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Take it or leave it? Investigating the ambivalence and willingness to pay for suboptimal fruits and vegetables among organic consumers in Germany

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Organic fruits and vegetables are often visually "suboptimal" because organic farming uses neither pesticides nor synthetic fertilisers to improve the cosmetic appearance of the produce. Despite the organic sector's natural and sustainable image, such foods often never reach the market or are left on the shelf, greatly increasing food waste. The current work hypothesised that an important factor in the rejection of suboptimal food is consumers' experience of ambivalence regarding these products. Data were collected through an online survey of (occasional) organic consumers in Germany (n = 493), including an online mouse-tracking experiment. We investigated the interplay of ambivalence with environmental concerns and attitudes towards suboptimal food that influence people's willingness to pay (WTP) for suboptimal fruits and vegetables. Our findings suggest that environmentally concerned consumers have more favourable attitudes and experience less ambivalence towards suboptimal food. Only subjective ambivalence was found to be directly associated with consumers' WTP, however, while attitudes were not. Based on these results, we propose measures for policymakers and food retailers to reduce such ambivalence and thus increase organic consumers' acceptance for suboptimal food.

KEYWORDS

ambivalence, attitude, food waste, mouse-tracking experiment, organic consumers, suboptimal food, willingness to pay, environmental concerns

Introduction

Although so-called "suboptimal" foods with an abnormal appearance in terms of weight, size or shape are safe to consume, these products are often wasted throughout the supply chain (Aschemann-Witzel et al., 2015). Around 30% of fruits and vegetables in Europe are wasted for cosmetic reasons (de Hooge et al., 2018; European Commission, 2021). This waste is not based on any objective product criteria such as nutritional and bacterial qualities identified by food safety authorities but on the subjective perceptions of retailers and consumers of what constitutes "optimal" appearance (Aschemann-Witzel et al., 2018).

On the one hand, consumers' perceptions of "acceptable" food and their purchasing behaviour determine the food standards applied by food retailers which then affect all actors in the entire food supply chain (de Hooge et al., 2018; Aschemann-Witzel et al., 2020a; Pfeiffer et al., 2021). On the other hand, retailers have long applied cosmetic standards that exceed the legal requirements to "prove" the premium quality of the foods they sell, especially in the case of fresh fruits and vegetables (de Hooge et al., 2018; Herzberg et al., 2022). This in turn shapes consumer perceptions of how "optimal" foods should look (Aschemann-Witzel et al., 2015, 2022). From this it follows that changes in the supply and marketing communications of retailers could positively influence consumer attitudes to suboptimal foods (Aschemann-Witzel et al., 2022). While several studies have explored the marketing of suboptimal food, important knowledge gaps still exist regarding the key factors determining the success of marketing measures applied by policymakers and food retailers.

The association between consumers' positive attitudes and reported purchase intentions has been confirmed by numerous studies (e.g., Barbe et al., 2017; Adel et al., 2021; Stöckli and Dorn, 2021). Research has also identified environmental concerns and food waste awareness as the most important drivers for consumers to purchase suboptimal food (de Hooge et al., 2017; Stöckli and Dorn, 2021). These conclusions have mainly been based on data from consumers in general, however, who differ from organic consumers in their altruistic values, food preferences and food involvement (Hamm et al., 2012). A study by Hermsdorf et al. (2017) with food retailers has shown that organic consumers are more likely to accept suboptimal fruits and vegetables because they mostly know that naturally produced foods vary in shape and size and that these variations do not affect taste. Because organic consumers are often found more willing to contribute to environmentally friendly behaviour (Hamm et al., 2012; Lord et al., 2021), we argue that they are an important target group for suboptimal fruits and vegetables. This is supported by a study by Stangherlin et al. (2019), which found that environmentally conscious consumers are inclined to accept suboptimal fruits and vegetables because they associate suboptimal appearance with organic qualities. Considering the promising opportunities for these products in the organic market, we found no study targeting organic consumers in previous reviews on suboptimal food (Stangherlin and Barcellos, 2018; Hartmann et al., 2021). Consequently, we still have limited information on the determinants of suboptimal food purchases among organic consumers, which is thus the focus of our present study.

We investigate the psychological factors that explain why people do (not) accept and buy fruits and vegetables with suboptimal appearance. In particular, we look at the factor of the psychological state known as subjective ambivalence, i.e., consumers' experiences of conflict between opposing evaluations (van Harreveld et al., 2015). This ambivalence arises, for example, when a person's desire to contribute to the environment pulls them towards choosing a suboptimal food such as crooked cucumbers displayed in a store alongside "perfect" cucumbers while at the same time their perception that "what is beautiful is good" (Dion et al., 1972, p. 289) pulls them towards purchasing the perfect cucumbers. In this way consumers can often be torn as to whether it is good or bad to buy suboptimal food. Investigating this state of ambivalence might help further our understanding of the inconsistencies between consumers' attitudes and behaviour when making purchase decisions for or against suboptimal food.

Following the recommendations of Hartmann et al. (2021) and the Federal Environment Agency (UBA, 2020), the present study brings together consumer research and psychological perspectives to investigate the purchasing barriers and drivers of organic consumers for the willingness to pay (WTP) for suboptimal food. This includes factors such as subjective ambivalence, environmental concerns, food waste awareness and moral norms regarding food waste reduction. We then discuss the theoretical and practical implications of our findings that could influence consumers' acceptance of suboptimal food.

Theoretical framework

Ambivalence

Ambivalence is defined as the simultaneous presence of positive and negative evaluations concerning an attitude object (van Harreveld et al., 2015). Psychological research further distinguishes between objective and subjective ambivalence. Objective ambivalence refers to the extent to which positive and negative associations towards an attitude object are similar in strength with each other, whereas subjective or "felt" ambivalence refers to people's meta-cognitive experience of this evaluative conflict (van Harreveld et al., 2015). This distinction implies that people can hold both positive and negative attitudes at the same time (objective ambivalence) without consciously experiencing conflict (subjective ambivalence), since ambivalent attitudes only become conflicting when people become conscious of the two opposing sides of an object. Such conflict typically arises when one has to decide how to act based on opposing, i.e., ambivalent, attitudes. Importantly, however, it is only the realisation of this conflict (subjective ambivalence) that has been shown to induce feelings of discomfort and can thus influence people's affect, cognition and behaviour (van Harreveld et al., 2015).

