



# Better safe than sorry: discriminability and response bias in adult food neophobia

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## Abstract

Food neophobia, the reluctance to try novel or unfamiliar foods, is thought to involve both uncertainty-related processes and avoidance tendencies under perceived risk. These components have largely been studied separately. This study integrates both using the Signal Detection Theory framework to examine how adults decide whether a food item is edible or inedible under conditions of uncertainty and risk. 57 young French adults (32 females;  $M=20.9$  years,  $SD=4.23$ ) completed validated measures of food neophobia and food disgust sensitivity, and performed a Go/no-Go task in which familiar and unfamiliar foods, presented with or without visual cues of spoilage. Results showed that higher levels of food neophobia were associated with poorer discriminability in distinguishing safe from unsafe food. Individuals with higher food neophobia also exhibited a cautious response bias, favoring “inedible” responses even at the cost of missing edible items, particularly unfamiliar foods. These findings extend previous research in children, highlighting the importance of considering both components to fully understand food neophobia in adults. Interventions aiming to increase acceptance of healthier or more sustainable foods, perceived as new by consumers, should address both reduced discriminability and cautious response tendencies.

**Keywords** Food neophobia · Categorization · Uncertainty · Familiarity · Risk · Signal detection theory

## Introduction

Food neophobia, the fear of novel foods (Pliner & Hobden, 1992), significantly hinders dietary variety, particularly for healthy options such as fruits and vegetables (for reviews, see Cole et al., 2017; Nicklaus & Monnery-Patris, 2018). This disposition is associated with poor diet quality (Jaeger et al., 2017) and an increased risk of metabolic problems (Rabadán & Bernabéu, 2021; Sarin et al., 2019). Research has also identified food neophobia as a childhood risk factor for developing Avoidant Restrictive Food Intake Disorder (ARFID; Zickgraf et al., 2016, 2019), a severe clinical condition characterized by restricted eating that results in at least one of the following: significant weight loss or failure to achieve expected weight gain, nutritional deficiencies, reliance on enteral feeding or oral nutritional supplements, or marked psychosocial impairment (APA, 2013). Beyond individual health, food neophobia is also a psychological barrier to the acceptance of more sustainable novel foods (de Koning et al., 2020; Siegrist & Hartmann, 2020). Given these challenges, decades of research have sought to better understand food neophobia and inform effective

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interventions (Appleton et al. 2016; Karaağaç and Bellikci-Koyu 2023; Lafraire et al. 2016a; Reilly, 2018).

While food neophobia is often broadly described as the fear of novel food, we adopt a more fine-grained, multi-component perspective. Specifically, neophobic responses may reflect (i) cognitive processes related to uncertainty and limited knowledge when foods or eating contexts are perceived as unfamiliar (Czeczor-Bernat, 2025; Foinant et al., 2022; Pickard et al., 2021; Rioux, 2020; Rioux et al., 2016), and (ii) affective-motivational processes that bias decisions toward avoidance when potential risks are anticipated (Fox et al., 2018; Maratos & Sharpe, 2018; Raudenbush & Capiola, 2012). Importantly, we do not claim that these components map uniquely onto the literal meaning of the term “neophobia”; rather, this distinction is introduced as a functional framework to clarify mechanisms and generate testable predictions. This conceptual separation also parallels models such as the SEA framework (Sensory, Emotional, Association; Coulthard et al., 2022), which differentiate between sensory/cognitive drivers and emotional underpinnings of food rejection.

These two classes of processes have often been investigated separately, with some studies examining how neophobia relates to the ability to discriminate entities in the food domain (e.g., Foinant et al. 2024a, 2024b; Gauthier and Fiestan 2023; Rioux et al. 2016), while others have focused on the affective fear responses triggered by unknown food (e.g., Galloway et al., 2003; Maratos & Staples, 2015; Raudenbush & Capiola, 2012). The present study aims to capture these components of food neophobia within the Signal Detection Theory framework (Lynn & Barrett, 2014; Macmillan & Creelman, 2004) to investigate how individuals decide under uncertainty whether a food item is edible or not. By adopting this approach, we seek to provide a more comprehensive understanding of how these processes may shape food-related decisions, which may, in turn, inform targeted interventions to improve dietary diversity.

Several studies, primarily targeting young children, have examined the relation between food neophobia and categorization abilities in the food domain. Rioux et al. (2016 2018a, 2018b, 2018c) conducted a series of pivotal studies revealing a negative correlation between food neophobia and category-based abilities, with higher levels of food neophobia predicting lower accuracy on tasks requiring discrimination between taxonomic categories, such as fruits and vegetables. This relationship was extended from uncertainty about food taxonomies (e.g., green apple, apple, fruit) to uncertainty about food thematic associations (Pickard et al., 2021) and eating contexts such as types of meal (Pickard et al., 2023; for discussion, see Gandolini et al., 2024). Other studies have yielded more mixed results: for instance, Fleischeuer et al. (2024) found that children’s

food rejection tendencies were not reliably associated with category-based induction or memory performance. Despite these inconsistencies in childhood, research in adults suggests that food neophobia remains linked to perceptual and categorization abilities. In two visual food discriminability tasks, Gauthier and Fiestan (2023) found that, even after controlling for general object recognition skills, personality traits, gender, and age, food neophobia remained the strongest, albeit negative, predictor of visual discrimination abilities. Collectively, these studies provide evidence for the link between food neophobia and both categorical and perceptual discrimination abilities across development, though findings in childhood are not entirely consistent.

Although studies on categorization provide valuable insights into the cognitive underpinnings of food neophobia, they represent only one side of the phenomenon. This research has largely addressed the cognitive triggers of neophobic responses: perceptual uncertainty and knowledge gaps. In parallel, another body of work has focused on the affective and defensive reactions associated with neophobia, often drawing on models of anxiety (Maratos & Sharpe, 2018; van den Brand et al., 2023). Individuals with high food neophobia exhibit heightened physiological fear responses, such as increased galvanic skin response and elevated pulse or respiration rates, when exposed to novel foods (Raudenbush & Capiola, 2012). They also report greater anxiety (Galloway et al., 2003) and disgust toward unfamiliar foods (Brown & Harris, 2012; Martins & Pliner, 2006), and display attentional vigilance toward novel food cues (Maratos & Staples, 2015). Neophobic individuals further tend to interpret foods they avoid as hazardous, anxiety-inducing, or even disgusting (“I think in most cases I’m just literally afraid of it [a unknown food]. I don’t wanna throw up or get sick” – Irene; p.5; Fox et al., 2018), while construing foods they consume as “safe” (“I mean, potato is one of my... major safe foods” – Amy; p.4) and, consistently, they provide lower explicit ratings of food safety (Coricelli et al., 2022). As reviewed by van den Brand and colleagues (2023), these patterns parallel a broader set of biases typically observed in anxiety, including attentional vigilance toward threat, negative interpretation of ambiguity, and heightened risk expectations. While this overlap highlights the connection between food neophobia and anxiety-related processes, not all anxiety-linked biases extend to the food domain; for example, food neophobia was unrelated to confirmation bias in young adults (Dibbets et al., 2021).

