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Consumers' willingness to pay for upcycled foods

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ABSTRACT

Research on food waste reduction suggests that solutions aimed at reducing waste early in the consumption cycle are the most impactful. Based on this premise, food research labs and food manufacturers have started creating and selling foods made from food ingredients that are generally discarded. Such foods, termed upcycled foods, are safe for human consumption and provide a promising solution to reduce food waste. However, the commercial success of this new category of foods will depend on consumers' acceptance. This research examines a key indicator of acceptance – consumers' willingness to pay. We find that although consumers are willing to pay less for upcycled foods compared to conventional alternatives, messaging increases consumers' willingness to pay. Specifically, we find that rational messaging is more effective than emotional messaging. Overall, our findings suggest that upcycled foods may command good acceptance among consumers.

1. Introduction

According to recent estimates, at least one third of the food produced globally is wasted (Hegnsholt, Unnikrishnan, Pollmann-Larsen, Askelsdottir, & Gerard, 2018; Lipinski et al., 2013; Lundqvist, de Fraiture, & Molden, 2008). In United States, it is estimated that forty percent of the food produced is wasted (Gunders, 2012). These estimates help visualize the magnitude of the crisis and underscore the need to continue researching solutions to the food waste problem.

The Environmental Protection Agency (EPA) argues that the most effective remedy for the food waste problem is waste reduction at source. The Food Recovery Hierarchy suggests that the greatest amount of food waste reduction can be achieved by reducing the amount of surplus food generated (www.epa.gov/sustainable-management-food/food-recovery-hierarchy). Given the sound economic logic behind this proposition, researchers have advocated for creating foods using ingredients that are generally wasted (O'Donnell, Deutsch, Yungmann, Zeitz, & Katz, 2015). The Food System Sensitive Model argues for use of such generally discarded ingredients in creating other food products (Bhatt et al., 2018; Bringezu & Bleischwitz, 2009; O'Donnell et al., 2015; Papargyropoulou, Lozano, Steinberger, & Wright, 2014).

Responding to the need for creating such foods, many food companies have started manufacturing foods made from surplus

ingredients. These foods are commonly termed as upcycled foods. Upcycled foods use food ingredients that are generally wasted close to the source of supply, often termed co-streams or byproducts. Such ingredients are used to create other foods that are safe for human consumption. An example would be brewers' spent grain. Barley and other grains are used in beer brewing. Once their flavor and nutrients like starch and sugar have been extracted for brewing beer, there is still valuable flavor and nutrition left in the grains. Such grains can be dried and used as an ingredient in baked goods or other food products. Similarly, carrots are widely consumed, but carrot peel is generally discarded, especially at an industrial scale for the manufacture of "baby carrots". Though ingredients such as carrot peels have nutritional value, a cultural norm has been to dispose of the peels. However, carrot peels can be dried and used in producing an upcycled powdered soup that is completely safe for human consumption. Examples of brands offering upcycled foods include Regrained and Planetarians in the United States, Remashed in the United Kingdom, and Kaffee Bueno in Denmark, among others. While upcycled foods have been launched in various markets, little is known about whether these foods will gain acceptance from consumers. Hence, we investigate a key indicator of the market success of upcycled foods by assessing consumers' willingness to pay. Our findings suggest that while consumers have lower willingness to pay for upcycled foods compared to conventional foods, their

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willingness to pay can be increased by using appropriate messaging while promoting these foods. Specifically, we find that rational communication is more effective than emotional communication in increasing consumers' willingness to pay for upcycled foods.

2. Literature review

2.1. Consumer acceptance of upcycled foods

The commercial success of upcycled foods hinges on acceptance of such foods by consumers (Bhatt et al., 2018). Previous research finds that consumers perceive such foods to be more alike premium organic foods than conventional foods and that consumers believe consuming such foods results in greater benefits to other people in the world (Bhatt et al., 2018). Other research also suggests a *prima facie* market potential for upcycled foods. Zhang et al. (2021) find that Baby Boomers are most likely to purchase upcycled foods while Gen X consumers are least likely to purchase upcycled foods. McCarthy, Kapetanaki, and Wang (2020) surveyed consumers in Australia and United Kingdom and found that nearly half of the 687 consumers they surveyed were willing to buy such foods. Further, these consumers were status seeking, convenience-oriented consumers, price conscious, and concerned about the problem of food waste. Aschemann-Witzel and Peschel (2019) examined consumer perception of a plant-based upcycled cocoa drink with an unconventional ingredient added to it (potato or grass protein). They also tested the role of brand (known vs. unknown brand) and sustainability benefit communication (present vs. absent) in shaping attitudes of male and female consumers toward the drink. These researchers find that the nature of the added ingredient, brand, communication, and gender all play a role in shaping consumers' attitudes towards the cocoa drink containing unconventional ingredients.

