.003
Desire	37.0 (26.3)	52.3 (28.0)	49.2 (28.1)	52.1 (28.0)	14.9 (1.23)	<0.001	−0.28 (1.47)	0.852	3.17 (1.37)	0.024

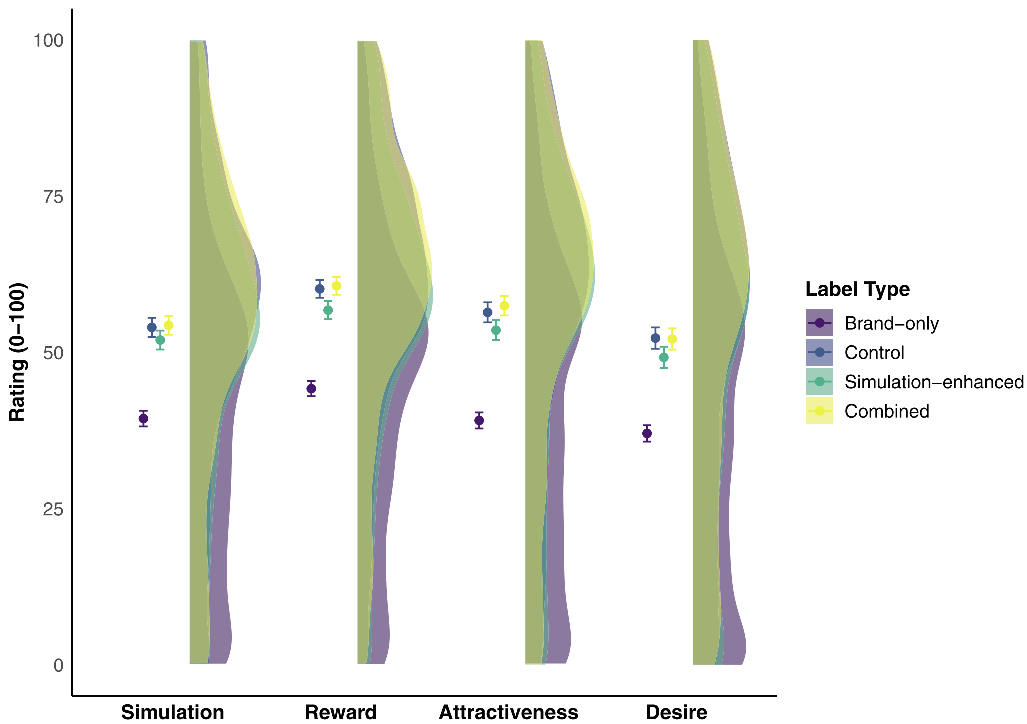

Fig. 3. Sensory and action simulations, anticipated reward, attractiveness, and desire ratings for different label types in Experiment 3. The density plots represent the distribution, the point and error bars represent the means and 95% confidence intervals.

emphasising origin and purity. Even when conventional water labels were "optimised" by combining them with words associated with the rewarding experience of consumption (Exp. 3), the appeal of water was not higher compared to these conventional labels, but it was higher compared to simulation-enhanced labels. Across experiments, all labels that included conventional descriptions and/or consumption and reward aspects were rated more favourably than brand-only labels.

Indirect pathways revealed that waters with labels that included sensory and consumption words were rated as more attractive and desirable compared to waters with brand-only labels (Exp. 2, 3) due to higher levels of anticipated reward. However, adding consumption and reward words to conventional labels consistently increased the appeal of water compared to labels only focused on consumption and reward aspects, but not compared to conventional labels (Exp. 3), again suggesting that it was information about origin and purity, as provided in conventional labels, that boosted water's appeal.