Taken together, the research on food neophobia encompasses two complementary strands: studies of cognitive processes, which highlight uncertainty in evaluating and reasoning about foods, and studies of affective and defensive reactions, which reveal fear-based and anxiety-like responses. While both aspects are clearly part of food

neophobia, the fact that they have typically been studied separately leaves open the question of whether neophobic decisions are primarily driven by one, the other, or both. To address this question, we employ the Signal Detection Theory (SDT; Lynn & Barrett, 2014; Macmillan & Creelman, 2004) framework. Recent theoretical efforts have positioned neophobia within SDT to better understand its underlying decision-making mechanisms (Crane et al., 2020), and this approach has already been successfully employed in research with children (Foinant et al. 2022; Lafraire et al. 2016b). SDT has also proven valuable in characterizing other phobias and anxiety-related traits, offering significant insights into their decision-making processes (e.g., Coles & Heimberg, 2005; Haberkamp et al., 2019; Lynn & Barrett, 2014; Weierich & Treat, 2015; Yoon et al., 2014).

This framework describes how individuals distinguish between signal (e.g., edible food) and noise (e.g., inedible food) under perceptual uncertainty (e.g., morphing, blurring or brief stimulus presentations, etc.) by considering two key psychophysical dimensions. The first, discriminability, measures how accurately a perceiver differentiates signal from noise. The second, response bias, captures the perceiver's tendency to respond "yes" or "no" to the presence of a signal. For example, if an individual perceives the costs of a false alarm (mistakenly identifying inedible food as edible) as greater than the costs of a miss (overlooking a safe food source), they will adopt a more conservative bias, increasing the likelihood of saying "no" to the presence of a signal.

Building on this framework, recent research in young children used SDT to examine how food neophobia influences discriminability and response bias (Foinant et al., 2022). The study employed a categorization task in which preschoolers were shown images of edible and visually similar non-edible items (e.g., a tomato and a red Christmas ball). The findings revealed that higher levels of food neophobia were associated with both poorer discriminability in distinguishing food from non-food and a more conservative response bias, favoring "it is inedible" errors. By contrast, Rioux et al. (2016) employed SDT in a task contrasting fruits and vegetables, a risk-free categorization without explicit consequences, and observed that food neophobia was related to reduced discriminability but not to the decision criterion, suggesting that response biases may emerge primarily in situations where errors carry perceived risks.

In adults, evidence from a Go/No-Go Association Task (Coricelli et al., 2022), provides converging support for the role of cautious, risk-averse tendencies in food-related decisions. Participants were asked to associate foods with either toxicity-related or safety-related words. Similar to the findings in Foinant et al. (2022) with children, neophobic adults were more likely than neophilic adults to incorrectly associate both familiar and unfamiliar foods with toxicity.

However, since SDT was not explicitly applied in this study, it remains unclear whether this reflects lower discriminability or a response bias associating food with danger.

While developmental studies have shown that food neophobia is associated with both lower discriminability (e.g., Rioux et al., 2016) and a risk-averse response bias (Foinant et al., 2022), it remains unclear whether these patterns persist into adulthood. Recent research suggests that lower discriminability continues to characterize neophobia in adults (Gauthier & Fiestan, 2023), but whether they also maintain a risk-averse response bias remains an open question.

To investigate both discriminability and response bias in adult food neophobia, we had participants complete an edible vs. inedible categorization task and a recognition memory task. In the categorization task, participants had to decide whether familiar and unfamiliar fruits presented for 80 milliseconds were edible or not. Given evidence that food rejection decisions are primarily based on visual cues (e.g., rotting, withering; Campbell et al., 2009; Dusoruth & Peterson, 2020; Parizeau et al., 2015), we presented each fruit in both a fresh and a spoiled form (e.g., a fresh versus rotten strawberry). This paradigm, adapted from Lafraire et al. (2016b), was designed to prevent ceiling effects, ensuring a sufficient number of errors for analysis using SDT (Grier, 1971; Snodgrass & Corwin, 1988; Stanislaw & Todorov, 1999).

We also conducted a recognition memory task in which participants viewed both previously seen images from the categorization task and new images. Their task was to determine whether each food image had appeared in the categorization task or not, without considering edibility. This builds on previous research showing that individuals with social phobia exhibit a response bias toward indicating that critical faces were previously seen, whereas non-anxious controls demonstrate a bias toward recognizing accepting faces (Coles & Heimberg, 2005). In this study, we aim to determine whether food neophobia similarly biases recognition memory toward inedible foods.

To ensure that our manipulation of familiar versus unfamiliar foods was effective, participants' familiarity with the food items was assessed post-task, confirming that the designated categories were perceived as intended. Additionally, because some stimuli included spoiled foods, we measured disgust sensitivity using the Food Disgust Scale (Hartmann & Siegrist, 2018) to account for individual differences in aversive reactions that could influence task performance. These measures allowed us to verify that observed effects on discriminability and response bias were attributable to food neophobia rather than differences in disgust sensitivity (Al-Shawaf et al., 2015; Ammann et al., 2018).

In line with existing findings, we hypothesized that (i) food neophobia would be negatively associated with

participants' ability to discriminate between edible and inedible foods and (ii) would be linked to a cautious response bias, increasing the tendency to respond "inedible", even at the cost of missing edible foods. Given the exploratory nature of the relationship between food neophobia and recognition memory discriminability and response bias, we did not formulate a specific hypothesis for this aspect of the study.

## Method

The study was conducted online via LabVanced (Finger et al., 2017), with participants giving informed consent before starting and adhered to the Declaration of Helsinki. It was preregistered on OSF (<https://osf.io/jnpcq>) and approved by the institutional ethics committee (#2024\_04). Lasting about 15 min, the study had five phases: (a) demographics, diet, and hunger questions; (b) rapid categorization task; (c) food neophobia and disgust sensitivity questionnaires; (d) recognition memory task; and (e) familiarity ratings of food stimuli. Color photographs of the stimuli used in this study, supplemental analyses and statistics, deidentified data, and R code for analyses are publicly available on OSF (see Data Availability statement [https://osf.io/3nzps/?view\\_only=fcc6f86b874a4c34acea9a74f17d0137](https://osf.io/3nzps/?view_only=fcc6f86b874a4c34acea9a74f17d0137)).

### Participants: demographics, diet, and hunger questions

Previous research using the SDT framework, albeit with children, reported effect sizes of 0.354 between food neophobia scores and categorization strategies (Foinant et al., 2022). To achieve a power of 0.80 at the standard alpha error probability of 0.05, a sample size of 60 participants was necessary.

Participants were recruited via convenience sampling through information notices posted at the university. Participation was entirely voluntary, and no remuneration or course credit was offered. In total, 63 participants reported their age, gender, education, employment status, job position, and residency. They also reported their dietary preferences (omnivore, vegetarian, vegan), food intolerances, and current hunger level on a Visual Analog Scale (VAS). The VAS distances ranged from 1 to 100, but this was not explicitly displayed to the participants. More precisely, participants were asked:

How hungry are you at the moment? (Not at all [0] – A lot [100]).