Research on a different but conceptually similar unconventional product i.e. reclaimed water, deserves a mention. Reclaimed water is obtained by treating wastewater which can then be used for purposes such as irrigation (Chen, Lu, Jiao, Wang, & Chang, 2013). Research on addressing water waste and water shortage by using reclaimed water contains some important findings that allude to consumers' perceptions about consuming food and water created using unconventional methods. This literature is noteworthy due to the natural similarities between reclaimed water and upcycled foods. Like reclaimed water is an unconventional alternative to water, upcycled foods are an unconventional alternative to typical foods. Further, by virtue of being produced through unconventional and radically new approaches, these products lead to concerns in the minds of consumers. For example, Savchenko, Kecinski, Li, and Messer (2019) examined consumer perception of foods produced using reclaimed water. These researchers find that consumers' safety concerns along with feelings of disgust and neophobia are major barriers to consumer adoption of foods produced with reclaimed water (Savchenko et al., 2019). The findings by Savchenko et al. (2019) highlight barriers to consumer acceptance of new food products and point to the need to research ways to overcome these barriers. Other research on consumer perceptions of reclaimed water suggests that branding plays an important role in shaping consumer perception (Ellis, Savchenko, & Messer, 2019). These researchers find that while consumers often reject reclaimed water due to concerns about its fitness for human consumption, such concerns can be minimized by through proper branding. More specifically, Ellis et al. (2019) find that brand names such as Pure, Eco-friendly and Advanced Purified resonate with consumers. These findings highlight that marketing interventions, such as branding, can be instrumental in improving consumer acceptance of unconventional food products such as upcycled foods.

While these findings in extant literature are encouraging, in that, they point to a possible acceptance of upcycled foods by consumers, many key dimensions of consumer acceptance are yet to be investigated. We examine consumers' willingness to pay for upcycled

foods because it is a key indicator of consumer acceptance.

2.2. Consumers' willingness to pay

Price of a product is central to assessing consumers' willingness to purchase the product and to understand acceptable prices for such products (Bergstein & Estelami, 2002; Marn, Roegner, & Zawada, 2003; Mukherjee, Jha, & Smith, 2017; Pauwels, Silva-Risso, Srinivasan, & Hanssens, 2004). Since consumers evaluate a product in comparison to a reference product, an upcycled food is likely to be compared with an available reference i.e., conventional food (Bhatt et al., 2018; Lee, Bhatt, & Suri, 2018). We measure consumers' willingness to pay the price for an upcycled food and contrast it with that for a comparable conventional food product at an identical price.

The price we chose represents a middle of the spectrum price point of the price range usually found in the market for five different types of foods – granola bars, pasta sauce, muffins, chicken nuggets, and ice-cream. Past research has tested consumers' willingness to pay using a single price and hence we adopted this practice (Laroche, Bergeron, & Barbaro-Forleo, 2001). Further, the five foods represent a spectrum of foods that consists of grain-based foods (granola bars), dairy products (ice-cream), bakery products (muffins), meat (chicken nuggets), and ingredient foods (tomato-based pasta sauce). Prior research on upcycled foods has also used multiple food categories to account for the differences arising from the nature of these foods (Bhatt et al., 2018).

2.3. Role of messaging

In addition to price, communicating such offers, i.e. messaging, is another important variable in the marketing of new products. Research suggests that consumers can be influenced to purchase new products by creating an appropriate message centered around the product (Krishnan & Jain, 2006). Further, extant literature suggests that the nature of the appeals used in such messages is likely to play an important role in persuading consumers. Research on messaging appeals emerged with Copeland's assertion that consumers often purchase goods and services for two reasons – emotional and rational (Copeland, 1924). Rational appeals in messages provide consumers with logical arguments as to why products might be of value to them. On the other hand, emotional appeals in messages stimulate positive or negative feelings associated with promoted products or support a cause to influence their purchase of that product (Armstrong, Adam, Denize, & Kotler, 2014). While both rational and emotional appeals are popular in marketing communications, an empirical question remains as to which of these two appeals will enhance consumers' willingness to pay for upcycled foods.

The literature has shown that compared to emotional appeals, a rational appeal in messages create more positive attitudes towards a product (Heath, Nairn, & Bottomley, 2009; Rizwan, Pirzada, Sohail, Nadeem, & Murid, 2013; Stafford & Day, 1995). Other studies however suggest that compared to rational appeals, emotional appeals create positive feelings that consumers associate with the product and are likely to make the advertised product more acceptable (Mehta & Purvis, 2006; Williams & Drolet, 2005; Yoo & MacInnis, 2005). Literature on food marketing also suggests that both emotional and rational appeals are used by food marketers to shape consumers' acceptance (Page & Brewster, 2007; Wei, Rickard, & Brown, 2015). Given these findings, we tested both types of messaging (rational and emotional). To our knowledge, our research is first to test the impact of both these appeals on consumers' willingness to pay for a novel food category i.e., upcycled foods.

