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Seeing is misbelieving: Consumers wrongly believe that unhealthy food tastes better when there is more of it

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ABSTRACT

Recent studies have shown that people can believe that unhealthy foods taste better, even if healthy and unhealthy foods are equally as tasty. Specifically, when tasty and unhealthy foods are frequent in one context but rare in another, people perceive unhealthy foods to taste better, even if health and taste are unrelated. Given that people often consume food in one context, the current study investigated whether false beliefs about the health-taste relationship in foods can also occur in just one single context, in which either healthy or unhealthy foods are predominant, when there is no contrasting context where the respective other food is predominant. In two experiments (N = 342), we presented participants with pictures of meals from a single context and varied the frequency of healthy and unhealthy foods between participants. Although healthy and unhealthy foods tasted equally as good, participants believed that (un)healthy foods tasted better when there were more of them. This research demonstrates that health-taste beliefs might be changed by increasing the relative frequency of healthy foods in the environment overall, not by just offering some healthy and tasty foods.

1. Introduction

"Eating healthy doesn't have to suck" is how the food blog "delish" introduces its healthy recipes (Livermore et al., 2021). This example illustrates the tendency in our society to associate unhealthy with tasty food (Briers et al., 2020; Garaus & Lalicic, 2021; Raghunathan et al., 2006; Turnwald et al., 2022). In contrast, when consumers separately rate the health and taste of individual products, they often rate the same foods as healthy and tasty (Haasova & Florack, 2019a, 2019b; Jo & Lusk, 2018). If consumers see that the same foods can be healthy and tasty, why do they still not believe it?

Recently, we proposed a cognitive-ecological account for food beliefs, like the unhealthy = tasty belief (Kunz et al., 2023). We found that people can form beliefs that unhealthy food tastes better if unhealthy and tasty foods are both frequent in one context (e.g., a fast-food restaurant) and both rare in a contrasting context (e.g., a school cafeteria), even if within each context, healthy food tastes better. Contrasting contexts, where unhealthy and tasty food is both frequent in one and both rare in another context especially encourage people to infer a relationship between health and taste, but they are a very specific case. Many people might consume food primarily in one single context or in contexts that are very similar to one another. For example, they might go to the same restaurants regularly or live in a town offering only a limited variety of food options. As most contexts offer predominantly tasty food (Baker & Friel, 2016; De Castro et al., 2000; Wahl et al., 2017), contrasting contexts with many not tasty foods might rarely occur in reality.

In the present studies, we demonstrate that people do not need a contrasting context to form beliefs about the health-taste relationship. We show that in a context with mostly tasty food, people more strongly think that unhealthy food tastes better when there is more unhealthy food than when there is more healthy food, even if the healthy and unhealthy foods are equally as tasty.

2. Theoretical background

Many past studies found that people generally believe unhealthy food to taste better than healthy food, known as the "unhealthy = tasty" belief (Briers et al., 2020; Garaus & Lalicic, 2021; Liem et al., 2012; Raghunathan et al., 2006). In contrast, when people spontaneously rate food products according to how healthy and tasty they expect them to be, they mostly rate the same products as both healthy and tasty (Haasova & Florack, 2019a, 2019b; Jo & Lusk, 2018). These findings suggest that the relationship between health and taste perceptions in food is actually positive and the unhealthy = tasty belief might be unwarranted.

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Why then do some people still form an unhealthy = tasty belief?

Researchers proposed two explanations for the development of food beliefs. First, according to internal explanations, the unhealthy = tasty belief is derived from the protestant ethic (Raghunathan et al., 2006; Weber, 1998), a general tendency to strictly separate between things that are wholesome and good for oneself and things that are fun and enjoyable. Accordingly, consumers might think that there is a trade-off between health and taste and they might use healthiness as a cue to infer that the food does not taste good (Raghunathan et al., 2006). Second, external explanations propose that people learn the unhealthy = tasty belief through communication and the media (Raghunathan et al., 2006). For instance, restaurant menus as well as popular U.S. movies and television shows describe healthy foods with less appealing language than unhealthy foods (Turnwald et al., 2017, 2020, 2022). Further, food marketing strongly promotes unhealthy food (WHO, 2022).

Here, we investigate another explanation which has often been overlooked: People can think unhealthy food tastes better simply because there is more of it. To estimate how two variables like health and taste are related, people can rely on how frequent the levels of the variables occur in their environment, known as a pseudocontingency inference (Fiedler et al., 2009). Imagine that there is a new restaurant in your town and you try the foods to find out whether unhealthy or healthy foods taste better. To accurately assess how health and taste are related, you need to consider how many foods were healthy and tasty at the same time (Allan, 1993). A much easier way is to estimate how many foods were tasty and healthy overall in the restaurant and then combine whatever is more frequent. If there are many unhealthy and tasty foods in the restaurant, you might think that unhealthy food tastes better.

Judging the contingency between two variables, like health and taste, based on their overall frequencies is a useful strategy because it often predicts the actual contingency (Kutzner et al., 2011) and people do not always observe both variables together. However, even if two variables are frequent, they may be unrelated or related in the opposite direction than their combined frequencies suggest. In this case, relying on overall frequencies can lead to misjudgements (Fiedler & Freytag, 2004). For instance, people might form negative stereotypes about a minority group, although the minority and majority group are equally likely to show positive behaviour, because they combine the two rare events of people belonging to the minority group and negative behaviour (Hamilton & Gifford, 1976).

We argue that especially in food contexts, overall frequencies of healthy and tasty food commonly differ from true contingencies between health and taste. For instance, Ariyasriwatana (2018) collected online restaurant reviews and coded each review according to whether it mentioned a healthy or unhealthy and tasty or not tasty food. There were altogether more reviews about tasty and unhealthy food than not tasty and healthy food. However, the contingency between healthiness and tastiness was close to zero, and even in the positive direction ($r_{\phi=}$0.08; see supplementary material S1 for details). Hence, in an environment with many tasty and unhealthy foods, the chance of getting a tasty food might be the same, whether one chooses an unhealthy or healthy food. We argue that a discrepancy between overall frequencies of healthy and tasty food and the true contingency between health and taste might give rise to false impressions about the health-taste relationship and contribute to an unhealthy = tasty belief.