The final sample consisted of 57 adults (32 females) with normal or corrected-to normal vision. Participants' ages ranged from 18 to 35 years ( $M=20.9$ ,  $SD=4.23$ ). The majority of the sample was high school graduates (56.1%), students (84.2%), and lived in a city with a population over 100,000 people (56.1%). Participants were mostly omnivores (93.0%) without any food intolerances (86.0%; details of frequencies for participants' demographics and diet information can be found in the supplementary materials, Appendix A). Hunger levels varied between 0 and 100 ( $M=35.3$ ,  $SD=29.6$ ). Data of six additional participants were excluded because they did not complete the task properly (refer to the data preparation section for further details).

## Procedure





The study was conducted remotely via LabVanced. Because the experiment included speeded keyboard-based responses, participation was restricted to desktop or laptop computers equipped with a physical keyboard. The task was not accessible on smartphones or tablets.

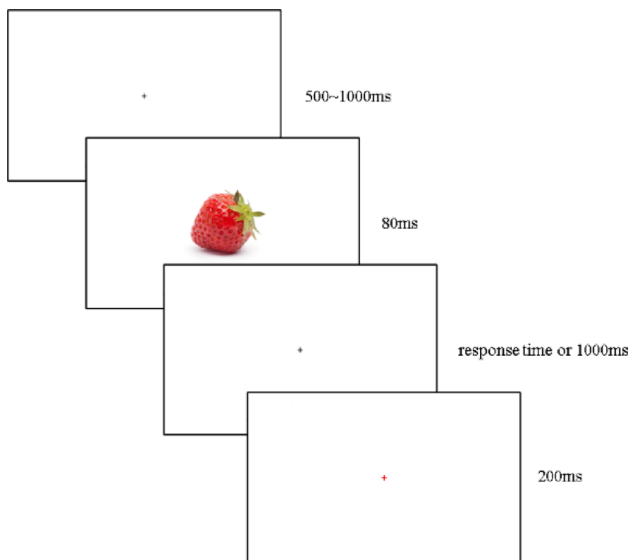
### The rapid categorization task

The experiment used 40 images of food items, 20 familiar (10 edible, 10 rotten) and 20 unfamiliar (10 edible, 10 rotten). Familiar foods were selected from validated databases (Blechert et al., 2014; Foroni et al., 2013) providing high familiarity ratings, whereas unfamiliar foods were sourced from copyright-free online databases and were assumed to be largely unknown to French participants. To confirm this distinction, participants provided familiarity ratings for each food item (see Sect. 2.2.4), which supported the intended categorization (reported in Sect. 2.3.4). As shown Table 1, all images were color photographs in jpg-format (1024×1024 pixels). 10 additional stimuli, 5 dogs and 5 non-dogs (e.g., a cat), were used for practice. Detailed information on individual food items and their corresponding images is provided in the supplementary materials.

In the rapid categorization task, participants had to place their finger on the space bar. Each trial started with a fixation cross (500~1000ms), followed by the presentation at the center of the screen of the stimulus for 80ms. Participants had 1000ms to release the space bar for target images (Go) and kept pressing for non-targets (no-Go). A red fixation cross confirmed the response, with a 200ms interval before the next trial (Fig. 1). Go trials were counterbalanced across participants. Half of the participants were instructed to release their finger upon seeing edible items, while the remaining half released their finger upon encountering inedible items.

**Table 1** Examples of stimuli used in the rapid categorization task

	Edible	Rotten
Familiar		
Unfamiliar		



**Fig. 1** Example of a trial

In the initial 10-trial familiarization phase, participants learned to distinguish dogs from other animals. Correct answers prompted a green circle, while incorrect ones triggered a red cross. Participants needed at least 70% accuracy to proceed; otherwise, they repeated this phase up to three times. In the subsequent test phase, they classified the 40 food images as edible or non-edible without receiving feedback. All images were presented randomly.

### Questionnaires on participants' characteristics

Following the categorization task, participants completed two standardized and validated questionnaires investigating food neophobia disposition (the Food Neophobia Scale; Pliner & Hobdin, 1992) and food disgust sensitivity (the Food Disgust Scale; Hartmann & Siegrist, 2018). While the Food Neophobia Scale has been validated in French (Siegrist et al., 2013), the Food Disgust Scale was administered in French without a forward-backward translation procedure.

The Food Disgust Scale assesses individuals' sensitivity to various food-related aversive items or situations. In this study, we specifically examined the Mold, Decaying fruit, Decaying vegetables, and Living contaminants subscales, comprising a total of 15 statements. Participants indicated their level of agreement with each statement using a 6-point Likert-like scale, ranging from "Not disgusting at all" to "Totally disgusting", resulting in possible scores from 15 to 90, with higher scores reflecting greater disgust sensitivity.

The Food Neophobia Scale measures the tendency to avoid novel foods. Participants responded on a 7-point Likert-type scale ranging from "Strongly disagree" to "Strongly agree," yielding possible scores from 10 to 70, with higher scores indicating greater food neophobia. For analyses, both Food Disgust Scale and Food Neophobia Scale scores were scaled.

## The recognition memory task

Participants engaged in an unexpected recognition memory task in which they had to use the *E* key when they recognized a previously seen image and the *I* key to indicate a new image. Key assignments were balanced among participants. This task included the 40 images from the categorization task and 40 new images, divided equally into four categories: familiar edible, familiar rotten, unfamiliar edible, and unfamiliar rotten food items, with 10 images each. Image presentation was randomized.

## Familiarity ratings

Finally, participants rated their familiarity with each edible food image on a VAS. The VAS scale was positioned below the randomly presented food images and ranged from 0 to 100, but this was not explicitly displayed to the participants. Participants were asked the following question (translated from French):

How frequently do you come across this food in your daily life? (Never [0] – Frequently [100]).

## Measures

### The rapid categorization task

In the rapid categorization task, individual response times (ms) were recorded. No specific measures were implemented to prevent automated responses (bots) in the online survey. However, the dataset was carefully inspected for irregularities, including extremely fast or abnormally long completion times. Three participants were excluded because they responded faster than 150ms in at least 10% of the trials, suggesting anticipation or random responding. An additional three participants were excluded for taking more than three standard deviations above the mean completion time to finish the study.

We recorded each participant's responses as Hits or Misses for Go trials, and Correct Rejections or False Alarms for No-Go trials. Participants received a Hit score (i.e., the probability to release the space bar for Go-trials) and a False alarm score (i.e., the probability to release the space bar for no-Go trials). Using the SDT, we computed a discriminability index ( $A'$ ) and a response bias index ( $B''$ ; see Grier, 1971; Snodgrass & Corwin, 1988; Stanislaw & Todorov, 1999). The  $A'$  index ranges from 0 to 1, with 0.50 indicating responses at chance level, and 1 indicating maximum discriminability. This index was computed as follows:

$$A' = \begin{cases} .5 + \frac{(H-F)(1+H-F)}{4H(1-F)} & \text{when } H \geq F \\ .5 - \frac{(F-H)(1+F-H)}{4F(1-H)} & \text{when } H < F \end{cases}$$

where  $H$  stood for the probability of a Hit and  $F$  corresponded to the probability of a False alarm.