3. Method

Two studies were conducted to assess – a) consumers' willingness to pay for upcycled foods vis-à-vis conventional foods (study 1), and b) the impact of two messaging interventions (rational vs. emotional) on

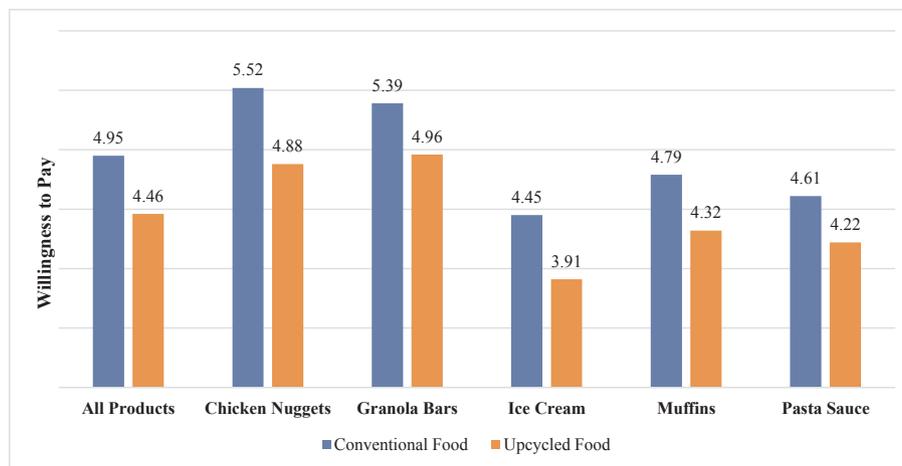


Fig. 1. Willingness to Pay for Conventional and Upcycled Foods (Study 1)

willingness to pay (study 2).

3.1. Study 1 – Consumers’ willingness to pay for conventional and upcycled foods

3.1.1. Participants, design, and procedure

Two hundred US participants (62.5% females, average age = 38.91 years) from a large online panel completed the study. At the beginning of the study, participants were informed that the study was to assess consumers’ perceptions and evaluations of food products. Next, participants were provided with descriptions of conventional and upcycled foods. Conventional foods were described as those that – “are manufactured from ingredients that are produced using allowable food production methods. The majority of foods are produced in this manner. Examples: A conventional muffin may use ingredients such as flour that would commonly be found in a supermarket. A soup made from carrots would be considered conventional food.” On the other hand, upcycled foods were described as foods that “are manufactured from ingredients that are byproducts from producing another food product. A minority of foods are produced in this manner. Upcycled foods are safe for consumption. Examples: An upcycled muffin may use ingredients such as flour milled from the leftover grain from beer brewing. A soup made from carrot peels and scraps would be considered upcycled food.” Both these product descriptions were presented to participants in a random order. After reading these descriptions, participants were asked to evaluate five products that were labelled as either conventional or upcycled. The product descriptions included the descriptor of the product (conventional vs. upcycled) and an image of the product accompanied by its price (see Appendix). In the conventional condition, the descriptor “Conventional” was added before the name of the product (e.g. Conventional Ice Cream), while in the upcycled condition the descriptor “Upcycled” was added before the name of the product (e.g. Upcycled Ice Cream). The food products included in this study were chicken nuggets, granola bars, pasta sauce, muffins, and ice cream. These products represented meat, grains, vegetable ingredients, bakery, and dairy products that are often promoted by manufacturers and retailers. Participants viewed all five products in a random order.

To determine range of acceptable prices for each product, researchers looked at market prices. The researchers then calculated the midpoint of this acceptable range to come up with prices used in this study: chicken nuggets (\$2.99), granola bars (\$2.74), pasta sauce (\$3.29), muffins (\$4.49), and ice cream (\$4.29). The price used in the stimuli was identical for conventional and upcycled versions of a given food product. After reviewing each product, participants indicated their willingness to pay for that product on a three item scale (“It is

acceptable to pay this price for the advertised [conventional/upcycled product name]”; “I would accept paying this price for the advertised [conventional/upcycled product name]”; “I would be willing to spend this amount for the advertised [conventional/upcycled product name]”; 1 = strongly disagree, 7 = strongly agree; Cronbach’s alpha = 0.96; (Laroche et al., 2001)). Finally, participants indicated their frequency of shopping for the products (“How often do you shop for [product name]?”; 1 = never, 7 = extremely frequently), their familiarity with upcycled foods (“Before participating in this survey, how familiar were you with upcycled foods?”; 1 = not at all familiar, 7 = extremely familiar) and demographic information (age and gender). Frequency of shopping for the five foods used in this study is likely to be different among participants. Hence, it is necessary to account for these differences. Similarly, prior familiarity with upcycled foods was also measured since it could influence participants’ evaluations of upcycled foods used in this study.