To investigate organic consumers' subjective ambivalence towards suboptimal fruits and vegetables, we asked our study participants to decide between opposing evaluations (positive vs. negative) of suboptimal and optimal products while measuring their mouse-trajectories (Mathur and Reichling, 2019). Mouse-tracking as an implicit measure enables researchers to evaluate

people's experience of ambivalence by capturing the dynamic aspect of ambivalence that unfolds during their evaluation processes. This method contrasts with self-reporting that only assesses the evaluation itself. Mouse-tracking circumvents biased answers in self-reports that might arise due to social desirability or to people's inability to report their own feelings and thoughts. The results of such tracking can nonetheless be related and compared to (explicit) self-reported measures of subjective ambivalence (Schneider et al., 2015). Mouse-tracking is thus particularly helpful when investigating consumers' unconscious motives and behavioural patterns because it can capture spontaneous motor reactions to a stimulus that cannot be captured through questionnaires. However, Bolos et al. (2019) have also demonstrated, both implicit and explicit measures of attitudes towards suboptimal food can effectively predict purchase intentions. In order to assess people's subjective ambivalence, therefore, we implemented both an explicit measure (self-report) and a more implicit measure (mouse-tracking).[1]

Ambivalence towards suboptimal food

Fruits and vegetables with suboptimal appearance have been found to trigger both positive and negative attitudes among consumers (Bolos et al., 2019; Aschemann-Witzel et al., 2020b). For example, many consumers have positive associations with suboptimal food because its purchase reduces food waste and thus benefits the environment (Barbe et al., 2017; Stöckli and Dorn, 2021). Suboptimal foods are also perceived as more natural than optimal foods and are sometimes considered as organically produced precisely on this account (Hermsdorf et al., 2017; Stangherlin et al., 2019; van Giesen and de Hooge, 2019). At the same time, however, negative perceptions can arise from the abnormal appearance of suboptimal food. For example, externally deviated fruits and vegetables are often seen by consumers as not being prototypical (Hingston and Noseworthy, 2020; Barone et al., 2021) and thus as less nutritious, fresh, attractive and tasty than optimal looking products, sometimes even being viewed with disgust and regarded as risky to consume (Jaeger et al., 2018; Loebnitz and Grunert, 2018; Cooremans and Geuens, 2019; Schifferstein et al., 2019; Hingston and Noseworthy, 2020; Pfeiffer et al., 2021).

Research has shown that considering ambivalence is useful for understanding consumers' attitudes and their purchase intentions for suboptimal food (e.g., in the case of visually non-normative apples: Bolos et al., 2019). Studies have also indicated that ambivalence plays an important role in consumers' WTP for food that is past its best-before date and their premeditated waste of such suboptimal products. Using the mouse-tracking measure, Buttlar et al. (2021) have demonstrated that consumers evaluate food with expired best-before dates not only as less favourable but also experience more ambivalence towards such food compared to non-expired products, with participants reporting they were more likely to waste food past its best-before date and would pay less for such products.

Importantly, however, these studies by Bolos et al. (2019) and Buttlar et al. (2021) relied on data from conventional consumers who are often found to have negative perceptions of suboptimal food (Aschemann-Witzel et al., 2020b; Giménez et al., 2021). By contrast, organic consumers may be more prone to experience higher levels of ambivalence. This is because subjective ambivalence becomes more pronounced when people have to make decisions on personally relevant topics to which they hold ambivalent attitudes (van Harreveld et al., 2015). From this it can be assumed that decisions about whether to buy suboptimal food are especially important for organic consumers due to their higher environmentally friendly motivation (Hamm et al., 2012), hence our following hypothesis for organic consumers:

Hypothesis (H1): suboptimal food elicits a higher degree of subjective ambivalence in comparison to optimal food.

Drivers and barriers influencing consumers' attitudes to and WTP for suboptimal food

Organic consumers are often found to value environmental-related attributes in their decisions regarding food purchase and management (Hamm et al., 2012; McCarthy and Liu, 2017). For instance, McCarthy and Liu (2017) reported that organic consumers demonstrated greater awareness than non-organic consumers of the waste of resources involved in throwing away edible foods and were thus more willing to reduce the amount of food waste. Such interindividual differences in environmental concerns and food waste awareness seem to be highly influential on consumers' attitudes towards suboptimal fruits and vegetables (Loebnitz et al., 2015; de Hooge et al., 2017; van Giesen and de Hooge, 2019). This has been confirmed in a study by de Hooge et al. (2017), who found that people with a higher commitment to environmental sustainability and higher food waste awareness both have a stronger tendency to favour suboptimal food. Prior studies have also shown that moral norms play a significant role in the context of food waste, since consumers tend to feel disturbed or guilty about wasting edible food (Stefan et al., 2013; McCarthy and Liu, 2017). Accordingly,

1 It is not the aim of this paper to compare the results of the mouse-tracking experiment with self-reported subjective ambivalence. Although the two methods differ in the nature of the measurement (motor behaviour vs. self-reported), combining the data from these measures enables us to validate the results of the novel ambivalence measure (mouse-tracking) and to harness the strengths of both methods.

it can be presumed that individuals who feel "guilty" when wasting food will also hold more positive attitudes towards suboptimal food. Based on these findings, we propose the following three hypotheses:

Hypothesis (H2a): an increase in environmental concerns will increase consumers' positive attitudes towards suboptimal foods.

Hypothesis (H2b): an increase in food waste awareness will increase consumers' positive attitudes towards suboptimal foods.

Hypothesis (H2c): stronger moral norms regarding food waste reduction will increase consumers' positive attitudes towards suboptimal foods.

In addition, a study on ethical consumption by de Pelsmacker et al. (2005) has shown the importance of analysing WTP when examining (intended) purchase behaviour. Indeed, it has been shown that consumers are unwilling to pay the same amount for food they perceive as inferior (Hartmann et al., 2021). Gaining knowledge about consumers' WTP is thus important to determine the practicality of selling suboptimal fruits and vegetables.

It is widely accepted that people's attitudes are an important determinant of purchase intentions and behaviour (Ajzen, 1991), and previous studies have confirmed that intentions to purchase suboptimal food can be hindered by negative attitudes to such products (Hingston and Noseworthy, 2020; Giménez et al., 2021). From this it follows that positive attitudes towards suboptimal fruits and vegetables might also lead to a higher WTP for these products. We thus propose the following hypothesis:

Hypothesis (H2d): an increase in positive attitudes towards suboptimal foods will increase consumers' WTP for suboptimal foods.

Although consumers' attitudes affect purchase intentions and WTP, however, attitudes do not necessarily translate into corresponding behaviour. This attitude-behaviour gap has been observed in numerous studies (e.g., Barbe et al., 2017; Schäufele and Janssen, 2021) and is often triggered by product prices (de Pelsmacker et al., 2005). For example, in a study of German consumers, Barbe et al. (2017) found that while 85% of the participants expressed willingness to support supermarkets that agree to relax their aesthetic standards on fruits and vegetables, only 27% would purchase misshapen carrots for the same price as flawless carrots.

In our present study we propose that this gap between attitude and WTP can be explained by consumers' experience of ambivalence. This proposal is partly supported by previous research on healthy eating which has demonstrated that ambivalence has a moderating effect on the attitude-behaviour relationship by showing that people with a low degree of ambivalence are associated with higher levels of attitude-behaviour consistency (Sparks et al., 2001; Conner et al., 2003). Hence our following hypothesis:

Hypothesis (H3): higher levels of subjective ambivalence will moderate (weaken) the relationship between attitude and WTP for suboptimal foods.

We present a model conceptualising all our hypotheses in Figure 1. We tested these hypotheses through a pre-registered experiment[2] using an online survey.

Materials and methods

Participants

The data were collected in Germany during May 2021 using a web-based survey. The participants were recruited from an online access consumer panel of a market research agency, taking into account gender, age and residence at state level to resemble the German population. The following two inclusion criteria were established to ensure the eligibility of the participants: (i) being a consumer of organic food (at least occasionally) and (ii) being (partly) responsible for buying groceries in their household. A total of 1,136 individuals were invited to participate, of whom 580 completed the online survey, amounting to a response rate of 51%.