The  $B''$  index ranges from  $-1$  to  $+1$ , with  $-1$  indicating a liberal response bias (i.e., a tendency to respond "Go" regardless of the stimulus), and  $1$  indicating a conservative response bias (i.e., a tendency to withhold the "Go" response). The  $B''$  index was as follows:

$$B'' = \begin{cases} \frac{H(1-H)-F(1-F)}{H(1-H)+F(1-F)} & \text{when } H \geq F \\ \frac{F(1-F)-H(1-H)}{F(1-F)+H(1-H)} & \text{when } H < F \end{cases}$$

where  $H$  corresponded to the probability of a Hit and  $F$  to the probability of a False alarm.

Separate formulas are used depending on whether  $H \geq F$  or  $H < F$  because the standard SDT equations assume a higher hit rate than false alarm rate. If this assumption is violated, applying the formula directly could produce values outside the theoretical bounds. Using conditional formulas ensures that  $A'$  is always constrained between 0 and 1, and  $B''$  is always constrained between  $-1$  and  $+1$ .

### Questionnaires on participants characteristics

Because the Food Disgust Scale had not been previously validated in French, we conducted an internal reliability test, yielding acceptable results (Cronbach's  $\alpha=0.672$ ). Accordingly, we calculated a Food Disgust score for each participant.

### The recognition memory task

Responses to each food item were recorded as Hits or Misses for the images that participants saw during the rapid categorization task, and Correct Rejections or False Alarms for the new images. We computed an  $A'$  index and a  $B''$  index for each participant.  $B''$  index negative values would indicate a tendency towards "I saw it before" responses, and positive values suggest a tendency towards "I did not see it before," regardless of the stimulus.

### Familiarity ratings

Familiarity ratings confirmed participants' greater recognition of familiar food items over unfamiliar ones, with a paired  $t$ -test showing a significant difference ( $t=39.74$ , 95% CI [61.4, 67.9],  $d=5.26$ ,  $p < .001$ ). Participants were more familiar with familiar food items ( $M=79.0$ ,  $SD=14.1$ ) than with unfamiliar food items ( $M=14.$ ,  $SD=11.3$ ). See

Appendix B in supplementary materials for the full list of stimuli and their respective familiarity rating.

## Results

### Statistical analyses

All analyses were performed using the R environment (R Core Team, 2021). First, we controlled that the participants in the Go-Edible condition (Go on edible items;  $n=27$ ) did not differ significantly from those in the Go-Inedible condition (Go on inedible items;  $n=30$ ) in terms of Gender distribution ( $\chi^2=1.06, p=.589$ ), Age ( $t=-1.84, 95\%$  CI mean difference  $[-4.22, 0.182,], d=-0.488, p=.071$ ), Hunger ( $t=1.11, 95\%$  CI mean difference  $[-7.03, 24.34], d=0.293, p=.274$ ), Food Disgust scores ( $t=-0.79, 95\%$  CI mean difference  $[-8.37, 3.64], d=-0.209, p=.434$ ), Food Neophobia ( $t=-0.85, 95\%$  CI mean difference  $[-10.76, 4.34], d=-0.226, p=.398$ ), and familiarity with the food items used in the experiment ( $t=-0.33, 95\%$  CI mean difference  $[-7.00, 5.01], d=-0.088, p=.741$ ). All tests indicated no significant differences between the two conditions (all  $p>.05$ ).

We analyzed participants' discriminability A' and response bias B'' indexes from the rapid categorization task and the recognition memory task using Linear Mixed-effects Models (Bates et al., 2015). In all models, participants served as a random effect to account for shared variances within subjects, controlling for Gender Identity, Age, Hunger and Food Disgust scores. Condition (Go-Edible and Go-Inedible), Familiarity (familiar food items and unfamiliar food items), and Food Neophobia scores, as well as interactions, were included as fixed factors sequentially based on corrected Akaike Information Criterion (AICc;

Burnham & Anderson, 2002) improvements. For the recognition memory task, Edibility (edible and inedible food items) was also included as a factor. Results report only the best-fitting mixed models, with Tukey's method adjusting for multiple comparisons.

Preliminary and Supplemental analysis of reaction times in the rapid categorization task is available in supplementary materials (see Appendix C et D, respectively). We also compared A' index means to chance (0.5) and B'' index to a neutral tendency (0) using one-sample  $t$ -tests for both tasks (see Appendix E). For the rapid categorization task, the level of significance was Bonferroni-adjusted to  $p\leq.015$ , whereas the adjusted level of significance in the recognition memory task was  $p\leq.01$ .

Descriptive statistics for the main measures, including Food Neophobia and Food Disgust scores, are reported in Table 2.

### The rapid categorization task

#### Categorization discriminability A'

Mean discriminability A' was 0.676 ( $SD = 0.246$ ). One-sample  $t$ -tests (Bonferroni-corrected; see Appendix E.1) confirmed that A' was significantly above chance (0.50) for both familiar and unfamiliar foods in both conditions (all  $p\leq.002$ ).

In the model, only Food Neophobia was retained as a fixed effect. The model had a better fit than the null model (including only control variables) as shown with a significant drop in AICc ( $\chi^2(1)=18.91, p<.001, R^2_{\text{marginal}}=0.281$ ).

Food neophobia was associated with poorer discrimination between edible and inedible items ( $\chi^2(1)=19.67,$

**Table 2** Descriptive statistics

	Mean (standard deviation)	Range (possible minimum – maximum scores)
Condition Go-Edible ( $n=27$ )		
Categorization A' index	0.682 (0.236)	0.080–0.948 (0–1)
Categorization B'' index	-0.212 (0.339)	-0.828–0.435 (-1–1)
Recognition A' index	0.685 (0.101)	0.430–0.875 (0–1)
Recognition B'' index	0.016 (0.145)	-0.311–0.401 (-1–1)
Hunger	39.89 (31.5)	0–100 (0–100)
Food disgust scores	45.70 (13.9)	24–75 (15–90)
Food neophobia scores	24.56 (13.7)	10–60 (10–70)
Condition Go-Inedible ( $n=30$ )		
Categorization A' index	0.670 (0.259)	0.109–0.975 (0–1)
Categorization B'' index	-0.010 (0.302)	-0.526–0.568 (-1–1)
Recognition A' index	0.728 (0.104)	0.476–0.950 (0–1)
Recognition B'' index	0.061 (0.226)	-0.413–0.851 (-1–1)
Hunger	31.23 (27.6)	0–100 (0–100)
Food disgust scores	48.07 (9.4)	27–69 (15–90)
Food neophobia scores	27.77 (14.6)	10–60 (10–70)

beta = -0.142, 95% CI [-0.202, -0.082],  $p < .001$ ,  $d = -1.254$ ,  $\Delta R^2_{\text{marginal}} = 0.226$ ), indicating that individuals with higher levels of food neophobia had poorer accuracy than more neophilic individuals.