3.1.2. Results

A General Linear Model (GLM) was estimated with all products combined to assess the impact of food product category on consumers’ willingness to pay. The model was estimated using food category (conventional vs upcycled) as a factor and consumers’ willingness to pay as the dependent variable. Respective frequency of shopping for the five foods and familiarity with upcycled foods were used as covariates.

Willingness to Pay

$$= \beta_0 + \beta_1 \text{FoodCategory} + \beta_2 \text{ShoppingFrequency} + \beta_3 \text{Familiarity} + \varepsilon$$

There was a significant effect of food category (conventional vs upcycled) on willingness to pay ($F(1,196) = 25.543, p < .05$; $M_{\text{conventional}} = 4.95, M_{\text{upcycled}} = 4.46$; see Fig. 1 and Table 1).

GLM was also used to analyze the impact of each product within a food category on consumer’s willingness to pay. Frequency of shopping and familiarity with upcycled foods were used as covariates. There was a significant effect of food category (conventional vs upcycled) on willingness to pay for chicken nuggets ($F(1,196) = 12.216, p < .05$), granola bars ($F(1,196) = 5.119, p < .05$), and ice cream ($F(1,196) = 6.742, p < .05$). There was a marginally significant effect of food category (conventional vs upcycled) on willingness to pay for muffins ($F(1,196) = 3.071, p < .10$; see Fig. 1 and Table 1).

3.1.3. Discussion

Results from this study indicate that participants’ willingness to pay for upcycled foods was lower compared to their willingness to pay for conventional foods. Specifically, participants’ willingness to pay was significantly less for upcycled alternatives of granola bars, chicken

Table 1
General Linear Model - Willingness to Pay (Study 1)

	All products F Value	Chicken nuggets F Value	Granola bars F Value	Pasta sauce F Value	Muffins F Value	Ice cream F Value
Corrected Model	19.766***	9.861***	2.697*	3.995**	11.450***	4.824**
Intercept	763.997***	279.681***	330.612***	75.815***	127.072***	61.486***
Shopping Frequency (respective food)	8.642**	18.617***	1.449	6.473*	1.832	1.860
Familiarity (with upcycled foods)	21.083***	0.107	0.907	1.370	23.636***	6.645*
Food Category (conventional vs. upcycled)	24.543***	12.216**	5.119*	2.367	3.071	6.742*
Adjusted R -squared	0.053	0.118	0.025	0.043	0.136	0.055

* $p < .05$.

** $p < .01$, *** $p < .001$.

nuggets, and ice cream. However, this was not the case for muffins and pasta sauce. These findings suggest that consumers may be more accepting of upcycled alternatives of certain food products and less accepting of others. Given these findings, we conducted study 2 to assess whether messaging increases consumers' willingness to pay for upcycled foods.

3.2. Study 2 – The effect of messaging on willingness to pay

To examine whether rational and emotional appeals increase consumers' willingness to pay for upcycled foods, we first conducted a pilot study to assess the effectiveness of two video messages containing these appeals.

3.2.1. Pilot study

Fifty-one US participants from a large online panel were shown a rational video and an emotional video in random order. The emotional video had human actors (adults and children) and the voice-over talked about how a child dies of hunger every five seconds while millions of pounds of food is wasted. The rational video was an animated video in which the voice-over talked about facts and statistics about food waste and hunger. Paired-samples t-tests were conducted to examine whether participants perceived a difference in the appeal contained in the videos. The tests revealed that participants perceived the rational video to be more rational than the emotional video and the emotional video to be more emotional than the rational video. On the first measure ("Does this video appeal more to your rational or emotional side?"; 1 = rational, 9 = emotional), the emotional video was perceived as significantly more emotional than the rational video ($t(50) = -7.33$, $p < .05$; $M_{\text{rational}} = 4.41$, $M_{\text{emotional}} = 7.65$). Similarly, on the second measure ("Does this video appeal more to your heart or to your mind?"; 1 = mind, 9 = heart), the emotional video was perceived to be significantly more appealing to the heart ($t(50) = -7.82$, $p < .05$; $M_{\text{rational}} = 4.57$, $M_{\text{emotional}} = 7.67$). These results suggest that the videos contained the intended appeal and were therefore used in the main experiment.