Following the data collection, the responses of 28 participants were deleted because these participants refused permission for using their mouse-tracking data. During the pre-registered data cleaning, a further 59 cases were excluded due to errors in the recording of mouse coordinates, overly rapid completion of the total survey (i.e., faster than half the median survey duration of 549 seconds), and "straightlining" (i.e., no answer variance in the questionnaire). The final sample thus amounted to 493 participants, 57% of whom were female. The age of the participants ranged from 18 to 75 years, with an average age of 47 (S.D. = 15 years). The rate of high school completion among the participants was 56%.[3] A summary of the socio-demographic characteristics of the final sample is presented in Table 1.

2 The pre-registration record of our study is available at: https://osf.io/2qpsu/?view_only=7d376685f53a4c2e982c784138ddfe61. The material, data, R scripts and syntax for the study are available at https://osf.io/mazr4/?view_only=df0a78570f404c32903ee1e4309686af. The Supplementary material include one-way ANOVA analyses for the evaluation of suboptimal food, ambivalence and WTP for suboptimal food among organic consumers with different organic purchase frequencies, together with a summary of the items used in the questionnaire.

3 This is higher than the 33.5% average for high school completion in the entire German population, which is based on the results of the 2019 microcensus (2020): https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bildung-Forschung-Kultur/Bildungsstand/Publikationen/Downloads-Bildungsstand/bildungsstand-bevoelkerung-5210002197004.pdf?__blob=publicationFile.

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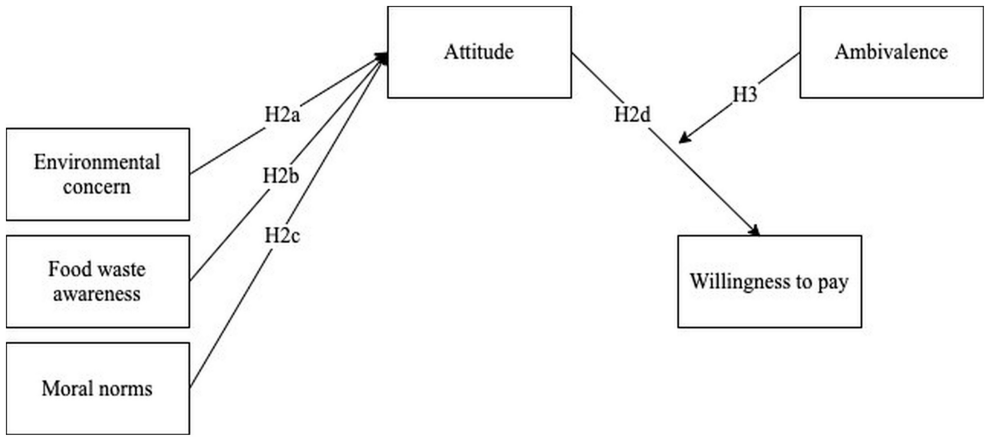

FIGURE 1
Conceptual model of consumers' WTP for suboptimal foods.

Procedure and measures

At the beginning of the survey the participants were informed of the strict protection of their anonymity and privacy, and a declaration of consent was obtained. The subsequent survey consisted of two parts: (i) a mouse-tracking experiment, which adopted a one-factor (suboptimal food vs. optimal food) within-subjects design; and (ii) a self-administered questionnaire. Prior to the survey, a pilot test was conducted with 57 participants, resulting in the addition of two filter questions to screen out participants not using a computer (PC/laptop) and a mouse in order to optimise the mouse-tracking measurement.

At the end of the questionnaire, the participants were informed that their mouse movements had been recorded at the beginning of the survey in order to be used for scientific purposes. This clarification was only given afterwards in order to avoid influencing the response behaviour in the mouse-tracking experiment. The participants were then given the option of actively agreeing or refusing to allow the use of their data. Any data whose usage was refused were removed from the dataset before the analysis began.

Mouse-tracking as a measure of ambivalence

A mouse-tracking experiment was used to determine the subjective ambivalence of the participants towards suboptimal and optimal fruits and vegetables. In order to conduct this experiment within the framework of an online survey, the open-source software developed by Mathur and Reichling (2019) for analysing a mouse-tracking experiment was adapted for use in the Unipark online survey platform.

For this experiment the participants were presented with 30 different pictures of fruits and vegetables in randomised order in the centre of their browser window. These stimuli were divided into 16 target stimuli (2 optimal and 2 suboptimal apples, potatoes, pears, carrots) and 14 distractor stimuli (optimal fruits and vegetables) to disguise the primary purpose of the study. In each trial the participants were asked to use their mouse to click on a "Positive" or "Negative" button in the upper-right or left corners of their browser window to indicate which response best represented their attitude to the food depicted. The participants' evaluations of the food stimuli were recorded and the movements of their mouse cursors were tracked during each evaluation. The mouse recordings each started with a click on the "Next" button (German translation: "Weiter") in the bottom middle of the browser window and ended with the selection of a positive or negative response button[4] (see Figure 2).

During each trial, the cognitive conflict between opposing evaluations was operationalized as the extent to which the curvature of the participants' mouse trajectories diverged most from the ideal trajectory, with this "ideal" being a straight line from the "Next" button to the selected response button. As the start and the end mouse position of every individual is different, this "ideal" trajectory is recalculated for each individual in every trial (Mathur and Reichling, 2019). The maximum distance between the ideal and the actual trajectory followed by the participants is defined as the maximum deviation (MD), and this was computed using the recorded mouse coordinates. As depicted in Figure 2, we predicted that the ambivalent stimuli, i.e., the suboptimal food, would generate a greater MD than univalent stimuli, i.e., the optimal food

4 To counterbalance any bias arising from the location of the response button, two versions of the mouse-tracking experiments were created by switching the positions of the Positive and Negative response buttons. The two versions were randomly distributed among the participants, each of whom saw only one version.

TABLE 1 Socio-demographic characteristics of the participants from the final sample ($N = 493$).

		Overall (%)
Gender	Female	57.4
	Male	42.4
	Other	0.2
Age	18–39	38.5
	40–59	34.1
	60–75	27.4
Education (years of school visit)	No degree	0.4
	9 or 10 years of school visit	42.2
	12 or 13 years of school visit	26.6
	College or university degree	29.6
	Other	1.2
Household size	Single	26.4
	2	39.4
	3	18.3
	4	11.4
	5 or more	4.6
Household components	No children under 18	75.3
	1	14.8
	2	7.1
	3 or more	2.8
Monthly household income (€)	Under 1,300	13.2
	From 1,300 until under 1,700	11.4
	From 1,700 until under 2,600	21.7
	From 2,600 until under 3,600	23.3
	From 3,600 until under 5,000	23.1
	Above 5,000	7.3
Organic food purchase frequency	Occasional	22.7
	Regular	29.8
	Frequent	47.4

(Schneider et al., 2015), reflecting a higher experience of conflict during evaluation.

In order to ensure optimal tracking of the mouse trajectory, we implemented measures suggested by Mathur and Reichling (2019). These included an alert whenever the browser window of the participants was not large enough to fully display the mouse-tracking experiment. In addition, alerts were triggered if participants took longer than 10,000 ms on a trial or if the time limit of 1,500 ms was exceeded for the first mouse movement within a trial. The "started too late" alert was aimed at ensuring that the dynamic aspect of ambivalence during evaluation was captured in the participants' mouse trajectories by preventing participants from waiting to start moving their mouse cursors until they had already made their evaluation decisions in their minds. This was supplemented by a "started too early" alert warning the participants that the mouse had moved outside of the "Next" button before the page had fully loaded. These alerts were displayed in the form of pop-up windows at the end of each trial in order not to interrupt the experiment. To practise the procedure of the experiment, five training stimuli in the form of various household items were presented to the participants for evaluation before the start of the actual experiment.