Accordingly, our previous research suggests that when judging the relationship between health and taste, people do not rely on the true contingency, but instead rely on how many foods are overall healthy and tasty in their environment which can lead to misjudgements (Kunz et al., 2023). We found that people believe that unhealthy food tastes better if there is mostly unhealthy and tasty food in a context (e.g., a fast-food restaurant), although the healthy food tasted better. In those studies, however, there was always a contrasting context (e.g., a cafeteria) with mostly healthy and not tasty food. Contrasting contexts, where two variables are both frequent in one and both rare in another context, make it especially likely that people infer contingencies from overall frequencies (Fiedler & Freytag, 2004). The constellation with many tasty und unhealthy foods in one context and many not tasty and healthy foods in another context creates a strong impression that unhealthy food tastes better, but this might be a misperception. Health and taste might still be completely unrelated and the healthy food might even taste better within each context (Kunz et al., 2023).

It is not known whether people need a contrasting context to form beliefs about the health-taste relationship. In reality, most people might consume food in only one context or in a few contexts that are very similar to one another. For example, they might eat at the cafeteria at their workplace daily and go to the same restaurants regularly. Or they might live in a town offering only a limited variety of food options. Possibly, many people do not contrast between different food contexts, when they think about the health-taste relationship. Also, there might rarely be contexts with few tasty foods, but tasty food is predominant in most contexts (Baker & Friel, 2016; De Castro et al., 2000; Wahl et al., 2017). Recently, research has found that people do not need contrasting contexts to infer contingencies. They can simply rely on what values of two variables are more frequent in one context, and combine them (Vogel et al., 2022). It might therefore be sufficient for people to see that there is mostly unhealthy as well as tasty food in a context to form a belief that unhealthy food tastes better than healthy food.

In the present research, we tested whether people form false beliefs about the health-taste relationship in a single context, providing further evidence for a cognitive-ecological mechanism explaining food beliefs. We hypothesised that people form a more negative health-taste belief in a context with mostly tasty and unhealthy food than in a context with mostly tasty and healthy food. We tested our hypothesis in a laboratory experiment and an online experiment in which participants viewed pictures along with health and taste ratings of different meals from a single context. The pictures displayed real complex meals, randomly sampled per participant, to increase ecological validity. Whereas there was always more tasty food in the context, we varied between participants whether there was more healthy or unhealthy food. That is, frequencies of healthy and tasty food were either aligned or misaligned. But healthy and unhealthy foods were equally likely tasty, meaning health and taste were unrelated. After viewing the meal pictures, participants estimated the health-taste relationship in the context.

2.1. Open practices statement

We preregistered our studies on aspredicted.org. The preregistration documents can be found in our OSF repository at https://osf.io/xsyv2 (Study 1) and https://osf.io/q9xmh (Study 2). We analysed the data for both studies with R 4.1.2 (The R Foundation for Statistical Computing, 2021), specifically the package rstatix (Kassambara, 2021). Deidentified data, codebooks, and analysis scripts for both studies are also publicly available at the OSF repository at https://osf.io/etx3z. In both studies, we applied attention and manipulation checks to ensure that participants paid attention to the presented health and taste ratings and they accurately identified the different frequencies of healthy and unhealthy foods in the respective conditions (a detailed report is available in the OSF repository). The studies were approved by the Departmental Review Board (DRB) of the Department of Occupational, Economic, and Social Psychology at the University of Vienna (Approval numbers: 2022/S/001 and 2023/S/002). Participants of both studies gave written informed consent to participate and were fully debriefed after participation.

3. Study 1: People form false health-taste beliefs

3.1. Participants

Using G*Power (Faul et al., 2007), we pre-determined a sample size of 156 to detect a medium-sized effect ($\eta_p^2 = 0.06$) between three groups,

with an alpha level of 0.05 and a statistical power of 0.80 in a one-way ANOVA. A total of 135 participants participated in the laboratory study. The majority (114 participants) were undergraduate Psychology students from the University of Vienna recruited via the university's laboratory administration system, who participated in exchange for course credits. The remaining 21 participants were volunteers recruited personally by the researchers. Only people speaking German as (well as) their native language and who were not currently on a diet were eligible to participate. One participant who indicated to be on a diet was therefore excluded from the analyses. The final sample consisted of 134 participants, 57.46 % women, 41.79 % men, 0.75 % other genders, with a mean age of 22.97 (SD = 4.25).

3.2. Procedure

After obtaining written informed consent, we instructed participants to imagine that they had tried out the food from a newly opened restaurant in their town. Participants viewed pictures of ostensible meals from this restaurant on separate pages in random order. Along with each meal picture, participants saw a rating of the meal's taste and health. Each meal picture and the ratings disappeared after 5 s and participants were asked to recall the health and taste rating, as an attention check. After having seen all meals, we asked participants to estimate how many foods in the restaurant were overall healthy and unhealthy as well as tasty and not tasty, as a manipulation check. Then, participants indicated their belief about the relationship between health and taste in the restaurant. Afterwards, participants indicated their general unhealthy = tasty belief and their general health interest, to control for the potential influence of inter-individual differences on these variables. At the end of the experiment, participants provided demographic data and were fully debriefed.

3.3. Materials and measures

3.3.1. Design

Participants were randomly assigned to one of three frequency conditions. The conditions differed regarding which foods were more frequent: Healthy and tasty foods, unhealthy and tasty foods, and a control condition, in which there were exactly as many tasty as not tasty and as many healthy as unhealthy foods. Importantly, we kept the contingency between health and taste at zero by controlling how many foods that participants saw were both healthy and tasty, both healthy and not tasty and so on, relative to how many healthy foods they saw overall. For example, participants in the "healthy frequent" condition saw overall 30 healthy foods, of which 20 were tasty and 10 were not tasty. They saw 15 unhealthy foods, of which 10 were tasty and 5 were not tasty. That means, any food – healthy or unhealthy – was twice as likely to be tasty than not tasty and therefore, taste was unrelated to health ($r_\phi = 0$). For details, see Table 1.