Table 2
General Linear Model - Willingness to Pay (Study 2)

	All products F Value	Chicken nuggets F Value	Granola bars F Value	Pasta sauce F Value	Muffins F Value	Ice cream F Value
Corrected Model	58.471***	15.949***	9.996***	8.355***	15.244***	14.469***
Intercept	1082.927**	353.363***	299.362***	131.407***	237.790***	130.524***
Shopping Frequency (respective food)	214.677***	74.898***	34.200**	17.343**	62.067***	41.670***
Familiarity (with upcycled foods)	7.645**	0.507	0.121	11.668*	0.142	8.396**
Intervention (emotional vs. rational)	2.288	0.001	0.032	2.652	0.403	1.036
Food Category (conventional vs. upcycled)	0.283	0.125	0.031	0.500	0.000	0.256
Food Category \times Intervention	13.058***	0.530	8.484**	3.135	0.691	3.275
Adjusted R -squared	0.166	0.207	0.135	0.114	0.199	0.190

* $p < .05$.

** $p < .01$.

*** $p < .001$.

3.2.2. Participants, design, and procedure

To assess the impact of these two video messages (emotional vs. rational) on consumers' willingness to pay for upcycled foods, 341 US participants (41% females, average age = 36.83) from a large online panel completed the study. Participants were randomly assigned to one of the four conditions in a 2-factor (food category: conventional vs. upcycled) \times (intervention: emotional vs. rational) between-subjects design. Participants first viewed descriptions for conventional and upcycled foods adopted from study 1. Next, participants watched one of the two videos (rational vs. emotional) that were tested in the pilot study. After watching the video, participants viewed either conventional or upcycled alternatives of the five food products in a random order. The five food products and their prices were the same as those in study 1. Similar to study 1, participants indicated their willingness to pay for each product on the three item scale used in study 1 (Cronbach's alpha = 0.93, (Laroche et al., 2001)).

Next, participants responded to an attention check question that tested whether participants paid attention to the content of the video (Abbey & Meloy, 2017; Kees, Berry, Burton, & Sheehan, 2017). Participants also indicated their frequency of shopping for each of the five products, their familiarity with upcycled foods, and demographic information (age and gender).

3.2.3. Results

Two hundred and eighty-eight participants who passed the attention check were included in the analysis (Abbey & Meloy, 2017; Kees et al., 2017). Similar to study 1, a General Linear Model (GLM) was estimated with all the five products using food category (conventional vs upcycled) and intervention (emotional vs rational) as factors and willingness to pay as the dependent variable. Frequency of shopping and familiarity with upcycled foods were used as covariates. There was no main effect of food category (conventional vs upcycled) ($F(1, 1434) = 0.283$, NS) or intervention (rational vs emotional) ($F(1, 1434) = 2.288$, NS) on willingness to pay. However, there was a significant interaction between the two ($F(1, 1434) = 13.058$, $p < .05$; see table 2). For conventional foods, participants who watched the

emotional video indicated a higher willingness to pay compared to those who watched the rational video ($M_{\text{emotional}} = 5.04$, $M_{\text{rational}} = 4.81$; $t(668) = 2.139$, $p < .05$). However, for upcycled foods, participants who watched the rational video indicated a higher willingness to pay compared to those who watched the emotional video ($M_{\text{emotional}} = 4.67$, $M_{\text{rational}} = 5.11$; $t(768) = -3.755$, $p < .05$). GLM was also used to assess the effect of the two factors on willingness to pay for each of the five foods.

3.2.3.1. Granola bars. The GLM on willingness to pay for granola bars revealed no main effect of food category (conventional vs upcycled) ($F(1, 282) = 0.031$, NS) or intervention (rational vs emotional) ($F(1, 282) = 0.032$, NS), but a significant interaction between the two ($F(1, 282) = 8.484$, $p < .05$). For conventional granola bars, there was a marginally significant difference in participants' willingness to pay between the two conditions of interventions ($t(132) = 1.807$, $p < .10$). Participants who watched the emotional video indicated a higher willingness to pay for conventional foods compared to those who watched the rational video ($M_{\text{emotional}} = 5.32$, $M_{\text{rational}} = 4.87$). However, for upcycled granola bars, there was a significant difference in participants' willingness to pay between the two conditions of interventions ($t(152) = -2.256$, $p < .05$). Participants who watched the rational video indicated a higher willingness to pay compared to those who watched the emotional video ($M_{\text{emotional}} = 4.85$, $M_{\text{rational}} = 5.38$).

3.2.3.2. Ice cream. The GLM on willingness to pay for ice cream revealed no main effect of food category (conventional vs upcycled) ($F(1, 282) = 0.256$, NS) or intervention (rational vs emotional) ($F(1, 282) = 1.036$, NS), but a marginally significant interaction between the two ($F(1, 282) = 3.275$, $p < .10$). For conventional ice cream, there was no difference in willingness to pay between participants who watched the two different videos ($M_{\text{emotional}} = 4.86$, $M_{\text{rational}} = 4.58$; $t(132) = 1.089$, NS). However, for upcycled ice cream, participants who watched the rational video indicated a higher willingness to pay compared to those who watched the emotional video ($M_{\text{emotional}} = 4.31$, $M_{\text{rational}} = 4.98$; $t(152) = -2.431$, $p < .05$).