Self-reported measure of ambivalence

The subjective ambivalence elicited by suboptimal food were also measured using the three items questionnaire developed by Priester and Petty (1996) to capture cognitive, affective and conative dimensions of ambivalence. The items began with the following statement: "Towards purchasing fruits and vegetables with cosmetic flaws I feel (have)…". The participants rated the conflicting nature of their thoughts, the degree of indecision and the extent of their mixed feelings on a 7-point scale ranging from 1 (no conflict/no indecision at all/completely one-sided reactions) to 7 (maximum conflict/maximum indecision/completely mixed reactions). The internal reliability of the three items was excellent ($\alpha = 0.94$) and the responses were averaged to obtain the mean result.

WTP for suboptimal food

Four foods (apples, carrots, potatoes and pears) were used as stimuli to measure the participants' WTP for suboptimal food using the contingent valuation method. For each stimulus, optimal and suboptimal versions of the food were presented to the participants on the left and right sides of the page respectively. The participants were asked to indicate their WTP *via* the following question:

Imagine you are looking to buy apples [carrots/potatoes/pears] and have the two products to choose from. The organic apples [carrots/potatoes/pears] on the left cost €2.49 [€1.39/€1.29/€2.69] per kilogramme. How much would you pay for one kilogramme of organic apples [carrots/potatoes/pears] on the right?

The reference prices for the optimal organic foods were determined based on the average market price of these products in Germany's organic retailing sector (AMI, 2020a,b). The participants were able to enter a price between €0 and the reference price of the optimal product. The percentage of WTP for the suboptimal foods was calculated *via* the formula (WTP/optimal product price) * 100%, and the average of the four stimuli was computed for the analysis. The internal reliability of the four stimuli with Cronbach's alpha was good ($\alpha = 0.85$). The average WTP of the participants for the suboptimal food is presented in Table 2.

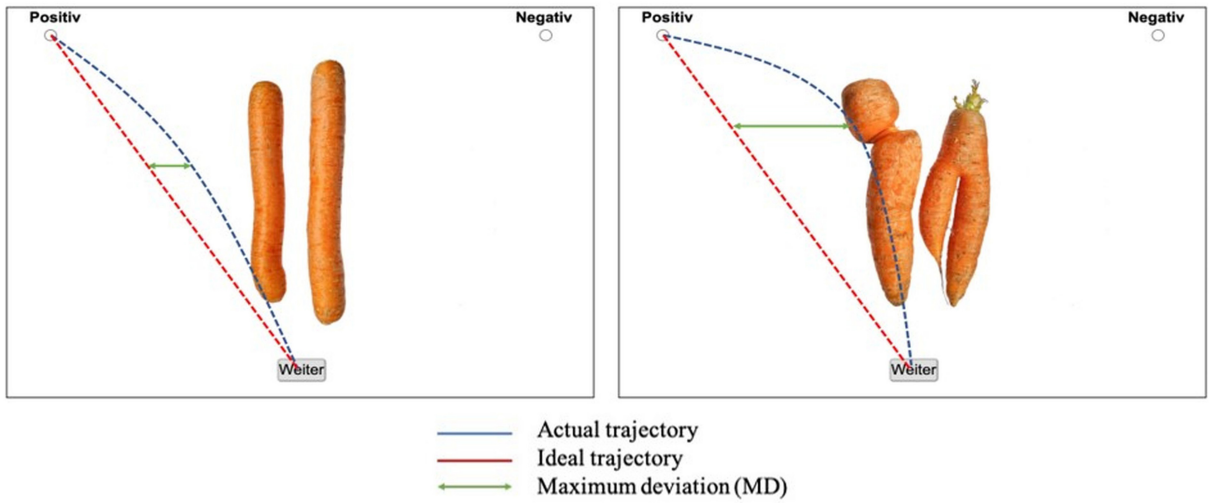

FIGURE 2
Example of the presentation of the mouse-tracking experiment, showing the mouse trajectories and maximum deviation between the ideal and the actual trajectory. Neither the ideal nor the actual mouse trajectories of the participants were visible during the experiment.

TABLE 2 Descriptive statistics on the percentage of consumers' WTP for each suboptimal food product.

Product	Mean (%)	SD	Min	Max
Apples	75.12	21.53	0	100
Carrots	75.10	20.94	0	100
Potatoes	83.16	18.20	0	100
Pears	80.17	20.71	0	100
Overall	78.39	16.84	0	100

Attitudes towards suboptimal food, environmental concerns, and food waste-related items

To measure attitudes towards suboptimal food, environmental concerns, food waste awareness and moral norms regarding food waste, a total of 22 items were taken from previous research and adapted to the context of suboptimal food purchase (see Supplementary material). The items were presented in randomised order and were rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating a more positive attitude, higher environmental concerns, greater awareness of food waste and stronger moral norms regarding such waste. The final variables for further analysis were determined after data collection using exploratory factor analysis (EFA). Depending on the number of factors extracted from EFA (see Section Exploratory factor analysis), the average score of the items for each construct was computed for analysis.

Socio-demographic characteristics

Data on the gender, age, formal level of education, household income and household size of the participants were collected. In addition, the participants indicated the frequency of their organic food purchases on a scale from 1 (almost never) to 7 (exclusively). Based on this self-assessment, the participants were divided into occasional (answer options 1–3), regular (answer option 4) or intensive consumers (answer options 5–7) of organic food. The socio-demographics of the respondents are shown in Table 1.

Results

Exploratory factor analysis

To test the reliability and validity of the measurements and identify the underlying factor structure, we conducted an EFA (principal axis factoring, promax rotation) for the items related to attitudes towards suboptimal food, environmental concerns, food waste awareness and moral norms regarding food waste. Descriptive statistics of the items are shown in Table 3. The univariate skewness and kurtosis of each measure were less than 2 and 7 respectively, which is not considered extreme (Watkins, 2018). Bartlett's test of sphericity was significant (χ^2 (231) = 5095.90, $p < 0.001$), indicating that the correlation matrix did not suffer from multicollinearity. The Kaiser-Meyer-Olkin criterion value was higher than 0.9 (KMO = 0.92), indicating excellent sampling adequacy for factor analysis (Kaiser, 1974; Watkins, 2018).

To determine the number of factors retained, a Visual Scree test, parallel analysis and Eigenvalues were used, resulting in three extracted factors.[5] Only items with rotated factor loadings of at least 0.40 were considered meaningful for interpretation (Watkins, 2018). Four items were dropped due to low factor loadings (see the italicised items in Table 3). All six reversed items loaded on the third factor, presumably due to method effects, and these items were accordingly excluded.[6] The twelve remaining items remained were reflected in two substantive factors, representing environmental concerns and attitudes towards suboptimal food. The Cronbach's alpha was $\alpha = 0.88$ for the environmental concern factor and $\alpha = 0.85$ for the attitude factor, indicating a high degree of internal consistency. Based on the results of the EFA, the pre-registered conceptual model was modified (see Figure 3). This led to food waste awareness and moral norms being dropped, meaning that hypotheses H2b and H2c could not be tested, leaving environmental concern as the sole predictor in the moderated mediation analysis.