Table 1
Frequency distributions of (un-)healthy and (not) tasty foods used in the studies.

Frequency condition		Study 1			Study 2	
Unhealthy and tasty	Tasty	Not tasty	Sum	Tasty	Not tasty	Sum
Healthy	10	5	15	3	1	4
Unhealthy	20	10	30	9	3	12
Sum	30	15	45	12	4	16
Healthy and tasty	Tasty	Not tasty	Sum	Tasty	Not tasty	Sum
Healthy	20	10	30	9	3	12
Unhealthy	10	5	15	3	1	4
Sum	30	15	45	12	4	16
Control	Tasty	Not tasty	Sum			
Healthy	11	11	22			
Unhealthy	11	11	22			
Sum	22	22	44			

3.3.2. Stimuli

Participants viewed pictures of individual meals, ostensibly from a fictitious restaurant. The meal pictures were randomly drawn per participant out of a pool of 104 pictures. Each picture had been categorised as healthy and tasty, unhealthy and tasty and so on. We used 102 pictures from an unpublished study (Haasova et al., 2024). In this study, the categorisation of the pictures had been validated with subjective health and taste ratings by university students. For each picture, they had rated how tasty they estimated the displayed food to be on a scale from 1 = *Not at all tasty* to 10 = *Very tasty*. Also, they had rated how healthy they estimated the food to be with a staple scale format. For the healthiness, the response options had ranged from +5 (indicating high healthiness) to −5 (indicating low healthiness) and were displayed vertically underneath each other. The mean healthiness and tastiness ratings of foods had matched their categorisation as (un)healthy and (not) tasty (see Table S2 in the supplementary material). We added two more pictures to the unhealthy-tasty category (sweet cut-up pancake with raisins and cheese spaetzle), which had not been validated, in order to obtain a large enough item pool to display. A detailed list with descriptions of all used pictures is available at https://osf.io/nuj5e.

In the main study, participants saw one picture per trial, accompanied by a taste and health rating. The taste ratings were indicated by a star-rating from one (bad taste) to five (good taste). The health ratings were indicated by a Nutri-Score, displaying the meal's healthiness by means of a letter and a traffic light colour, with a green "A" or "B" meaning high, and an orange "D" and red "E" meaning low healthiness (Santé Publique France, 2018). The meaning of the star ratings and Nutri-Scores was explained to participants in the instructions. When programming the survey, we took care that the health and taste ratings always matched the picture category, but we randomised the exact combinations of Nutri-Scores and star-ratings with the pictures. For instance, a picture categorised as unhealthy and tasty would also have low health and high taste ratings, but whether this low health rating was a "D" or "E" Nutri-Score and whether the taste rating was four or five stars, was random. For an illustrative example, see Fig. 1.

3.3.3. Health-taste belief

The dependent variable was the belief about the relationship between health and taste in the presented foods, which we assessed in two ways (measures adapted from Kunz et al., 2023). First, participants indicated their health-taste belief indirectly by estimating how many percent of meals were *both* healthy and tasty, *both* unhealthy and tasty, and so on. They were asked to enter their four estimates as numbers in separate text boxes, which had to amount to 100 %. We calculated the r_ϕ coefficient based on the four estimates, representing the health-taste belief. Second, we assessed the health-taste belief more directly with a scale-based measure. Participants indicated which foods tasted better, on a slider scale from 0 = *The unhealthy foods* to 100 = *The healthy foods*. We subsequently re-coded this measure to range from - 0.50 to 0.50, with a negative value indicating an unhealthy = tasty and a positive value a healthy = tasty belief.

Fig. 1. Illustrative Example of Stimuli Used in Study 1. *Note.* Due to copyright reasons, here we used a food icon for the sake of illustration. In the study, we used pictures of real complex meals. Health and taste ratings for each meal were presented simultaneously, on the same page. See the online article for the colour version of this figure.

3.3.4. Additional measures

We assessed the following individual characteristics of participants to control for their possible influence on the results: We measured participants' general unhealthy = tasty belief with two scales. First, we administered two items by Raghunathan et al. (2006): "Things that are good for me rarely taste good", and "There is no way to make food healthier without sacrificing taste". Participants indicated their agreement on a 9-point-scale (1 = *Strongly disagree*, 9 = *Strongly agree*). Due to low reliability (Cronbach's α = 0.55), we did not use the scale in the control analyses. Second, we administered two items by Pivecka et al. (2023). Participants indicated whether a meal that was somehow made tastier would as a result be much unhealthier or healthier than before and whether a meal that was made healthier would be much less tasty or much tastier, both on a slider scale ranging from 1 to 100 (Cronbach's α = 0.70). Further, we assessed participants' general health interest (Roininen et al., 1999) with eight items (e.g., "I am very particular about the healthiness of food I eat", Cronbach's α = 0.76) to which participants indicated their agreement on a 7-point-scale (1 = *Strongly disagree*, 7 = *Strongly agree*).

3.4. Results

Our hypothesis was that if there is more unhealthy and tasty food, people form a more negative health-taste belief than if there is more healthy and tasty food, although health and taste are unrelated. We conducted one-way ANOVAs testing the effect of frequency condition (healthy and tasty frequent vs. unhealthy and tasty frequent vs. control) on the health-taste belief. We also tested pairwise comparisons between conditions, applying Bonferroni corrections.

In the first ANOVA, we analysed the scale-based measure of the health-taste belief as dependent variable. In line with our hypothesis, there was a medium-sized effect of frequency condition on the health-taste belief, F (2, 131) = 7.37, p = 0.001, η_p^2 = 0.10. Participants formed a more negative health-taste belief when there was more unhealthy and tasty food (M = −0.06; SD = 0.22) compared with when there was more healthy and tasty food (M = 0.10; SD = 0.17; $p_{adj.}$ = 0.001) and the control group (M = 0.05; SD = 0.18; $p_{adj.}$ = 0.02; see Fig. 2). The health-taste belief did not differ significantly between a context with more healthy food and the control group ($p_{adj.}$ = 0.65).