3.2.3.3. Pasta sauce. The GLM on willingness to pay for pasta sauce revealed no main effect of food category (conventional vs upcycled) ($F(1, 282) = 0.500$, NS) or intervention (rational vs emotional) ($F(1, 282) = 2.652$, NS). However, there was a marginally significant interaction between the two ($F(1, 2482) = 3.135$, $p < .10$). For conventional pasta sauce, there was no difference in willingness to pay between participants who watched the two different videos ($M_{\text{emotional}} = 5.07$, $M_{\text{rational}} = 5.00$; $t(132) = 0.261$, NS). However, for upcycled pasta sauce, participants who watched the rational video indicated a higher willingness to pay compared to those who watched the emotional video ($M_{\text{emotional}} = 4.59$, $M_{\text{rational}} = 5.16$; $t(152) = -2.318$, $p < .05$).

3.2.3.4. Muffins. The GLM on willingness to pay for muffins revealed no main effect of food category (conventional vs upcycled) ($F(1, 282) = 0.000$, NS) or intervention (rational vs emotional) ($F(1, 282) = 0.403$, NS). Further, there was no significant interaction between the two ($F(1, 282) = 0.691$, NS). For conventional muffins, there was no difference in willingness to pay between participants who watched the two different videos ($M_{\text{emotional}} = 4.70$, $M_{\text{rational}} = 4.52$; $t(132) = 0.716$, NS). Similarly, for upcycled muffins, there was no difference in willingness to pay between participants who watched the two different videos ($M_{\text{emotional}} = 4.49$, $M_{\text{rational}} = 4.77$; $t(152) = -1.008$, NS).

3.2.3.5. Chicken nuggets. The GLM on willingness to pay for chicken nuggets revealed no main effect of food category (conventional vs upcycled) ($F(1, 282) = 0.125$, NS) or intervention (rational vs

emotional) ($F(1, 282) = 0.001$, NS). Further, there was no significant interaction between the two ($F(1, 282) = 0.530$, NS). For conventional chicken nuggets, there was no difference in willingness to pay between participants who watched the two different videos ($M_{\text{emotional}} = 5.29$, $M_{\text{rational}} = 5.07$; $t(132) = 0.888$, NS). Similarly, for upcycled chicken nuggets, there was no difference in willingness to pay between participants who watched the two different videos ($M_{\text{emotional}} = 5.13$, $M_{\text{rational}} = 5.26$; $t(152) = -0.499$, NS).

We conducted additional analysis to assess the increase in willingness to pay for upcycled foods attributable to the two interventions (emotional vs. rational). To do so, we contrasted participants' willingness to pay for upcycled foods in this study against participants' willingness to pay for upcycled foods observed in study 1. Since participants in study 1 indicated their willingness to pay for upcycled foods without being exposed to any messaging intervention, these participants' willingness to pay provides a baseline. Against this baseline, the willingness to pay for upcycled foods after watching an intervention video (in study 2) was contrasted. Participants' willingness to pay in each condition (study 1 vs. emotional vs. rational) for the five products combined was contrasted using a one-way ANOVA. The ANOVA revealed a significant difference in participants' willingness to pay between the three conditions ($F(2,1267) = 15.278$, $p < .05$). Planned contrasts revealed a significant difference between willingness to pay in study 1 and willingness to pay after watching the rational video ($p < .05$). Also, there was a significant difference between willingness to pay in study 1 and willingness to pay after watching the emotional video ($p < .05$). Finally, there was a significant difference in willingness to pay between participants who watched the emotional video and those who watched the rational video ($p < .05$). Fig. 2 presents the mean willingness to pay in study 1 alongside mean willingness to pay after exposure to the interventions (emotional and rational). ANOVA was also used to test for differences in willingness to pay between the three conditions for each of the five products.

3.2.3.6. Granola bars. For granola bars, the ANOVA revealed a marginally significant difference in participants' willingness to pay between the three conditions ($F(2,251) = 2.620$, $p < .10$). Planned contrasts revealed a marginally significant difference between willingness to pay in study 1 and willingness to pay after watching the rational video ($p < .10$). However, there was no difference between willingness to pay in study 1 and willingness to pay after watching the emotional video (NS). As expected from previous analysis, there was a significant difference in willingness to pay between participants who watched the emotional video and those who watched the rational video ($p < .05$).