Hypothesis testing

The confirmatory data analysis was conducted using the pre-registered analyses.

Correlation analysis

To avoid the influence of outliers in further analyses, and in accordance with the guidelines developed by Schneider et al. (2015), all trials in the mouse-tracking experiment with a reaction time under 300 ms or over 3,000 ms were removed, amounting to 17.48% of all trials. Since conducting a mouse-tracking experiment online is still a new method for measuring ambivalence, we validated the approach by comparing the mouse tracker variable (MD) with the self-reported subjective ambivalence of participants towards suboptimal food (Schneider et al., 2015). As a threshold value, a positive correlation coefficient of greater than $r = 0.3$ between self-reported ambivalence and MD for suboptimal food was pre-registered for the mouse tracker variable to be accepted as a valid measure of ambivalence in the analyses (Schneider et al., 2015). In the case of $r < 0.3$, the self-reported ambivalence would be used for further analyses. For this purpose, a one-tailed correlation analysis between the average MD for all suboptimal foods and the self-reported subjective ambivalence was conducted. This analysis revealed that the MD in trials pertaining to suboptimal food was not significantly associated with the self-reported subjective ambivalence towards suboptimal food ($r = 0.033$, $p = 0.24$).

During the analysis of the mouse-tracking data, however, we realised that the trials in which participants moved their mouse too early were highly influential for the overall MD score because the calculation of the ideal trajectory and the relative deviation from this trajectory on the x-axis (MD) depends on the first position of the mouse in each trial, i.e., the "Next" button (Mathur and Reichling, 2019). An additional one-tailed correlation analysis was therefore carried out after the removal of all trials with the "started too early" alert, revealing that the MD in the trials pertaining to suboptimal food had a weak association with self-reported subjective ambivalence towards suboptimal food ($r = 0.25$, $p < 0.001$). As the correlation did not exceed the pre-registered threshold, the self-reported measure of subjective ambivalence was applied in the moderated mediation analysis and parallel mediation analysis.

Paired sample t-test

To test the H1 hypothesis, data on subjective ambivalence for both suboptimal and optimal food are required. However, self-reported ambivalence was only measured for the suboptimal fruits and vegetables. Data on self-reported subjective ambivalence towards optimal food was therefore unavailable. For this reason, the hypothesis (H1) could only be tested using the mouse-tracking data.[7] A one-tail paired sample *t*-test was thus performed using MD for suboptimal and optimal food (after removing trials with the "started too early" alerts),

5 Based on the recommendation from Watkins (2018), a two-factor solution was also evaluated. However, the extracted factors were not theoretically meaningful because the second factor was formed from a combination of the attitude items and the reversed items (Factors 2 and 3 from the three-factor solution), with the latter having factor loadings higher than 0.5, while the attitude items have loadings of less than 0.5. Therefore, the three-factor solution was adjudged most appropriate, as identified by the Visual Scree test, Eigenvalues and parallel analysis.

6 The use of reversed items has the purpose of reducing acquiescence bias (Paulhus, 1991). However, it could also lead to method effects that can influence the factor structure, since understanding the items becomes more difficult for the participants (Zhang et al., 2016). Method effect is defined as the tendencies of individuals to answer questions based on criteria other than the intended contents, resulting in a construct that measures something irrelevant to what the researcher expects to measure (Lindwall et al., 2012). In line with the finding from Zhang et al. (2016), the EFA in the present study extracted a total of three factors, one of which is a method factor consisting of all the reversed items (Factor 3) and was thus excluded from further analysis.

7 The results of the hypothesis (H1) testing should be interpreted with caution, as the correlation between the mouse-tracker variables and the self-reported subjective ambivalence was weaker ($r = 0.25$) than the expected threshold ($r = 0.3$; Schneider et al., 2015).

TABLE 3 Descriptive statistics and factor loadings of the items of the questionnaire for 493 participants.

Items	Descriptive statistics		Factors		
	Mean	SD	1	2	3
			EC	Attitude	(excluded)
It is important to me that the products I consume do not harm the environment.	5.45	1.35	**0.64**	0.18	−0.042
I consider the potential environmental impact of my actions when making many of my decisions.	4.72	1.45	**0.88**	−0.11	−0.056
My purchase habits are affected by my concern for our environment.	4.73	1.46	**0.83**	−0.16	0.082
I am concerned about wasting the natural resources of our planet.	5.82	1.33	**0.45**	0.39	0.042
I am willing to be inconvenienced in order to take actions that are more environmentally friendly.	4.98	1.44	**0.74**	0.047	−0.038
I would describe myself as environmentally responsible.	5.04	1.31	**0.74**	0.061	−0.12
I am strongly for that supermarket also offer fruit and vegetable in unusual shapes and sizes.	6.08	1.29	0.044	**0.76**	0.044
I like that supermarket also offer consumers to purchase food items that have minor flaws, such as apples with brown spots, crooked cucumbers, etc.	6.08	1.23	0.040	**0.69**	0.074
I believe there are no quality differences between impeccable and misshapen fruits and vegetables.	5.74	1.44	−0.071	**0.78**	−0.063
Fruits and vegetables with unusual shapes and sizes look more natural.	5.27	1.46	0.043	**0.65**	−0.20
We can avoid food waste by buying fruits and vegetables with "abnormal" shapes.	5.95	1.30	0.067	**0.71**	0.000
Most "abnormal" fruits and vegetables are wasted.	5.53	1.41	0.022	**0.64**	−0.051
Flawless fruits and vegetables taste better than those with "abnormal" shapes. (reversed)	5.72	1.59	−0.25	0.38	**0.54**
Fruits and vegetables with cosmetic flaws could turn bad more quickly. (reversed)	5.56	1.65	−0.21	0.31	**0.46**
Food waste generated in Germany does not impact the resources of developing countries. (reversed)	4.80	1.86	0.075	−0.25	**0.83**
Food waste generated in Germany does not have an impact on undernourished people in the world. (reversed)	4.98	1.77	0.14	−0.18	**0.71**
Food waste is not a problem for the environment as it is natural and biodegradable. (reversed)	4.43	1.88	0.039	−0.058	**0.51**
Throwing away food does not bother me. (reversed)	5.76	1.77	−0.013	0.065	**0.49**
I compare product appearance to decide which fruit and vegetables to buy. (reversed)	*3.59*	*1.68*	*−0.036*	*−0.003*	*0.33*
Food waste increases the burden on the environment.	*5.94*	*1.37*	*0.37*	*0.26*	*0.19*
I feel disturbed by the amount of food being wasted since it takes a lot of resources to grow, process, package and transport food.	*5.80*	*1.38*	*0.38*	*0.37*	*0.088*
I feel guilty/bad when I throw away food because some people don't have enough to eat.	*5.79*	*1.43*	*0.39*	*0.16*	*0.18*

EC, environmental concern.
Factor loadings ≥ 0.40 on pattern matrix in boldface. Items that have a low loading < 0.40 on all factors are italicised and excluded from the analysis.
Factor 3 is excluded from further analyses as it is a methods artefact containing a mix of reversed scored items.
The italic parts show all items that have a loading of lower than 0.40 on all factors and thus were excluded from further analysis .

representing ambivalence levels for suboptimal and optimal food respectively.