### Categorization response bias B''

Mean response bias B'' was -0.106 ( $SD = 0.333$ ). The model included Familiarity, Condition, Food Neophobia, and their interactions as fixed effects ( $\chi^2(7) = 34.91$ ,  $p < .001$ ,  $R^2_{\text{marginal}} = 0.336$ ).

The effect of Condition ( $\chi^2(1) = 13.50$ , beta = 0.311, 95% CI [0.155, 0.468],  $p < .001$ ,  $d = 0.774$ ,  $\Delta R^2_{\text{marginal}} = 0.088$ ) indicated that participants were more liberal in the Go-Edible condition ( $M = -0.212$ ,  $SD = 0.339$ ) than in the Go-Inedible condition ( $M = -0.1010$ ,  $SD = 0.302$ ).

There was an interaction between Condition and Food Neophobia ( $\chi^2(1) = 3.83$ , beta = -0.170, 95% CI [-0.330, -0.010],  $p = .050$ ,  $d = -0.415$ ,  $\Delta R^2_{\text{marginal}} = 0.120$ ). In both conditions, more neophobic participants exhibited a cautious response bias compared to more neophilic individuals. They were more conservative in the Go-Edible condition (beta = 0.128,  $SE = 0.057$ , 95% CI [0.014, 0.241]), meaning they made more misses, often failing to respond to edible items. Conversely, as hypothesized, they were more liberal in the Go-Inedible condition (beta = -0.154,  $SE = 0.047$ , 95% CI [-0.249, -0.059]), leading to more false alarms, where they incorrectly classified edible items as inedible.

Figure 2 shows the three-way interaction between Condition, Food Familiarity and Neophobia ( $\chi^2(1) = 4.89$ , beta = -0.224, 95% CI [-0.419, -0.029],  $p = .027$ ,  $d = -0.607$ ,  $\Delta R^2_{\text{marginal}} = 0.020$ ). Post-hoc comparisons revealed that, in the Go-Inedible condition, participants with higher levels of food neophobia were more liberal (i.e., more

likely to classify food as inedible) for unfamiliar foods (beta = -0.237,  $SE = 0.058$ , 95% CI [-0.352, -0.121]) compared to familiar (beta = 0.099,  $SE = 0.068$ , 95% CI [-0.037, 0.234];  $t = -3.87$ ,  $p = .001$ ) and unfamiliar foods in the Go-Edible condition (beta = 0.157,  $SE = 0.068$ , 95% CI [0.022, 0.292];  $t = -4.54$ ,  $p < .001$ ). In the Go-Edible condition, they were also more conservative (i.e., less likely to classify food as edible) for unfamiliar foods ( $t = -2.63$ ,  $p = .048$ ) compared to familiar foods in the Go-Inedible condition (beta = -0.071,  $SE = 0.058$ , 95% CI [-0.186, 0.044]). Although other comparisons were not significant, it's noteworthy that only the slopes for unfamiliar foods, in both Conditions, were significant. This suggests that participants' response bias was significantly related to food neophobia only for unfamiliar foods.

### The recognition memory task

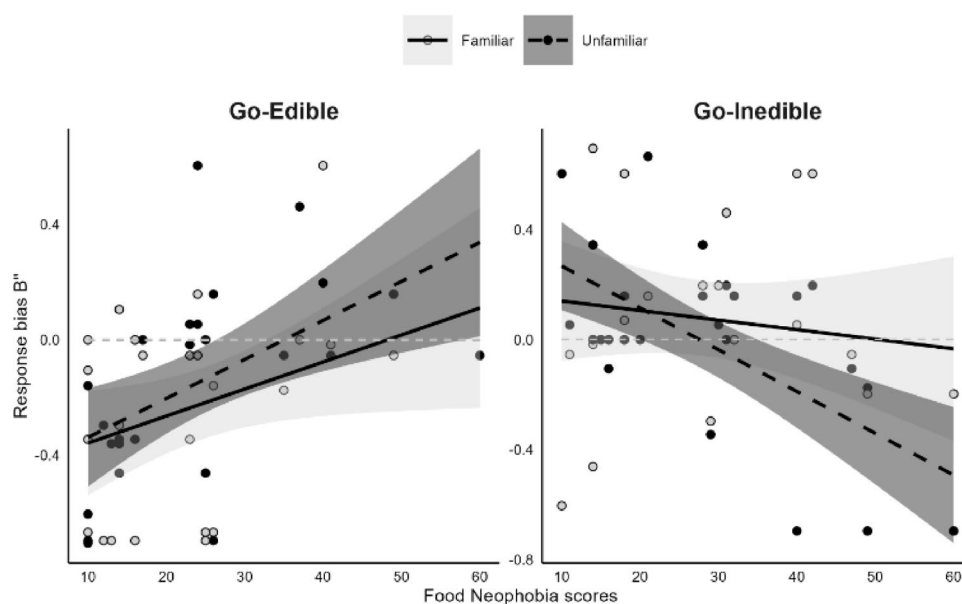
#### Recognition memory discriminability A'

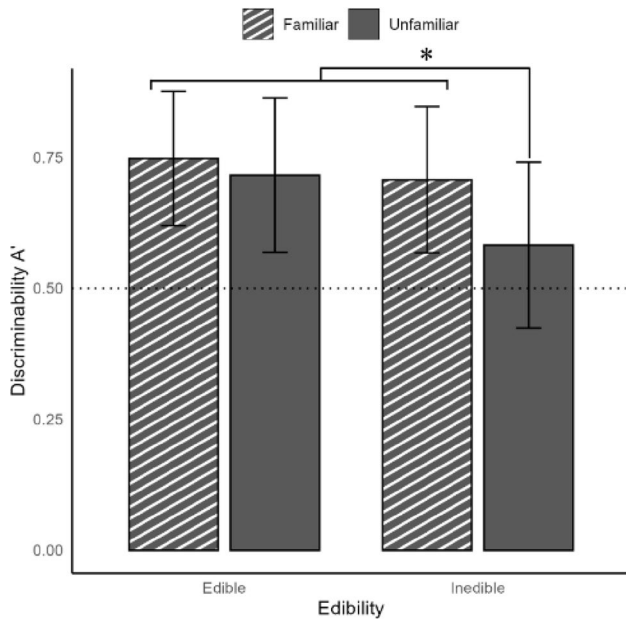
Mean discriminability A' was 0.708 ( $SD = 0.104$ ). One-sample  $t$ -tests (Bonferroni-corrected; Appendix E.3) confirmed that recognition A' was significantly above chance for all trial types (all  $p < .001$ ).