These robust findings go against our main hypotheses based on the grounded cognition theory of desire (Papies & Barsalou, 2015; Papies, Best, Gelibter, & Barsalou, 2017) and are also inconsistent with previous research in the domain of food, showing that taste and reward-focused labels and hedonic nudges can increase desire for healthy foods (Cadario & Chandon, 2019). The only result in line with this theoretical framework is the finding that bottled water labels enhanced with consumption and reward aspects increased anticipation of reward, attractiveness and desire for water compared to bottled waters with only a brand name. However, waters with conventional labels also outperformed brand-only waters.

One possible reason for these contrasting findings is that the studies that did find effects of sensory or hedonic labels on the attractiveness of healthy foods used a variety of often novel vegetarian dishes (Papies et al., 2021; Turnwald et al., 2019). This also allowed for diverse use of sensory and hedonic language, while for water this language is more limited. Importantly, the grounded cognition theory of desire suggests that simulations of previous consumption experiences lead to desire if these simulations are experienced as rewarding. Consuming water, however, tends to be perceived as neutral at best (Rodger et al., 2021) when not in a state of dehydration, and so mentally re-experiencing the consumption of water may also be neutral, rather than rewarding. Our results suggest that consumers may have relatively stable cognitive representations of the taste, feel, and reward of drinking water, which

Table 8
Results of mediation analyses Experiment 3.

Impact of label type on attractiveness mediated by anticipated reward						
	Control vs. combined		Simulation-enhanced vs. combined		Brand-only vs. combined	
	b (95% CI)	*p*	*b* (95% CI)	*p*	*b* (95% CI)	*p*
Total effect	1.08 (−0.79, 2.99)	0.280	3.60 (1.57, 5.47)	<0.001	18.4 (16.8, 19.9)	<0.001
Direct effect	0.58 (−0.53, 1.76)	0.320	0.84 (−0.21, 1.94)	0.130	3.59 (2.58, 4.63)	<0.001
Indirect effect	0.50 (−0.98, 2.00)	0.510	2.76 (1.19, 4.29)	<0.001	14.8 (13.6, 16.2)	<0.001
Proportion mediated	0.53 (−3.70, 4.08)	0.310	0.77 (0.48, 1.09)	<0.001	0.81 (0.76, 0.86)	<0.001
Impact of label type on desire mediated by anticipated reward						
	Control vs. combined		Simulation-enhanced vs. combined		Brand-only vs. combined	
	b (95% CI)	*p*	*b* (95% CI)	*p*	*b* (95% CI)	*p*
Total effect	−0.43 (−2.33, 1.54)	0.640	3.18 (1.32, 5.09)	<0.001	15.0 (13.5, 16.4)	<0.001
Direct effect	−0.90 (−2.14, 0.32)	0.180	0.59 (−0.53, 1.72)	0.330	1.56 (0.47, 2.67)	0.008
Indirect effect	0.47 (−0.92, 1.94)	0.520	2.59 (1.06, 4.14)	0.004	13.4 (12.2, 14.6)	<0.001
Proportion mediated	0.16 (−15.23, 9.66)	0.860	0.82 (0.52, 1.26)	<0.001	0.90 (0.83, 0.97)	<0.001

are difficult to change, at least through language alone. If individuals do not have a positive situated conceptualisation for water stored in memory, reward words on labels may not lead them to simulate rewarding experiences (Piqueras-Fiszman & Spence, 2015). This is also consistent with previous research showing that mental simulations of consuming a food increase desire for foods that are seen at least as mildly rewarding, but not for healthy foods, which are often seen as not very rewarding (Elder & Krishna, 2012; Muñoz-Vilches et al., 2019, 2020).

In addition, the results of Experiment 2 suggest that anticipated reward may play a role in predicting attractiveness and desire for waters with conventional labels. While these findings cannot prove a causal role of anticipated reward (Fiedler, Schott, & Meiser, 2011, 2018), the references about the natural (and sometimes exotic) origin, purity, and health benefits of the water on our control labels may have triggered hedonic reward, which was then attributed to the water. Thus, it is also possible that grounded cognitive processes, such as sensory and reward simulations, do not play the hypothesised role in the desire for drinks, and that other factors matter more, for example knowledge about the provenance or production of drinks. This could explain why our findings do not align with our hypotheses derived from the grounded cognition theory of desire and with previous food research. Alternatively, the absence of a difference between conventional and simulation-enhanced labels may also be due to a ceiling effect: Across the experiments, anticipated reward for waters with simulation-enhanced and with conventional labels was between 57 and 64 out of 100, which may be already high for water.