3.2.3.7. Ice cream. For ice cream, the ANOVA revealed a significant difference in participants' willingness to pay between the three conditions ($F(2,251) = 7.264$, $p < .05$). Planned contrasts revealed a significant difference between willingness to pay in study 1 and willingness to pay after watching the rational video ($p < .05$). However, there was no difference between willingness to pay in study 1 and willingness to pay after watching the emotional video (NS). As expected, there was a significant difference in willingness to pay between participants who watched the emotional video and those who watched the rational video ($p < .05$).

3.2.3.8. Pasta sauce. For pasta sauce, the ANOVA revealed a significant difference in participants' willingness to pay between the three conditions ($F(2,251) = 6.844$, $p < .05$). Planned contrasts revealed a significant difference between willingness to pay in study 1 and willingness to pay after watching the rational video ($p < .05$). However, there was no difference between willingness to pay in study 1 and willingness to pay after watching the emotional video (NS). There was a significant difference in willingness to pay between participants who watched the emotional video and those who watched the rational

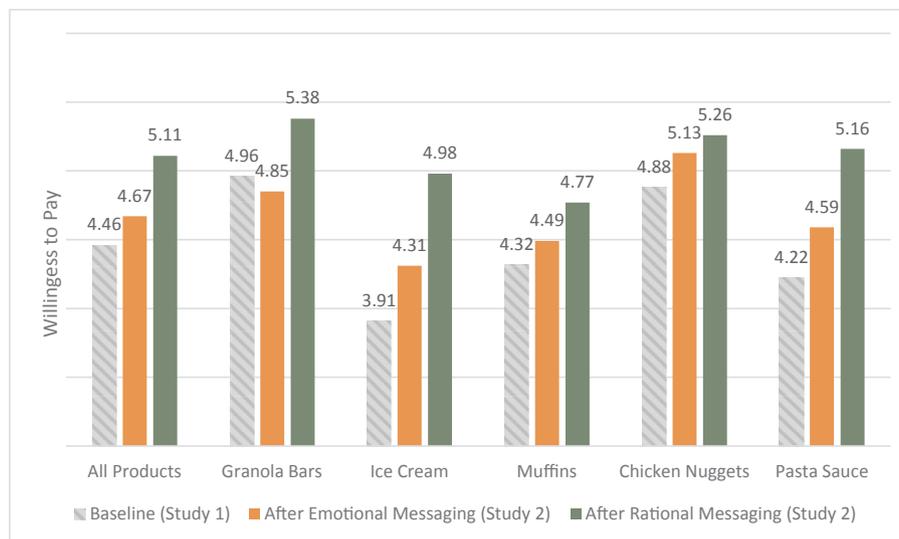


Fig. 2. Increase in Willingness to Pay for Upcycled Foods (Study 2)

video ($p < .05$).

3.2.3.9. Muffins. For muffins, the ANOVA did not reveal a significant difference in participants' willingness to pay between the three conditions ($F(2,251) = 1.299$, NS).

3.2.3.10. Chicken nuggets. For chicken nuggets, the ANOVA did not reveal a significant difference in participants' willingness to pay between the three conditions ($F(2,251) = 1.291$, NS).

3.2.4. Discussion

Results from study 2 show the relative effectiveness of the two messaging appeals. Overall, the rational video message led to significantly higher willingness to pay for upcycled foods. Contrasting mean willingness to pay for upcycled foods between studies 1 and 2 shows that, while both video messages increased willingness to pay for upcycled food items compared to similar items in study 1, the rational video message enhanced participants' willingness to pay more than an emotional message. In sum, results from study 2 suggest that though both communication messages can influence consumers' willingness to pay for upcycled foods, a message that provides rational arguments supporting consumption of such foods to address food waste will be more effective than an emotional message.

4. General discussion

Extant literature suggests that food waste is a big problem (Gunders, 2012; Hegnholt et al., 2018; Lipinski et al., 2013; Lundqvist et al., 2008). Upcycled foods provide a promising solution by tackling the problem close to the source of food waste (Bhatt et al., 2018). Despite the benefits, research on consumer acceptance of these foods is limited. Extant research on upcycled foods has not investigated consumers' willingness to pay which is a key indicator of consumer acceptance (Aschemann-Witzel & Peschel, 2019; Bhatt et al., 2018; McCarthy et al., 2020). The current research fills this gap.

Two studies were conducted to examine consumers' willingness to pay for upcycled foods vis-à-vis their conventional alternatives and to investigate the impact of rational and emotional messaging on the willingness to pay. Findings from study 1 indicate that consumers have a lower willingness to pay for upcycled foods compared to similar conventional foods. Additionally, findings from study 2 show that consumers' willingness to pay for upcycled foods can be increased using the right messaging. Our results indicate that rational messaging is more effective than emotional messaging. Findings from this research

advance theoretical understanding about upcycled foods and provide actionable insights to practitioners in the food industry.