The effect of frequency condition on the health-taste belief remained stable, F (2, 129) = 7.73, p = 0.001, η_p^2 = 0.11, after controlling for the general unhealthy = tasty belief and general health interest as covariates. There was a small effect of the general unhealthy = tasty belief on the health-taste belief in the experiment, F (1, 129) = 5.42, p = 0.02, η_p^2 = 0.04. According to a Pearson correlation, the more participants believed unhealthy food tasted better in general, the more strongly did they believe that unhealthy food tasted better also in the experiment (r = 0.19).

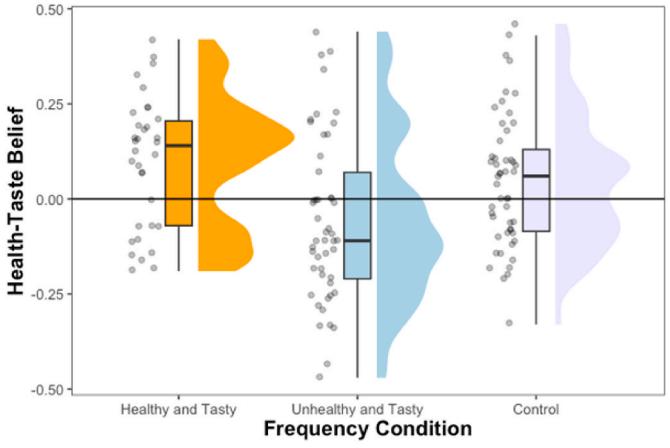

Fig. 2. Mean Health-Taste Belief Depending on the Overall Frequencies of Healthy and Tasty Food in Study 1. *Note*. Negative values represent an unhealthy = tasty belief, positive values represent a healthy = tasty belief. See the online article for the colour version of this figure.

In addition to the pre-registered analysis, we conducted one-sample t-tests of the health-taste belief against zero within each condition to test whether the strength of the formed health-taste beliefs differed between conditions. When healthy food was more frequent, participants formed a significant, moderately strong healthy = tasty belief, t (33) = 3.35, p < 0.01, d = 0.57. When healthy and unhealthy foods were equally frequent, participants formed a marginally significant, weak healthy = tasty belief, t (50) = 1.89, p = 0.06, d = 0.27. When unhealthy food was more frequent, participants formed a marginally significant, weak unhealthy = tasty belief, t (48) = −1.84, p = 0.07, d = −0.26.

In the second ANOVA, we replaced the scale-based measure of the health-taste belief with the r_ϕ coefficient that we calculated based on participants' percentage estimates of foods that were *both* healthy and tasty, *both* unhealthy and tasty and so on, as dependent variable. Contrary to our hypothesis, there was no effect of frequency condition on this measure of the health-taste belief, F (2, 131) = 0.30, p = 0.74, η_p^2 = 0.005.

3.5. Discussion

In Study 1, we found that consumers can form false beliefs about the health-taste relationship based on how many foods are overall healthy and tasty in a context. Participants perceived a more negative health-taste relationship when there was more tasty and unhealthy food than when there was more tasty and healthy food, although healthy and unhealthy food was equally as tasty. Participants formed stronger false health-taste beliefs when healthy food was frequent than when unhealthy food was frequent.

Study 1 has, however, several limitations. First, we only found an effect of our manipulation on one out of two measures of the health-taste belief. When asked directly whether unhealthy or healthy foods tasted better, participants relied on whether healthy or unhealthy foods were overall more frequent. Yet, when participants estimated the percentages of food that was *both* healthy and tasty, *both* unhealthy and tasty, and so on, those estimates did not differ based on overall frequencies of foods. Possibly, the task was too difficult for participants or they did not understand the instructions properly and answered randomly. Second, the generalisability of our findings is limited to Psychology students. We addressed these limitations in Study 2, in which we replicated the findings with a consumer sample, recruited to approximate the population distribution of age, gender, and federal state, using only the simple scale-based measure for the health-taste belief. Additionally, as the unhealthy = tasty belief has long been explained by the protestant ethic, we measured participants' protestant ethic in Study 2 to control for its possible influence on the health-taste belief.

4. Study 2: Replication with a consumer sample

4.1. Participants

We conducted an online experiment with German consumers recruited via the TALK online access panel to approximate the distribution of age, gender, and federal state in Germany. Using G*Power (Faul et al., 2007), we pre-determined a sample size of 126 to detect a medium-sized effect (η_p^2 = 0.06) between two groups, with an alpha level of 0.05 and a statistical power of 0.80 in a one-way ANOVA. We instructed the panel to recruit 200 consumers, to rule out any power considerations. Upon data collection, we screened out consumers who did not speak German as (well as) their native language, did not eat meat, were currently on a diet, or failed an attention check question at the beginning of the study. The study was completed by 209 consumers. As preregistered, we excluded one participant with zero variance in their

responses, indicating that they clicked through the survey. The final sample consisted of 208 participants, 49.04% women, 50.96 % men, with a mean age of 45.06 (SD = 14.94) and a mean BMI of 25.70 (SD = 5.61).

4.2. Procedure

The procedure was the same as in Study 1, with the following exceptions: Instead of a restaurant, we asked participants to imagine that they viewed food from a new food delivery app called "Eats". Also, for each meal, we presented first the health and then the taste rating. Participants could look at the ratings as long as they liked. Finally, instead of participants' general unhealthy = tasty belief and their general health interest, we assessed participants' protestant ethic to control for its possible influence in the analysis.