Hypothesis H1 predicted that suboptimal food would elicit a higher degree of subjective ambivalence in comparison to optimal food. As predicted, the analysis revealed a significant difference between the MD for suboptimal food and the MD for optimal food. Participants were observed to experience a higher degree of subjective ambivalence when presented with suboptimal food (0.34 ± 0.27) as opposed to optimal food (0.27 ± 0.21), which is a statistically significant difference of 0.063 (95% CI [−0.086, −0.40], $t(457) = -5.36$, $p < 0.001$, $d = 0.25$).[8]

Moderated mediation analysis

To test hypotheses H2a, H2d and H3, moderated mediation analysis was conducted using PROCESS v3.5 macro Model 14 in SPSS (10,000 bootstrapped samples; Hayes, 2018), with WTP as the dependent variable, environmental concerns as the independent variable, attitudes towards suboptimal food as the mediator, and self-reported subjective ambivalence as the moderator. The analyses were conducted with the z-standardised values of the variables. See Figure 3 for a schematic visualisation of the moderated mediation analysis.

Hypotheses H2a and H2d predicted that higher level of environmental concerns would increase consumers' positive attitudes towards suboptimal food and thus their WTP for suboptimal food. As predicted, the analysis reveals that environmental concern has a significant effect on attitudes towards suboptimal food, $a = 0.56$, $SE = 0.049$, $p < 0.001$, 95%

8 The same results were observed in the analyses using the mouse-tracking data without the removal of any trials with alerts and after the removal of trials with all alerts.

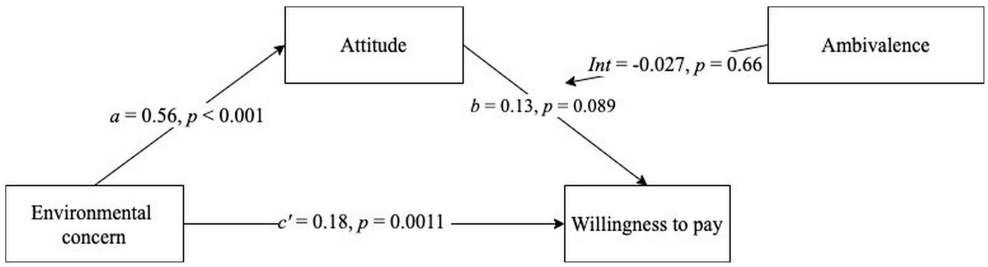

FIGURE 3
Moderated mediation analysis visualising the effect of environmental concerns on WTP for suboptimal food mediated by attitudes towards suboptimal food and moderated by ambivalence.

CI [0.46, 0.65], and a significant positive direct effect on WTP towards suboptimal food, c' = 0.18, SE = 0.056, p = 0.0011, 95% CI [0.073, 0.29]. However, attitude is shown to have no significant effect on WTP towards suboptimal food, b = 0.13, SE = 0.075, p = 0.088, 95 % CI [−0.019, 0.28], even though a higher WTP does correspond with positive attitudes towards suboptimal food.

Hypothesis (H3) suggested that the relationship between attitudes towards suboptimal food and WTP is moderated by ambivalence towards suboptimal food. However, the link between attitude and WTP was not significantly moderated by ambivalence towards suboptimal food, Int = −0.027, SE = 0.061, p = 0.66, 95% CI [−0.15, 0.093]. Furthermore, the index of moderated mediation was not significant, B = −0.015, 95% CI [−0.078, 0.040]. This analysis thus provides no support for hypotheses H2d and H3.

Exploratory data analysis: Parallel mediation analysis

Following Buttlar et al. (2021) research on the mediating role of ambivalence in premeditated food waste, the mediating effect of ambivalence on WTP for suboptimal food was assessed by a parallel mediation analysis using PROCESS v3.5 macro Model 4 in SPSS as recommended by Hayes (2018). The analysis was performed using WTP as the dependent variable, environmental concerns as the predictor, attitudes towards suboptimal food as the first mediator, and self-reported subjective ambivalence as the second mediator. These variables were analysed in z-standardised format. The mediation analysis, based on 10,000 bootstrap samples, is presented in Figure 4.

Conditional on the model assumption shown in Figure 4, our statistical test shows an indirect effect of subjective ambivalence that accounts for a significant portion of variance of the relationship between environmental concerns and WTP for suboptimal food, $a'b'$ = 0.09, 95% CI [0.05, 0.15], but not in the case of attitudes towards suboptimal food, ab = 0.07, 95% CI [−0.01, 0.14]. The analysis further reveals significant associations between environmental concerns and subjective ambivalence, a' = −0.33, SE = 0.05, p < 0.001, 95% CI [−0.42, −0.23], and between subjective ambivalence and WTP for suboptimal food, b' = −0.29, SE = 0.06, p < 0.001, 95 % CI [−0.40, −0.17], accounting for 26.7 % of the total model. Regardless of this indirect effect, environmental concerns had a significant direct effect on WTP for suboptimal food, c' = 0.19, SE = 0.05, p = 0.0005, 95% CI [0.083, 0.30], accounting for 53.98% of the total model.

Discussion

Consumers' in-store choices for suboptimal food play an important role in reducing food waste (Aschemann-Witzel et al., 2015). Our research aimed to contribute to a better understanding of the factors influencing these choices by applying a psychological perspective to investigate the barriers to and opportunities for the acceptance of suboptimal fruits and vegetables among organic consumers.

Using the study participants' mouse trajectories as indicators of evaluation conflicts, our analysis reveals that suboptimal fruits and vegetables elicit greater ambivalence than optimal products (in line with Hypothesis H1). This suggests that organic consumers perceive both positive and negative aspects of suboptimal food, although the reasons for this can only be assumed in the present study. These findings corroborate the results of a study by Bolos et al. (2019) indicating that suboptimal food is an ambivalent attitude object, which is consistent with our assumption regarding the experience of ambivalence among organic consumers towards suboptimal fruits and vegetables. For instance, the participants' lack of familiarity with externally suboptimal fruits and vegetables may have led them to move their mouse initially towards the

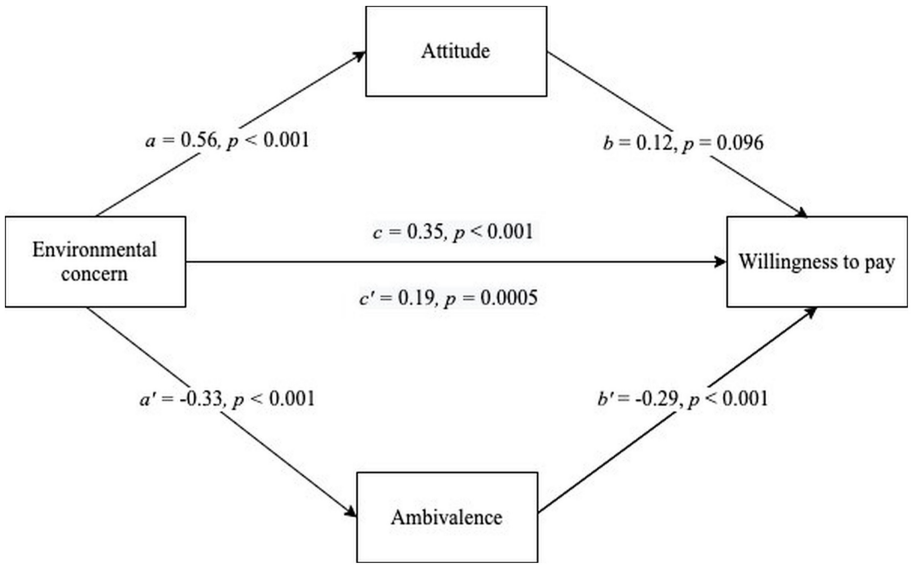

FIGURE 4
Parallel mediation analysis visualising the effect of environmental concerns on WTP for suboptimal food mediated by attitudes towards suboptimal food and ambivalence.