In the model, Edibility, Familiarity, Food Neophobia, as well as the interactions between Edibility and Familiarity, and between Familiarity and Food Neophobia were modeled as fixed effects ( $\chi^2(5) = 64.0$ ,  $p < .001$ ,  $R^2_{\text{marginal}} = 0.196$ ).

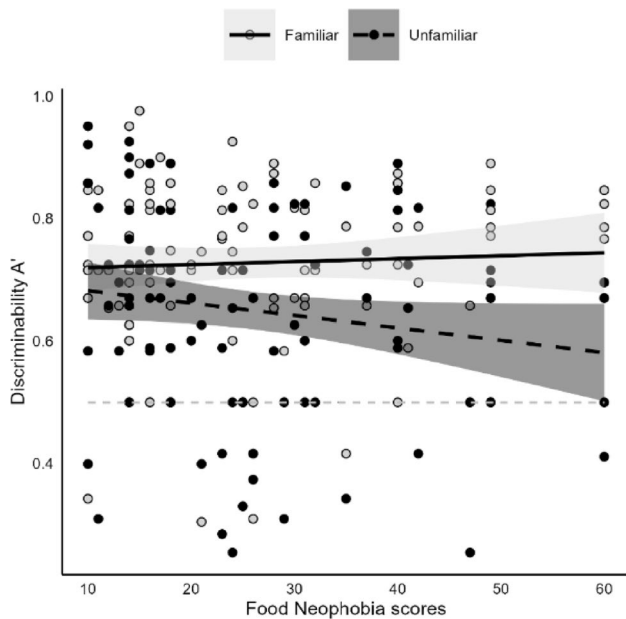
Figure 3 shows the interaction between Edibility and Familiarity ( $\chi^2(1) = 9.60$ , beta = -0.093, 95% CI [-0.152, -0.035],  $p = .002$ ,  $d = 0.479$ ,  $\Delta R^2_{\text{marginal}} = 0.021$ ), with inedible unfamiliar foods less well recognized than the other items (all  $p_{\text{Tukey}} < 0.001$ ).

**Fig. 2** Response bias B'' as function of condition, familiarity, and food neophobia scores





**Fig. 3** Discriminability A' as function of familiarity and edibility. Bars indicate 95% confidence intervals



**Fig. 4** Discriminability A' as function of familiarity and food neophobia scores

Figure 4 illustrates the interaction between Familiarity and Food Neophobia ( $\chi^2(1)=5.43$ ,  $\beta=-0.035$ , 95% CI  $[-0.065, -0.006]$ ,  $p=.020$ ,  $d=-0.361$ ,  $\Delta R^2_{\text{marginal}}=0.011$ ), showing that more neophobic participants had poorer recognition performance for unfamiliar foods ( $\beta=-0.021$ ,  $SE=0.018$ , 95% CI  $[-0.058, 0.015]$ ) compared to familiar foods ( $\beta=0.014$ ,  $SE=0.018$ , 95% CI  $[-0.022, 0.050]$ ), than their more neophilic counterparts.

### Recognition memory response bias B''

Mean response bias B'' to the recognition memory task was 0.040 ( $SD=0.192$ ). The model included Edibility and Familiarity as fixed effects ( $\chi^2(2)=28.76$ ,  $p<.001$ ,  $R^2_{\text{marginal}}=0.116$ ).

Regarding Edibility, participants were more conservative with inedible ( $M=0.089$ ,  $SD=0.187$ ) than edible items ( $M=-0.051$ ,  $SD=0.284$ ;  $\chi^2(1)=22.91$ ,  $\beta=0.158$ , 95% CI  $[0.094, 0.223]$ ,  $p<.001$ ,  $d=0.736$ ,  $\Delta R^2_{\text{marginal}}=0.072$ ). This indicates that participants were more likely to miss previously seen rotten foods but were willing to falsely recognize new edible foods as previously seen. The effect of Familiarity indicated that participants were more conservative with familiar ( $M=0.091$ ,  $SD=0.261$ ) than with unfamiliar foods ( $M=0.014$ ,  $SD=0.194$ ;  $\chi^2(1)=8.04$ ,  $\beta=0.094$ , 95% CI  $[0.029, 0.159]$ ,  $p=.005$ ,  $d=0.436$ ,  $\Delta R^2_{\text{marginal}}=0.025$ ), meaning they were more likely to miss familiar foods compared to unfamiliar ones.

### Discussion

Building on recent theoretical (Crane et al. 2020; Lafraire et al. 2016a) and empirical work on food neophobia (Foinant et al., 2022; Rioux et al., 2016), we leveraged the Signal Detection Theory (SDT) framework to simultaneously capture two classes of processes that are often studied in isolation: uncertainty-related processes (i.e., discriminability) and avoidance-related decisional tendencies under perceived risk (i.e., response bias). This approach allowed us to extend recent findings in children (Foinant et al., 2022) to adults, demonstrating that food neophobia is associated with both reduced discriminability and risk-averse response biases.

Participants first completed a rapid categorization task (see Lafraire et al. 2026b for a similar methodology with children), where they classified familiar and unfamiliar fruits, presented either with or without visual signs of spoilage, as edible or inedible. This was followed by a recognition memory task, in which they had to determine whether food images had appeared in the earlier categorization task, irrespective of edibility.

Regarding the categorization task, our results confirmed our hypothesis, revealing a significant negative association between participants' food neophobia levels and their ability to discriminate between edible and inedible foods. This finding extends prior research with young children (e.g., Rioux et al. 2016, 2018b) and aligns with recent evidence suggesting that food neophobia in adults is also characterized by reduced discriminability (Gauthier & Fiestan, 2023). Building on Gauthier and Fiestan's (2023) work, which

focused on visual discrimination between similar-looking dishes, our study demonstrates that neophobia also affects categorical judgments about edibility. The convergence of findings in children and in adults suggests that food neophobia may be associated with both perceptual and categorical uncertainty, potentially making more neophobic individuals less adept at recognizing risks and opportunities in their food environment.

Uncertainty is particularly critical in the food domain, as errors in consumption can have potentially severe consequences. To mitigate the risk of making potentially harmful errors, this uncertainty may lead individuals with higher levels of food neophobia to err on the side of caution, rejecting foods or situations in which they cannot confidently determine safety or edibility (Crane et al., 2020).

This cautious approach is reflected in our findings our findings on response biases in the categorization task, consistent with the idea that perceived risk interacts with uncertainty to promote avoidance. Specifically, a significant three-way interaction among food neophobia, task condition, and familiarity revealed that individuals with higher levels of neophobia were more conservative in the Go-Edible condition, accepting fewer unfamiliar items as edible than their more neophilic counterparts. Conversely, in the Go-Inedible condition, more neophobic participants exhibited a liberal bias, categorizing most unfamiliar items as inedible. These results extend the findings of Foinant et al. (2022) in children, demonstrating that food neophobia is associated with a risk-averse response bias in adulthood.