4.3. Materials and measures

4.3.1. Stimuli and design

Participants viewed pictures of 16 meals, along with their health and taste ratings. For the meal pictures, we selected 100 images from the "Food-pics_extended" (Blechert et al., 2019) open-source data base and categorised each picture as healthy or unhealthy and tasty or not tasty, based on palatability ratings on a scale ranging from 1 to 100 and energy density (calories per 100 g) provided by Blechert et al. (2019). For the mean palatability ratings and calories per category, see Table 2. A detailed list of all used pictures is available at https://osf.io/nuj5e.

Each participant viewed a random sample of 16 pictures out of the stimulus pool. Taste ratings were indicated by stars ratings, like in Study 1. For the health ratings, we used a traffic light symbol with a red light indicating an unhealthy and a green light indicating a healthy meal (see Fig. 3). We manipulated the frequencies of healthy and tasty foods between participants in the same way as in Study 1, but without the control group. For details, see Table 1.

4.3.2. Dependent measures

The dependent variable was again the belief about the relationship between health and taste in the presented foods, which we measured with the same scale-based measure as in Study 1. In addition, we assessed participants' protestant ethic (Mirels & Garrett, 1971) to control for its possible influence. We administered eleven items from Katz and Hass (1988), to which participants indicated their agreement on a 6-point Likert scale from 0 = *Strongly disagree* to 5 = *Strongly agree* (e.g., "I feel uneasy when there is little work for me to do", Cronbach's α = 0.83).

4.4. Results

In line with our hypothesis, there was a medium-sized effect of frequency condition on the health-taste belief, F (1, 206) = 31.35, p < 0.001, η_p^2 = 0.13. Participants formed a more negative health = taste belief (M = −0.17; SD = 0.24) when there was more unhealthy and tasty food than when there was more healthy and tasty food (M = 0.01; SD = 0.23; see Fig. 4). The effect of frequency condition remained stable when re-running the analysis while controlling for the protestant ethic as covariate, F (1, 205) = 34.58, p < 0.001, η_p^2 = 0.14. In addition, there was a small effect of protestant ethic on the health-taste belief, F (1, 205) = 6.28, p = 0.01, η_p^2 = 0.03. According to a Pearson correlation, the more participants endorsed the protestant ethic, the more strongly did they believe that healthy food tasted better (r = 0.13).

According to one-sample t-tests against zero, participants formed a moderately strong unhealthy = tasty belief when unhealthy food was more frequent, t (102) = −7.03, p < 0.001, d = −0.69, but did not form a healthy = tasty belief when healthy food was more frequent, t (104) = 0.65, p = 0.52, d = 0.06.

Table 2
Example item descriptions and mean tastiness (palatability ratings) and healthiness (calories per 100 g) of foods per category (Study 2).

Food Category	Example Item Description	Mean Tastiness (SD)	Mean Kcal per 100 g (SD)
Healthy and tasty	Salmon with spinach	71.54 (4.61)	110.45 (53.63)
Unhealthy and tasty	Pizza with salami	68.09 (4.64)	274.07 (94.11)
Healthy and not tasty	Stuffed eggplant	34.92 (8.31)	94.83 (40.78)
Unhealthy and not tasty	Fried porkchop	34.87 (6.47)	229.19 (58.70)

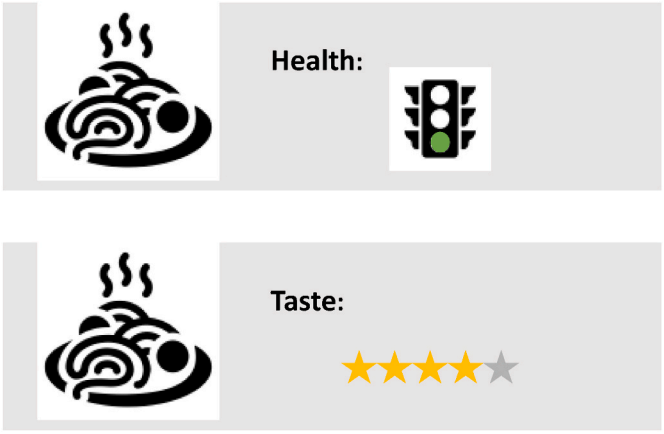

Fig. 3. Illustrative Example of Stimuli Used in Study 2. *Note*. Due to copyright reasons, here we used a food icon for the sake of illustration. In the study, we used pictures of real complex meals. Participants first saw the meal's health rating, then the taste rating, on separate pages. See the online article for the colour version of this figure.

4.5. Discussion

In Study 2, we replicated the findings of Study 1 with a consumer sample, using only a direct measure for the health-taste belief. Again, we found that consumers perceived a more negative health-taste relationship when there was more tasty and unhealthy food than when there was more tasty and healthy food, although healthy and unhealthy food was equally as tasty. In contrast to Study 1, participants formed stronger

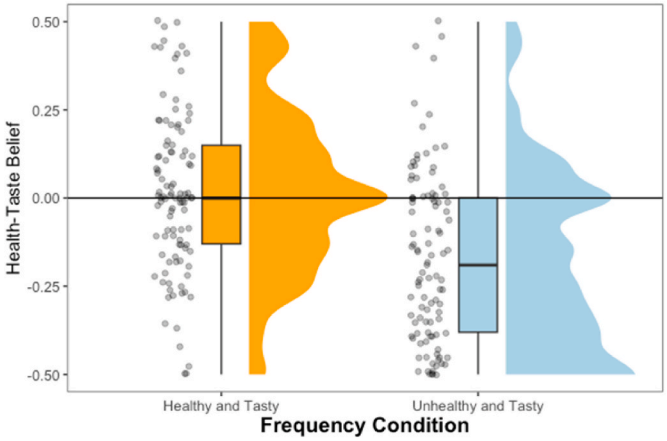

Fig. 4. Mean Health-Taste Belief Depending on the Overall Frequencies of Healthy and Tasty Food in Study 2. *Note*. Negative values represent an unhealthy = tasty belief, positive values represent a healthy = tasty belief. See the online article for the colour version of this figure.

false health-taste beliefs when unhealthy food was frequent than when healthy food was frequent.