"Negative" response button before considering the products' environmental benefits and ultimately clicking the "Positive" response button. Indeed, despite the experience of ambivalence, the organic consumers rated most of the suboptimal foods positively (see Supplementary material), which further supports the findings of earlier studies with environmentally concerned consumers (van Giesen and de Hooge, 2019; Stöckli and Dorn, 2021). Despite these encouraging findings from the mouse-tracking data, the results should be interpreted with caution. This is because the correlation between the mouse-tracker variables and the self-reported subjective ambivalence was weaker than we expected based on previous studies in the lab (Schneider et al., 2015). Accordingly, our main analyses focused on the participants' self-reported experiences of ambivalence towards suboptimal food.

In this way, we further identified several barriers (or drivers) contributing to lower WTP among organic consumers for suboptimal fruits and vegetables. As predicted in hypothesis H2a, our findings reveal that environmental concern is a good predictor of attitudes towards suboptimal food and also plays a significant role in increasing consumers' WTP for suboptimal fruits and vegetables. These results are mostly consistent with previous studies that have found consumers with stronger environmental concerns to have higher preferences and purchase intentions for abnormal-looking foods (de Hooge et al., 2017; van Giesen and de Hooge, 2019; Stöckli and Dorn, 2021; for a conflicting finding, see Loebnitz et al., 2015). However, we did not find evidence that attitudes towards suboptimal food are related to people's WTP, which indicates an attitude-behaviour gap in consumer decision-making regarding suboptimal food. While this gap could not be explained by the moderation of ambivalence as predicted in H3, our exploratory analysis revealed that subjective ambivalence was directly related to WTP for suboptimal food. This means that the participants with higher levels of environmental concerns not only had more positive attitudes towards suboptimal food but were also less ambivalent. However, only ambivalence was associated with WTP.

We believe that these findings are sensible even though we did not find the expected moderating effect of ambivalence. Previous studies have mainly assessed objective ambivalence to show its moderating effect on the attitude-behaviour link (Sparks et al., 2001; Conner et al., 2003). This is understandable given that the coexistence of positive and negative evaluations (objective ambivalence) can be construed as reflecting a weaker attitude (Hohman et al., 2014),[9] which in turn is less predictive of behaviour than strong univalent attitudes (Armitage and Conner, 2000). Based on this explanation, people with a strong objective ambivalence should demonstrate a weaker attitude-behaviour relationship similar to our hypothesis H3 (Hohman et al., 2014). For our study, however, we measured subjective

9 Objective ambivalence is measured through questions such as the following (Conner et al., 2003, p. 82): "Consider for a few moments only the positive [negative] things about X and ignore any negative [positive] things about it. Please rate how positive [negative] those positive [negative] things are".

rather than objective ambivalence, finding a direct link between this meta-cognitive conflict and people's WTP. This finding accords with theorising on ambivalence which claims that simply holding both positive and negative associations towards an attitude object does not always have an impact on what people think and do because this ambivalence may remain dormant (van Harreveld et al., 2015). In contrast, subjective ambivalence refers to the meta-cognitive awareness of ambivalence that often arises in choice situations (van Harreveld et al., 2015). This subjective experience of conflict often generates negative emotions and thus leads to coping behaviour (e.g., van Harreveld et al., 2009). As such, subjective ambivalence has a more direct impact on people's behaviour than objective ambivalence (van Harreveld et al., 2015). This has been confirmed in a study by Buttlar et al. (2021) which showed—with similarities to our own findings—a direct negative association between people's ambivalence towards food past its best-before date and their premeditated waste of and WTP for these products. This might suggest that the experience of ambivalence evoked by meta-cognitive awareness of conflicting attitudes may play a crucial role in people's intentions and behaviours regarding the purchase and consumption of suboptimal food.

The present study has contributed to theory as it extends previous knowledge on the inconsistencies between consumers' attitude and behaviour by showing the importance of cognitive conflict for the acceptance of suboptimal food. Indeed, people's subjective ambivalence outweighed the impact of people's mere attitude on their willingness to pay for suboptimal food. This suggests that it is rather the meta-cognitive awareness about the conflicting evaluations of suboptimal food that affects people's purchases than their attitudes. While this is in line with the idea that ambivalence-induced discomfort might affect people's actions beyond their attitudes, it extends previous theorising on the acceptance of suboptimal food (Adel et al., 2021). Taken together, we see this study as one piece of the puzzle to better understand the determinants of purchase decisions for or against suboptimal food.

Practical contributions

Our findings can help inform retailers, policymakers and other relevant stakeholders in their efforts to reduce food waste by supporting the market for suboptimal fruits and vegetables. Indeed, the present study suggests that subjective ambivalence affects the WTP of organic consumers for suboptimal food beyond mere attitudes. Outside the scope of our study, it is likely that this subjective ambivalence is even more important in real life situations, such as a supermarket, where people constantly have to make decisions between different food products. For instance, previous research has already shown that avoiding decisions involving ambivalent attitudes is a common way for people to resolve such internal conflict and circumvent its negative affect (van Harreveld et al., 2015). When people decide which food to buy, ambivalence may thus be reflected in lower WTP for suboptimal products (Russel et al., 2011). Why would someone pay the same for a product that makes them feel uncomfortable? Notwithstanding this effect, applying price discounts for suboptimal food may not be the best long-term solution, since discounts may be perceived as a cue that such products are indeed inferior not only in appearance but in their internal qualities (Aschemann-Witzel et al., 2017).

Our study contributes to alternative solutions to discounting by highlighting the positive association between environmental concerns and WTP for suboptimal fruits and vegetables among organic consumers. Such consumers generally attach great importance to environmental friendliness in the process of their food purchases (Hamm et al., 2012; Lord et al., 2021). Furthermore, (intensive) organic consumers also tend to have a greater tolerance for visual imperfections on fruits and vegetables and a higher purchase intention for these products (see Supplementary material; Hermsdorf et al., 2017; van Giesen and de Hooge, 2019). Our findings further confirm that organic consumers are an important target group for suboptimal fruits and vegetables on account of their pro-environmental concerns.