Moreover, our study highlights the moderating role of familiarity in this relationship. Participants with higher levels of food neophobia displayed heightened caution specifically for unfamiliar items, supporting Crane et al.'s (2020) general principle that increased uncertainty in a risky environment promotes more risk-averse decision-making. Indeed, our experimental design introduced two layers of uncertainty. Perceptual uncertainty was present because the same fruits were briefly presented in both fresh and rotten states. For unfamiliar foods, there was an additional layer of uncertainty stemming from a lack of prior knowledge about the food, including cues that signal edibility or spoilage, and its potential consequences upon consumption. The convergence of these two sources of uncertainty may amplify risk-averse response biases when decisions are perceived as consequential.

Furthermore, our results revealed an intriguing pattern among individuals with lower levels of food neophobia (or higher neophilia). Despite their better accuracy in distinguishing between edible and inedible foods, thereby reducing their actual risk of consuming something harmful, they exhibited riskier response tendencies. One possible explanation for this pattern is overconfidence: their

enhanced discriminability may foster a sense of mastery in the food domain, leading them to overestimate the reliability of their own judgments (Menkhoff et al., 2013). Indeed, empirical evidence across multiple domains, including sensory decisions, medical judgments, and managerial forecasting (Lebreton et al., 2018; Miller et al., 2015; Tsai et al., 2008), indicates that higher accuracy often correlates with increased confidence, which in turn can justify a more liberal decision criterion (i.e., accepting more possible options) even if it risks some misclassification. Accordingly, more neophilic individuals may be more inclined to accept a wider range of foods, potentially exposing themselves to greater risk despite their heightened discrimination abilities. By repeatedly engaging with unfamiliar foods, individuals with lower levels of food neophobia might have refined their ability to distinguish safe from unsafe options through experience. Future research should examine whether this bidirectional relationship holds, whether risk-taking promotes better discrimination or vice versa, by tracking individuals' food choices and categorization performance over time. Recent longitudinal evidence suggests that in children, discriminability predicts subsequent response bias, but not the reverse (Foinant et al., 2025). This suggests a potential causal pathway, where growing mastery, and the confidence it implies, supports more liberal decision-making.

Turning to the recognition memory task, we found that food neophobia influenced discriminability but not response bias. Specifically, participants with higher levels of food neophobia demonstrated lower accuracy in distinguishing unfamiliar foods previously encountered in the categorization task from new ones. This finding is particularly interesting and suggests that when given sufficient time to process the stimuli, individuals with higher neophobia do not exhibit greater uncertainty about familiar foods compared to their more neophilic counterparts. However, their ability to recognize unfamiliar stimuli, those inherently more uncertain, appears to be impaired.

The absence of a correlation between food neophobia and response bias in the recognition task is also noteworthy. One might have expected a memory bias akin to that observed in socially anxious individuals, who tend to falsely recognize critical faces (Coles & Heimberg, 2005). However, the lack of such an effect aligns with Crane et al.'s (2020) general principle that cautious biases in neophobia arise from the interplay of uncertainty and perceived risk. In the recognition task, where judgments were unrelated to edibility, the element of risk was absent, potentially explaining the absence of bias.

This interpretation is consistent with prior findings showing no link between food neophobia and response bias when discriminating between food categories (e.g., fruits vs. vegetables; Rioux et al., 2016) or in neutral and positive

contexts (e.g., safety-related associations, Coricelli et al., 2022; or positive food health-related properties, Foinant et al., 2021). Recent neuroimaging evidence further supports this idea, demonstrating that information about a food's immediate edibility is not processed by the brain unless edibility is central to the task (Moerel et al., 2024).

Nevertheless, as van den Brand et al. (2023) and previously Maratos and Sharpe (2018) suggested, given the established links between food neophobia and anxiety (Galloway et al., 2003; Maiz & Balluerka, 2018), future research should further explore whether food neophobia is associated with cognitive biases commonly observed in anxiety disorders.

In sum, our findings underscore the importance of considering both uncertainty-related processes and avoidance-related decisional tendencies under perceived risk, as they contribute distinct but complementary effects on food-related decision-making. By applying the SDT framework, we provide empirical evidence that food neophobia is characterized by both reduced discriminability and risk-averse response biases. This supports the theoretical relevance of SDT in capturing the cognitive mechanisms underlying food neophobia (Crane et al. 2020; Lafraire et al. 2016b). Building on this initial validation, future research should systematically manipulate both uncertainty and risk to disentangle their respective contributions to food neophobia (Crane et al., 2020). One promising approach would be to use morphing techniques to generate stimuli that vary along a finely graded continuum (e.g., Lynn & Barrett, 2014) from fresh to rotten, allowing for a precise assessment of how different levels of uncertainty and risk interact to shape food-related decisions. Such investigations could offer valuable insights into the thresholds at which neophobic responses are triggered.

Beyond manipulating perceptual uncertainty, it would also be valuable to independently vary categorical uncertainty to better understand their distinct contributions to food neophobia. Conceptual uncertainty could be modulated by manipulating the familiarity and cultural context of food items. By systematically varying both perceptual and conceptual uncertainty, future studies could clarify how these two sources of uncertainty interact and whether their combined effects amplify neophobic tendencies. Additionally, this approach could provide insights into the developmental trajectory of food neophobia, as children's reliance on perceptual versus conceptual cues may shift with age (Rioux et al. 2018a, 2018b, 2018c).

In addition to identifying new avenues for research, the results of this study invite a reconsideration of interventions aimed at mitigating food neophobia. To maximize effectiveness, interventions should target two complementary aspects: reducing uncertainty and minimizing perceived risk, both of

which are associated with neophobic responses. To reduce uncertainty, interventions should focus on improving individuals' food discrimination abilities. This approach aims to empower individuals to more accurately identify and categorize items in their food environment, thereby reducing the ambiguity that fuels neophobic responses. Such interventions could include knowledge-based educational programs that teach people about different food categories (e.g., Gripshover & Markman, 2013), their characteristics, and how to distinguish between safe and potentially harmful foods.

To reduce perceived risk associated with food neophobia, interventions should focus on addressing the negative representations and expectations that individuals develop about unknown foods. These foods, that fall outside one's "safe foods" list, are often viewed as hazardous, anxiety-inducing, or disgusting (Fox et al., 2018; Pliner, 2008). Effective interventions should aim to expand this list by providing controlled, positive experiences with unknown foods. Multi-component approaches, which have been shown to be more effective than single-component interventions (Karaağaç & Bellikci-Koyu, 2023), should gradually expose individuals to new foods in non-threatening contexts. These interventions could include sensory exploration activities that allow individuals to familiarize themselves with the appearance, smell, and texture of novel foods without pressure to consume them immediately. Additionally, educational components highlighting the nutritional benefits and cultural significance of these foods can help reframe them as appealing rather than threatening. By addressing both sensory exposure (Martins & Pliner, 2005) and increasing knowledge (Pliner et al., 1993), such interventions can help individuals expand their comfort zones, redefine their criteria for "safe" foods, and ultimately reduce the perceived risk of trying new foods.