5. General discussion

The belief that unhealthy food tastes better than healthy food persists in society, although many people perceive the same foods as healthy and tasty. So far, researchers assumed that this unhealthy = tasty belief stems from a higher-order belief, the protestant ethic, or consumers learn the belief through communication and the media (Raghunathan et al., 2006; Turnwald et al., 2017, 2020, 2022). More recently, we proposed a cognitive-ecological account, demonstrating that consumers can learn false unhealthy = tasty beliefs when healthy and tasty food is differently frequent across contrasting food contexts (Kunz et al., 2023). It was not clear whether people need a contrasting context to form food beliefs. Especially contexts with mostly not tasty foods are not likely in reality, as most food people daily consume is tasty (De Castro et al., 2000; Wahl et al., 2017) and it can be assumed that eating places with mostly unpalatable food would quickly vanish from the foodscape.

We found that consumers can form false beliefs about the health-taste relationship already in a single context. Participants inferred a relationship between health and taste, based on how many foods were overall healthy and tasty in the context. Participants perceived a more negative health-taste relationship when there was more tasty and unhealthy food in a context than when there was more tasty and healthy food, although healthy and unhealthy food was equally as tasty. Hence, to form a belief about the health-taste relationship, participants seemingly did not rely on how often health and taste occurred together within the same foods, but on how many foods were tasty overall and how many foods were healthy overall. Thus, their judgements reflected a pseudocontingency inference instead of a genuine contingency assessment (Fiedler et al., 2009).

Interestingly, the strength of inferred relationships varied depending on whether healthy or unhealthy food was more frequent and this pattern was exactly opposite between Study 1 and 2. In Study 1, participants formed stronger health-taste beliefs in a context with mostly healthy food, whereas in Study 2, participants formed stronger health-taste beliefs in a context with mostly unhealthy food. Possibly, student participants in Study 1 held more positive healthy = tasty beliefs in general, whereas consumers in Study 2 held more negative unhealthy = tasty beliefs and the frequency of healthy foods could reinforce and attenuate, but not flip their respective pre-existing beliefs. Yet, this explanation remains speculative and cannot be answered in the present studies. Hence, our finding offers new avenues for theoretical research on pseudocontingencies (Fiedler et al., 2009): Can pseudocontingency inferences actually change pre-existing beliefs and if yes, to what extent?

The present studies build on our own recent research demonstrating that a cognitive-ecological mechanism can help explain food beliefs, such as the unhealthy = tasty belief (Kunz et al., 2023). In those studies, frequencies of healthy and tasty food differed across two contrasting contexts. For example, when there was mostly unhealthy and tasty food in one context, there was mostly healthy and not tasty food in another context. We extend our previous findings by showing that people form health-taste beliefs based on overall frequencies also in a single context with mostly tasty and mostly (un)healthy food. Our present findings suggest that contrasting contexts are not necessary for people to form beliefs about the health-taste relationship. Consumers might form a false belief that unhealthy food tastes better simply when there is more of it. This finding is highly relevant for practice as it shows that food beliefs might be easier to change with a cognitive-ecological approach than previously assumed. To encourage consumers to think that healthy food tastes good, it may be sufficient to increase the overall numbers of healthy and tasty foods within a single environment.

Also, our findings contribute to research showing that people's (un) healthy = tasty beliefs might not be universal, but vary with the context. Past studies proposed that the unhealthy = tasty belief varies between different cultures. Specifically, in cultures in which food is generally associated with pleasure and enjoyment, people more likely hold positive healthy = tasty beliefs (Werle et al., 2013). Our findings offer an additional explanation that consumers in some cultures might develop positive healthy = tasty beliefs because healthy food may be more frequent in these cultures. Moreover, recent research shows that consumers can even hold opposite beliefs about the health-taste relationship in different contexts, for instance when people pay more attention to food's healthiness (Mai et al., 2018).

Mai et al. (2018) measured implicit health-taste associations which consumers can hold even when they do not explicitly agree with the belief (Raghunathan et al., 2006). In our study, we only measured participants' explicit beliefs and show that those too can be affected by the context, specifically the relative frequencies of healthy and unhealthy food. We cannot conclude whether food frequencies also affect the formation of implicit associations. In past studies, however, overall frequencies of tasty and healthy foods have been found to affect not only explicit beliefs, but also consumers' food choices and preferences (Kunz et al., 2023; Vogel & Kutzner, 2017). Because consumer choices are predicted by implicit health-taste associations (Mai et al., 2018; Raghunathan et al., 2006), we assume that people who observe different frequencies of healthy foods in their environment should also form implicit health-taste associations. Future studies might test how the frequency distribution of foods affects implicit and explicit beliefs.

A methodological strength of the present study is the more realistic stimulus presentation compared with our previous studies (Kunz et al., 2023). We presented participants with pictures of complex meals as opposed to mere numerical health and taste ratings. The meal pictures were randomly sampled per participant, to increase generalisability and ecological validity. Moreover, in our previous studies, participants first viewed the taste ratings and then the health ratings of all foods in separate blocks. Presenting health and taste information separately and sequentially made it extremely difficult to remember how often the same foods were both healthy and tasty, thus encouraging participants even more to rely on the overall frequencies of healthy and tasty food. In the present study, participants saw the health and taste ratings of each food together, combined with a food picture displaying the health and taste simultaneously. Still, participants apparently did not rely on observations of health and taste within the same foods, but rather relied on how many foods in the context were healthy and tasty overall.

An important limitation of the study is that, although we tried to make the study more realistic by using pictures of real meals, we still manipulated the frequencies of healthy and tasty food and the "true" health-taste relationship in an artificial laboratory setting. It is an important goal for future research to investigate how healthy and tasty foods are distributed in real contexts and whether consumers form beliefs about the health-taste relationship within these contexts.