By showing that environmental concern is strongly associated both with higher WTP and lower ambivalence towards suboptimal food, our findings further underline the importance of addressing consumers' ambivalence towards suboptimal food by highlighting the benefits of purchasing these products for reducing food waste. From this it can be argued that people with environmental concerns value the positive environmental aspects of suboptimal food and that this leads to more positive and univalent attitudes rather than ambivalence, since for them the positive aspects of suboptimal food outweigh the negative aspects. One pathway to reduce ambivalence towards suboptimal food would thus be to promote the environmental benefits of such products while seeking to increase the environmental concerns of organic consumers. This is because organic consumers are not all driven by environmental concerns, with many choosing to purchase organic foods due to other factors such as health, taste or animal welfare (Hughner et al., 2007; Schleenbecker and Hamm, 2013). This implies that there is still potential to increase the environmental concerns of organic consumers, which in turn underlines the importance of education about sustainable food in schools and families and the need for activities to reconnect children with nature (e.g., picking and growing produce) in order to increase their familiarity with imperfect foods and encourage their development into environmentally conscious adults (Hingston and Noseworthy, 2020; Makhal et al., 2020).

At present, however, even pro-environmental consumers such as organic consumers may not recognise the purchase of suboptimal food as a type of "green" behaviour because they are accustomed to seeing foods with an impeccable appearance

(Yue et al., 2009; Loebnitz et al., 2015). To overcome this barrier, our findings suggest to convey the environmental benefits of buying suboptimal products more effectively, including through targeted TV cooking shows (Elhoushy, 2022) and social media campaigns (Young et al., 2017). Current efforts in Germany to increase awareness of the benefits of suboptimal food include the use of the private label *Die Naturgut Bio-Helden* ("Naturally good organic heroes") by Penny supermarket (Penny, n.d.) and the "Too Good for the Bin" campaign of Germany's Federal Ministry of Food and Agriculture (BMEL, n.d.).

Given that most people base their purchase decisions on a mixture of several product attributes, including a product's environmental footprint, price, and perceived qualities (de Pelsmacker et al., 2005; de Hooge et al., 2017; Aschemann-Witzel et al., 2018), multi-component interventions are necessary to increase acceptance of suboptimal food. Such interventions should aim at increasing consumers' exposure to different-looking fruits and vegetables alongside effective communications (de Hooge et al., 2017; Hingston and Noseworthy, 2020; Bolos et al., 2022). More hands-on experience with suboptimal food could both help persuade organic consumers of their benefits and counteract negative associations such as lower expectations regarding taste (Loebnitz and Grunert, 2018; Hingston and Noseworthy, 2020). In this way multi-component interventions could decrease the intensity of ambivalence experienced by consumers towards suboptimal food and might shift prevailing cosmetic expectations and demands among consumers and retailers.

Limitations and future research

This study initially aimed to measure attitudes towards suboptimal food, environmental concerns, food waste awareness and moral norms towards food waste reduction, as pre-registered. Therefore, relevant items from previous studies were collected and structured into assumed constructs. To ensure these assumed constructs were actually distinct, we used EFA to obtain the best factor solution for this data (Watkins, 2018). However, we failed to show that these multiple latent constructs could explain the covariation between the variables except for attitudes towards suboptimal food and environmental concerns. This highlights the need for a more systematic construction of scales able to measure relevant constructs regarding the underlying factors of food waste.

Our research is based on the hypothetical WTP of consumers participating in an online survey using on-screen food pictures. Although this method has often been used (e.g., Grewal et al., 2019), it can lead to an overestimation of WTP since consumers may behave differently when in a real purchase decision involving a real trade-off between cost (i.e., money) and benefits (i.e., products and their qualities) (Yue et al., 2009). Future studies based on incentive-compatible techniques could be conducted to compare and calibrate the results of the present study.

The present paper also offers a methodological contribution. Conducting mouse-tracking experiments within the context of an online survey is particularly useful given the increasing importance of online studies in consumer research. Moreover, this implicit measure of ambivalence provides a mean to capture the spontaneous motor reactions that unfolds during evaluation process, which is not possible to be captured through self-report. Although the correlation with the self-report data was lower than expected, we nonetheless believe that having different measures of the same construct is useful for research in the area of suboptimal food (cf. Bolos et al., 2019) and that the results of this study are a promising first step towards validating online mouse-tracking. Indeed, after removal of outliers, the correlation coefficient approached our pre-determined threshold. Moreover, the results on our H1 demonstrate the expected differences in ambivalence towards optimal and suboptimal food. We believe that this suggests that the mouse-tracking paradigm may help to better understand cognitive conflicts in consumer psychology. Nonetheless, researchers who wish to adopt this method are encouraged to take some precautions, for instance, increasing the number of trials per stimuli category to increase reliability and pre-register outlier exclusion (including "started too early" alerts) to increase validity. Future studies should also try to account for further factors (e.g., mouse sensitivity and pointing device) that may introduce unsystematic variance in the mouse-tracking experiment (Kieslich et al., 2020). This is especially relevant for conducting mouse-tracking in online settings, despite the fact that Mathur and Reichling (2019) have already tried to account for such issues in their software.

In this study we did not apply a one-size-fits-all approach but specifically aimed to study organic consumers. Interestingly, evaluations for suboptimal food, ambivalence and WTP for suboptimal foods differed even among organic consumers in relation to their organic purchasing frequencies (see Supplementary material), with more frequent purchasers of organic foods evincing more positive evaluations of suboptimal food, lower experience of ambivalence and higher WTP. Given that the experience of ambivalence might thus be linked to increased purchases of suboptimal food, a completely different pattern of results might be obtained from conventional consumers who might be more prone to univalent negative attitudes towards visually imperfect foods. Considering the interindividual differences of consumers, our findings cannot easily be generalised and, therefore, need to be verified using different samples (e.g., socio-demographic, frugality norms and attitude towards the food in general).

Conclusions

Fruits and vegetables from organic agriculture are often more susceptible to suboptimal appearance, making organic consumers an important target consumer for these food products. With this study we aimed to gain deeper insights into the barriers and drivers for purchasing suboptimal fruits and vegetables among organic consumers by incorporating psychological perspectives into a consumer research study. Our research suggests that attitudes are not a good predictor of people's WTP, rather indicating that consumers' WTP for suboptimal food is associated with experiences of ambivalence and environmental concerns. Higher environmental concerns were shown to be an important driver for the acceptance of suboptimal food precisely because it reduces such ambivalence. If food waste is understood and communicated as a consequence of ambivalence towards suboptimal food, we argue, policymakers, retailers and other stakeholders could try to reduce ambivalence among organic consumers to increase sales. Information campaigns and communication efforts should highlight the environmental benefits of suboptimal fruits and vegetables to promote a more positive and univalent attitude towards these food products. In addition, increasing the exposure of organic consumers to fruits and vegetables of various sizes, shapes and colours could help normalise such products to reduce the experience of ambivalence, thereby increasing the willingness of organic consumers to purchase these purportedly ugly but beautiful foods.

Data availability statement

The datasets presented in this study can be found in online repositories at https://osf.io/mazr4/?view_only=df0a78570f404c32903ee1e4309686af.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. This study was carried out in accordance with the University's guidelines for good scientific practice. The participants provided their written informed consent to participate in this study.

Author contributions

BP: conceptualisation, methodology, software, formal analysis, validation, investigation, writing—original draft, and visualisation. BB: conceptualisation, methodology, software, formal analysis, validation, writing—review and editing, and supervision. BJ: conceptualisation, methodology, investigation, writing—review and editing, supervision, project administration, and funding acquisition. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2022.934954/full#supplementary-material

TABLE S1
One-way ANOVA analyses, comparing the evaluation, subjective ambivalence and WTP for suboptimal food of different organic purchase frequency groups.

TABLE S2
Summary of the items in the questionnaire with German translation and source information.

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