We examined consumers' willingness to pay for upcycled foods based on theoretical insights from three streams of literature – pricing, communication, and food research. Extant pricing literature suggests that when consumers have little knowledge about a product and its price, they use an advertised price more in its traditional economic role as an indicator of the monetary sacrifice that they have to make to acquire the product (Lee et al., 2018; Suri & Monroe, 2003). When consumers use price more as an indicator of monetary sacrifice, they endeavor to lower the monetary sacrifice which is reflected in lower willingness to pay (study 1). However, price perception can be shaped by many factors other than the price itself (Adaval & Monroe, 2002; Grewal, Monroe, & Krishnan, 1998; Puccinelli, Chandrashekar, Grewal, & Suri, 2013; Suri & Monroe, 2003; Ye, Bhatt, Jeong, Zhang, & Suri, 2020). Based on extant literature that demonstrates the role of marketing communications in shaping consumers' perception of prices of new products, we examined the role of messages (emotional and rational). Comparing willingness to pay in the absence of marketing communications (study 1) with that after communications (study 2), we find that rational messaging is more effective than emotional messaging in increasing consumers' willingness to pay for upcycled foods. These findings are in line with past research that supports the role of cognitive appeals in persuasion (Eagly & Chaiken, 1984). Although the use of emotional appeals in marketing communications is increasing, these results show the efficacy of rational appeals when marketing upcycled foods. Our research also contributes to the food marketing literature. Generally, consumer acceptance of new products is low due to concerns about the quality and benefits of these products. Such concerns are compounded in the case of edible products such as foods due to their direct effect on consumers' well-being. However, our results show that consumer acceptance can be shaped through appropriate communication.

The empirical findings from our studies provide implications for marketing of upcycled foods. First, our findings suggest that consumers are less accepting of an upcycled product when priced identical to a comparable conventional product (study 1). Manufacturers of upcycled foods need to be cognizant of this. Manufacturers of these foods may benefit by promoting upcycled foods at prices that are lower than those of comparable conventional foods. Such a pricing approach will help position these foods as more affordable alternatives to conventional and organic foods. Second, it becomes critical to connote better value through a strong communication effort. The fact that rational messaging was found to be more effective than emotional messaging is an

actionable finding for industry practitioners (study 2). Creating and executing marketing communications requires substantial investment of resources. Hence, practitioners benefit from an a priori understanding of which type of messaging is likely to be more effective. Our findings show that practitioners will be able to market upcycled foods better by creating rational messaging around such foods. Third, our findings also align with past research that suggests an industry potential for upcycled foods (Aschemann-Witzel & Peschel, 2019; Bhatt et al., 2018; McCarthy et al., 2020).

4.1. Limitations and future research

One limitation of this research is that we do not inquire into why participants were more persuaded by a rational message than an emotional message when indicating their willingness to pay for upcycled foods. Is rational messaging more effective because upcycled foods are a new category of products? Is rational messaging more effective because consumers are looking for facts and figures about these products? Will rational messaging remain more effective as market for upcycled foods evolves? What is the long-term impact of rational (vs. emotional) messaging on consumers' perceptions of brands that provide upcycled products? Future research should examine these important questions.

Future research should also investigate other aspects of consumer acceptability of upcycled foods as well as additional categories of upcycled foods. We examined five different foods that represent different categories of foods. However, within these categories, intrinsic attributes such as form, texture, aroma etc. must be considered. Other important variables that could influence consumers' perceptions include quality assurance cues (certifications, logos, etc.), brand reputation, source of origin (country-of-origin, country-of-manufacture, etc.), and packaging cues (color, material, information, etc.) among others. Further, consumer-level characteristics such as concern for the environment, food preferences, and awareness should be investigated. Also, the participants in our studies were residents of United States. Future research should examine whether similar effects are observed among consumers in other countries.

In sum, the future of upcycled foods will be determined by how well consumers accept these foods. To our knowledge, this research is the first to examine consumers' willingness to pay for upcycled foods and demonstrate that proper communication could increase the willingness to pay. Increased willingness to pay will increase consumer demand for upcycled foods which will help expand the market for such foods.

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CRedit authorship contribution statement

Siddharth Bhatt: Conceptualization, Methodology, Investigation, Formal analysis, Writing - original draft, Writing - review & editing. **Hongjun Ye:** Data curation, Software, Visualization, Formal analysis. **Jonathan Deutsch:** Funding acquisition, Conceptualization, Project administration. **Hasan Ayaz:** Conceptualization, Supervision. **Rajneesh Suri:** Conceptualization, Writing - review & editing, Supervision, Resources.

Declaration of Competing Interest

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

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