Another limitation is that we manipulated the health and taste of the presented foods by means of a star rating and a health label. We did not assess participants' subjective health and taste perceptions of the presented foods and whether they corresponded to the presented ratings. Hence, we cannot be certain that consumers trusted the presented ratings or that the ratings were in line with their expectations about the presented foods. However, we ensured that the presented ratings matched the subjective healthiness and tastiness ratings obtained from a different sample of participants, so we assume that our provided ratings are, on average, in line with subjective consumer judgements. Still, it is an important avenue for future research to measure consumers' subjective health and taste judgements in a context and their effects on the perceived health-taste relationships within this context.

Future studies should also address a possible confound of our results. If a type of food is more frequent in a context, consumers might infer that the respective restaurant specialises in this type of food. For example, if a restaurant offers mostly unhealthy burgers, consumers might think that this restaurant is particularly good at making burgers and the unhealthy food might therefore taste better at this restaurant. That said,

results of our studies do not support this specialisation account. If participants had inferred a health-taste relationship based on the restaurants' assumed specialisation, they should have formed comparably strong healthy = tasty beliefs in a context with mostly healthy foods as unhealthy = tasty beliefs in a context with mostly unhealthy foods. Yet, participants' health-taste beliefs within a predominantly healthy context were inconsistent across studies. When healthy food was more frequent, participants in Study 1 inferred a healthy = tasty belief, whereas participants in Study 2 inferred no relationship between health and taste. We therefore think it is unlikely that participants in our study based their judgements on an inferred specialisation of the context. Still, future studies should explicitly address the specialisation of eating places as a potential confound.

Our findings offer more support for a novel cognitive-ecological account for the unhealthy = tasty belief that might inform policies for fostering healthy food choices. Importantly, the cognitive-ecological account suggests that food beliefs cannot only arise from personality or cultural factors, such as the protestant ethic. In fact, the endorsement of the protestant ethic (Katz & Hass, 1988; Mirels & Garrett, 1971) was only weakly related to the health-taste belief in Study 2, and even in the opposite direction than expected. That is, the more participants endorsed the protestant ethic, the more they believed that *healthy* food tasted better.

Rather, our findings suggest that specific food environments can contribute to food beliefs, which are easier to change than personality or cultural factors. The implication for policy makers is that to help consumers believe that healthy food is tasty, it is not sufficient to create individual foods that are healthy and tasty at the same time. When looking at individual foods, consumers already see that the same foods can be healthy and tasty (Haasova & Florack, 2019a, 2019b; Jo & Lusk, 2018). Instead, it may help to change consumers' food environment, for example by offering overall more healthy relative to unhealthy options on restaurant menus, to make consumers realise that eating healthy indeed "does not suck".

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Ethical statement

The present studies were conducted in accordance with the Declaration of Helsinki (revised 1983) and local guidelines of the university where the study was conducted. In each study, participants were informed about its aim and confidentiality of the data collection, and gave their consent to participate. Participants could also withdraw at any time during the studies and were fully debriefed after participation. The studies were approved by the Departmental Review Board (DRB) of the Department of Occupational, Economic, and Social Psychology at the University of Vienna (Approval numbers: 2022/S/001 and 2023/S/002).

CRediT authorship contribution statement

Sonja Kunz: Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Niklas Pivecka:** Writing – review & editing, Validation, Methodology, Conceptualization. **Clara Dietachmair:** Writing – review & editing, Investigation, Formal analysis. **Arnd Florack:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

We have shared the link to the data and analyses files in the manuscript: https://osf.io/etx3z.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2024.107295.

References

Allan, L. G. (1993). Human contingency judgments: Rule based or associative? *Psychological Bulletin, 114*(3), 435–448.

Ariyasriwatana, W. (2018). "Healthy deliciousness": Discovering the secret to healthy eating via social media [University of Hawai'i]. *Journal of Chemical Information and Modeling*. https://doi.org/10.1017/CBO9781107415324.004

Baker, P., & Friel, S. (2016). Food systems transformations, ultra-processed food markets and the nutrition transition in Asia. *Globalization and Health, 12*(1). https://doi.org/10.1186/s12992-016-0223-3

Blechert, J., Lender, A., Polk, S., Busch, N. A., & Ohla, K. (2019). Food-pics_extended-an image database for experimental research on eating and appetite: Additional images, normative ratings and an updated review. *Frontiers in Psychology, 10*, 1–9. https://doi.org/10.3389/fpsyg.2019.00307

Briers, B., Huh, Y. E., Chan, E., & Mukhopadhyay, A. (2020). The unhealthy = tasty belief is associated with BMI through reduced consumption of vegetables: A cross-national and mediational analysis. *Appetite, 150*, Article 104639. https://doi.org/10.1016/j.appet.2020.104639

De Castro, J. M., Bellisle, F., Dalix, A. M., & Pearcey, S. M. (2000). Palatability and intake relationships in free-living humans: Characterization and independence of influence in North Americans. *Physiology and Behavior, 70*, 343–350. https://doi.org/10.1016/S0031-9384(00)00264-X

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175–191. https://doi.org/10.3758/BF03193146

Fiedler, K., & Freytag, P. (2004). Pseudocontingencies. *Journal of Personality and Social Psychology, 87*(4), 453–467. https://doi.org/10.1037/0022-3514.87.4.453

Fiedler, K., Freytag, P., & Meiser, T. (2009). Pseudocontingencies: An integrative account of an intriguing cognitive illusion. *Psychological Review, 116*(1), 187–206. https://doi.org/10.1037/a0014480

Garaus, M., & Lalicic, L. (2021). The unhealthy-tasty intuition for online recipes – when healthiness perceptions backfire. *Appetite, 159*, Article 105066. https://doi.org/10.1016/j.appet.2020.105066

Haasova, S., & Florack, A. (2019a). Sugar labeling: How numerical information of sugar content influences healthiness and tastiness expectations. *PLoS One, 14*(11). https://doi.org/10.1371/journal.pone.0223510

Haasova, S., & Florack, A. (2019b). Practicing the (un)healthy = tasty intuition: Toward an ecological view of the relationship between health and taste in consumer judgments. *Food Quality and Preference, 75*, 39–53. https://doi.org/10.1016/j.foodqual.2019.01.024

Haasova, S., Koch, T., & Florack, A. (2024). *When healthy and tasty go together: How perception of overlap in healthiness and tastiness of food reduces ambivalence and aids healthier eaters* [Manuscript in preparation].