5.2. Limitations

Our experiments have some limitations that could be addressed in future research. First, participants rated multiple labels, and although we purposefully reduced their number by using randomized blocks of labels, the repetitiveness of the labels may have reduced the extent to which participants simulated their content. Moreover, participants were shown only the words that would typically be printed on labels of bottled water, without actual water bottles. This may have reduced the extent to which participants simulated actually consuming and enjoying water, and could explain why these labels did not induce more sensory and action simulations compared to conventional labels. Future research could make use of more complete sensory stimuli including an image of a water bottle with colour and shape symbolically matching the hedonic label (Ngo, Piqueras-Fiszman, & Spence, 2012), or stimuli that may appeal more strongly to the senses such as an image of a water bottle or a person in the act of drinking water. During our online experiments, participants were also aware that they did not have the possibility to consume the waters we presented. This may have limited the motivational relevance, and therefore the ecological validity of our procedure. Lastly, our measures consisted of self-reported ratings only, and future research may replicate and extend our findings in actual drinking or purchasing situations.

5.3. Implications

Our findings suggest that using words to emphasise the hedonic experience of consumption cannot easily increase the attractiveness of water for regular SSB consumers, possibly because they have a relatively fixed representation of what water tastes and feels like. This is in contrast to previous work, where language emphasising sensory and reward aspects was effective to increase the appeal of a set of more diverse and unfamiliar plant-based foods (Papies, Johannes, et al., 2020). Nevertheless, reward expectations predicted motivation for water, and thus remain a promising avenue for future research.

Bottled water companies tend to emphasize the product's origin or purity in their advertisements, as seen in brands such as Evian and Perrier (Wilk, 2006). This might trigger connotations with attractive destinations, youthfulness, or health. Our findings suggest that this may be a more effective way of increasing the attractiveness of water than through taste- or sensory-driven hedonic pathways, which should be tested in future research. Given the prevalence and negative health implications of underhydration and of SSB consumption, additional strategies to increase the appeal of water should be explored. We would like to add that we are acutely aware of the environmental impact of single-use plastics associated with the consumption of bottled water and SSBs alike. Nevertheless, from a public health perspective, and especially in settings where tap water is not easily available, or not perceived as safe (Saylor, Prokopy, & Amberg, 2011), consuming water from plastic bottles would still be preferrable over consuming SSBs. In addition, SSBs have a high environmental footprint, for example in terms of water use, as it has been estimated that it takes between 169 and 309 L of water to produce a 0.5 L bottle of a sugar-sweetened drink (Ercin, Martinez Aldaya, & Hoekstra, 2010). Finally, it is possible that increased bottled water consumption may further translate into increased tap water consumption, through increased liking of water and habit formation. This is an important avenue for further research, that could help to lower the environmental impact of consumer behaviours, while providing significant public health benefit.

6. Disclosure

All experiments were approved by the College of Science and Engineering Ethics Committee of the University of Glasgow.

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CRediT authorship contribution statement

Maria Almudena Claassen: Investigation, Formal analysis, Writing - original draft. **Dorottya Rusz:** Conceptualization, Investigation. **Esther K. Papies:** Conceptualization, Writing - review & editing.

Declaration of Competing Interest

EKP and DR received travel expenses and registration fee from Danone Research to attend the 2019 Hydration for Health Scientific Conference, and EKP also for the European Federation of the Associations of Dietitians 2019 Conference, and the 2020 and 2021 European and International Congress on Obesity (online).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodqual.2021.104403.

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