This reduction in perceived risk can initiate a virtuous cycle: as individuals become less cautious and more willing to engage with a variety of foods, their experience grows, which may further enhance their food discrimination abilities. Improved discrimination, in turn, could reduce uncertainty and lower perceived risk even further, reinforcing a positive feedback loop that may help individuals gradually overcome their food neophobia.

While much of the focus in past studies, and in the present research, has been on the challenges of neophobia, our findings highlight the importance of also considering neophilic individuals. Although neophilia may seem advantageous in today's food environment, where variety is abundant and most options are safe, the riskier response biases exhibited by more neophilic individuals warrant closer examination. While these tendencies may promote dietary diversity, they could also have unintended consequences beyond the food domain. Recent research by Basaran and Ozbek (2023)

suggests that neophilic individuals may be more prone to unhealthy substance and alcohol use, potentially due to their greater willingness to engage in novel and risky behaviors. This “nothing ventured, nothing gained” heuristic, though beneficial in some contexts, may lead to maladaptive outcomes in others. Therefore, future research should explore whether these risk-taking tendencies extend beyond food choices into broader decision-making domains.

While this study opens new avenues for research and interventions in food neophobia, it is important to acknowledge its limitations. First, the present study relied on a cross-sectional and correlational design which does not allow causal conclusions about whether food neophobia contributes to lower discriminability and more conservative response criteria, or whether these perceptual and decisional tendencies contribute to self-reported neophobia. Longitudinal designs and experimental manipulations (e.g., training, repeated exposure, or feedback) will be necessary to clarify the directionality and causal mechanisms underlying these associations.

Second, because we manipulated both familiarity and risk, we used edible and rotten foods to instantiate the risk cue, as both familiar and unfamiliar items can visibly exhibit signs of spoilage. However, rotten food also elicits another defensive mechanism, disgust, which may have influenced participants' responses. Although we controlled for individual differences in disgust sensitivity, this limitation underscores the complexity of studying food-related behaviors and the challenge of isolating specific psychological mechanisms. In addition, for unfamiliar foods it may generally be more difficult to recognize whether an item is spoiled, which could have amplified perceptual uncertainty in our design. Future research should therefore investigate alternative properties related to inedibility, particularly toxicity, as neophobia is thought to have evolved primarily as a protective mechanism against potential toxins (Rozin, 1976, 1990). It would also be beneficial to implement a gradation of spoilage rather than a binary distinction between fresh and rotten, as this would more closely approximate real-life decisions.

Third, our study exclusively focused on fruits as the primary food category for investigation. While this choice was grounded on their evolutionary significance in the context of food neophobia (Pliner & Salvy, 2006; Ungar & Sponheimer, 2011) and the fact that fruit rejection is primarily driven by visual cues of spoilage (Campbell et al., 2009), restricting stimuli to fruits may limit the generalizability of our findings. Food neophobia is expressed across a wider range of food categories, including cooked foods, mixed dishes, animal-based products, and culturally unfamiliar foods, and may rely on different sensory cues and sources of uncertainty than those manipulated here. Therefore, to

establish the robustness and broader applicability of our findings, future research should extend this investigation to encompass a wider range of food categories and contexts. This expansion would not only validate the current results but also potentially uncover category-specific nuances in neophobic responses.

Fourth, our sample was composed primarily of young adults, with a substantial proportion of university students. Given that food preferences, risk perception, and health considerations evolve with age (Adamska et al., 2012; Nolte & Hanoch, 2024), this may limit the generalizability of our findings to older adults or to individuals with different socioeconomic or educational backgrounds. Examining different age groups and more diverse samples would allow researchers to test whether the same mechanisms apply across the adult lifespan, and whether cultural and dietary exposure histories shape discriminability and response tendencies.

Fifth, the distribution of food neophobia scores in our sample was skewed toward the lower end of the scale. As a result, our findings may not fully capture the behavioral and cognitive patterns characteristic of individuals at the extreme high end of neophobia. Future studies should strive for more balanced sampling, possibly through targeted recruitment of highly neophobic individuals, to enhance generalizability across the full spectrum of the trait.

Sixth, although the present tasks were designed to capture core components of perceptual decision-making, they necessarily simplify real-world eating situations. Rapid categorizations of food images are only an approximation of everyday decisions, which often involve additional sensory information (i.e., smell, texture, taste), contextual cues (e.g., social setting, availability), and motivational states (e.g., hunger). In particular, olfaction is a key determinant of food acceptance and rejection, and may contribute to neophobic responses through both orthonasal and retronasal routes (Boesveldt & de Graaf, 2017). Empirical work suggests that reactivity to food odours is positively associated with food neophobia in young children (Monnery-Patris et al., 2015), and that neophobic adults may show poorer odour identification performance (Demattè et al., 2013), although not necessarily differences in odour detection thresholds (Stafford et al., 2017). These findings indicate that food neophobia may involve uncertainty and avoidance tendencies that are not exclusively visual. As the present study focused on visual information, the observed changes in discriminability and response criteria may reflect only one modality-specific component of neophobic decision-making. Future research should therefore test whether analogous shifts in discriminability and response bias emerge when decisions are based on olfactory cues, and whether cross-modal integration modulates these effects.

In addition, although reaction times were not a primary outcome in this study, it is important to acknowledge that online, browser-based testing can yield slower and more variable response latencies than laboratory settings due to heterogeneity in hardware and software; nevertheless, prior research has shown that robust reaction-time effects and cognitive patterns can be reliably detected in web-based experiments, and that behavioral effects observed online often replicate those obtained in controlled laboratory environments (Hilbig, 2016; Reimers & Stewart, 2016).

Finally, while food neophobia has been associated with some eating disorders (Herle et al., 2020; Zickgraf et al., 2016, 2019), our study did not screen for these conditions. Previous research has shown that disordered eating can significantly influence both discriminability and response biases, particularly when individuals are presented with stimuli that pose relevant risks, such as high-calorie foods for those with anorexia (Lakritz et al., 2023, 2024). By not accounting for these conditions, our study may have inadvertently conflated neophobic responses with those arising from underlying eating disorders. Future research should consider disordered eating to better differentiate the cognitive mechanisms underlying food neophobia from those associated with eating disorders. Such insights could help refine preventive strategies and inform the development of early diagnostic tools for eating disorders. In addition, food neophobia was assessed through self-report, which is standard in the literature but may not fully capture behavioral avoidance in real contexts. Combining questionnaire measures with behavioral indices (e.g., willingness-to-try tasks) would strengthen the interpretation of the relation between neophobia and perceptual decision processes.

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**Data availability** Color photographs of the stimuli used in this study, supplemental analyses and statistics, deidentified data, and R code for analyses are publicly available on OSF ([https://osf.io/3nzps/?view\\_only=fcc6f86b874a4c34acea9a74f17d0137](https://osf.io/3nzps/?view_only=fcc6f86b874a4c34acea9a74f17d0137)).

## Declarations

**Competing interests** The authors declare no competing interests.

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