Hamilton, D. L., & Gifford, R. K. (1976). Illusory correlation in interpersonal perception: A cognitive basis of stereotypic judgments. *Journal of Experimental Social Psychology, 12*(4), 392–407. https://doi.org/10.1016/S0022-1031(76)80006-6

Jo, J., & Lusk, J. L. (2018). If it's healthy, it's tasty and expensive: Effects of nutritional labels on price and taste expectations. *Food Quality and Preference, 68*, 332–341. https://doi.org/10.1016/j.foodqual.2018.04.002

Kassambara, A. (2021). *rstatix: Pipe-friendly framework for basic statistical tests (R package version 0.7.0)*. https://cran.r-project.org/package=rstatix.

Katz, I., & Hass, G. R. (1988). Racial ambivalence and American value conflict: Correlational and priming studies of dual cognitive structures. *Journal of Personality and Social Psychology, 55*(6), 893–905.

Kunz, S., Haasova, S., Pivecka, N., Schmidt, J., & Florack, A. (2023). Food is all around: How contexts create misbeliefs about the health-taste relationship. *Psychological Science, 34*(5), 568–580. https://doi.org/10.1177/09567976231158288

Kutzner, F., Vogel, T., Freytag, P., & Fiedler, K. (2011). Contingency inferences driven by base rates: Valid by sampling. *Judgment and Decision Making, 6*(3), 211–221. http://journal.sjdm.org/11/9727/jdm9727.html.

Liem, D. G., Toraman Aydin, N., & Zandstra, E. H. (2012). Effects of health labels on expected and actual taste perception of soup. *Food Quality and Preference, 25*(2), 192–197. https://doi.org/10.1016/j.foodqual.2012.02.015

Livermore, S., Flager, M., & Villarosa, D. (2021). *65 healthy dinners you'll actually look forward to eating*. Delish https://www.delish.com/cooking/recipe-ideas/g3733/healthy-dinner-recipes/.

Mai, R., Trendel, O., Cooremans, K., & Basil, M. (2018). Is it possible to hold opposite beliefs at implicit levels? Contextualized intuitions about (un) healthy foods. In

M. Geuens, M. Pandelaere, M. T. Pham, & I. Vermeir (Eds.), *European advances in consumer research* (Vol. 11, pp. 120–121). Association for Consumer Research.

Mirels, H. L., & Garrett, J. B. (1971). The Protestant Ethic as a personality variable. *Journal of Consulting and Clinical Psychology, 36*(1), 40–44. https://doi.org/10.1037/h0030477

Pivecka, N., Kunz, S., & Florack, A. (2023). Social class differences in dietary intake are mediated by the perceived relationship between health and taste: Findings from a cross-sectional and longitudinal study. *Food Quality and Preference, 109*, Article 104914. https://doi.org/10.1016/j.foodqual.2023.104914

Raghunathan, R., Naylor, R. W., & Hoyer, W. D. (2006). The unhealthy = tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing, 70*, 170–184. https://doi.org/10.1509/jmkg.70.4.170

Roininen, K., Lähteenmäki, L., & Tuorila, H. (1999). Quantification of consumer attitudes to health and hedonic characteristics of foods. *Appetite, 33*, 71–88. https://doi.org/10.1006/appe.1999.0232

Santé Publique France. (2018). *Nutri-score: C'est plus facile de manger mieux* [Nutri-Score: It's easier to eat better].

The R Foundation for Statistical Computing. (2021). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.r-project.org/.

Turnwald, B., Anderson, K. G., Jurafsky, D., & Crum, A. J. (2020). Five-star prices, appealing healthy item descriptions? Expensive restaurants' descriptive menu language. *Health Psychology, 39*(11), 975–985. https://doi.org/10.1037/hea0001025

Turnwald, B., Jurafsky, D., Conner, A., & Crum, A. J. (2017). Reading between the menu lines: Are restaurants' descriptions of "healthy" foods unappealing? *Health Psychology, 36*(11), 1034–1037. https://doi.org/10.1037/hea0000501

Turnwald, B., Perry, M. A., Jurgens, D., Prabhakaran, V., Jurafsky, D., Markus, H. R., & Crum, A. J. (2022). Language in popular American culture constructs the meaning of healthy and unhealthy eating: Narratives of craveability, excitement, and social connection in movies, television, social media, recipes, and food reviews. *Appetite, 172*, Article 105949. https://doi.org/10.1016/j.appet.2022.105949

Vogel, T., Ingendahl, M., & McCaughey, L. (2022). Pseudocontingencies: Flexible contingency inferences from base rates. *Judgment and Decision Making, 17*(2), 400–424. https://doi.org/10.1017/s1930297500009165

Vogel, T., & Kutzner, F. (2017). Pseudocontingencies in consumer choice: Preference for prevalent product categories decreases with decreasing set quality. *Journal of Behavioral Decision Making, 30*(5), 1193–1205. https://doi.org/10.1002/bdm.2034

Wahl, D. R., Villinger, K., König, L. M., Ziesemer, K., Schupp, H. T., & Renner, B. (2017). Healthy food choices are happy food choices: Evidence from a real life sample using smartphone based assessments. *Scientific Reports, 7*(1), 1–8. https://doi.org/10.1038/s41598-017-17262-9

Weber, M. (1998). *The protestant work ethic and the spirit of capitalism* (2d ed.) Roxbury.

Werle, C. O. C., Trendel, O., & Ardito, G. (2013). Unhealthy food is not tastier for everybody: The " healthy=tasty" French intuition. *Food Quality and Preference, 28*, 116–121. https://doi.org/10.1016/j.foodqual.2012.07.007

WHO. (2022). *Food marketing exposure and power and their associations with food-related attitudes, beliefs and behaviours: A narrative review*. World Health Organization. https://www.who.int/publications/i/item/9789240041783.