



Emotions and food waste behavior: Do habit and facilitating conditions matter?

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ABSTRACT

Food waste is currently a critical global issue, even more so because waste has continued to increase despite various reduction initiatives. Deeper research insights into why people waste food are needed to formulate effective strategies to counter such behavior. This study investigated the drivers of food delivery app (FDA) users' attitudes against food waste and their behavioral intentions to reduce it. Specifically, the study employed the theory of interpersonal behavior (TIB) to explicate the role of emotions in driving attitude and intentions. Data collected from active FDA users (N = 561) were analyzed to test the proposed associations. The other two key variables in the TIB framework – *habit*, operationalized in this study as *ordering more food than necessary to take advantage of special offers*, and *facilitating conditions*, captured through *belief that food ordered via FDAs often goes to waste* – are conceptualized and examined as moderation variables. The results confirmed the positive association of attitude and negative emotions with intentions, as well as the positive association of negative emotions and attitude. However, the negative association of positive emotions was confirmed with attitude only. In addition, attitude mediated the negative emotions-intentions association. Finally, the analysis revealed that the variable *belief that food ordered via FDA often goes to waste* moderated the association of positive and negative emotions with intentions. The findings of the study offer significant inferences.

1. Introduction

Food waste generated during the year 2019 was 931 million metric tons globally, representing around 17 % of total food available for consumption that year (Tiseo, 2021). Despite millions going hungry, as reported by WHO (2019) time and again, there are many with abundant food supply but very little concern about wasting it (Melbye, Onozaka & Hansen, 2017). Other recent studies have also noted concerns related to food security and the environmental fallout of food waste (Dhir et al., 2020; Kaur et al., 2021). If available food is handled and consumed properly, then both the incidence of food insecurity and the extent of environmental damages caused by food waste, including greenhouse gas emissions (Cakar et al., 2020), will drastically decrease. Despite these

widely acknowledged outcomes, food waste persists. Recognizing the severity of the challenge and its societal implications, researchers and social scientists have tried to investigate the issue of food waste from various perspectives. Focusing on quantity and sources of such waste generated globally, past studies observe that despite inter-country variations in quantity, the largest quantities, the world over, are consumer-generated (Talwar et al., 2022b; Filimonau et al., 2020) and those generated in the food service sector (Okumus, 2020; Luu, 2020). For example, in the E.U. alone, household food waste accounted for 53 % of the total waste (Ilakovac et al., 2020).

Focusing on drivers of consumer-generated food waste, scholars have discussed shopping, food-ordering, and planning routines, leftover takeaway and reuse intentions, etc., in both at-home and out-of-home

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dining (Stöckli et al., 2018; Talwar et al., 2021a; 2021b; 2021c). While these findings offer useful and interesting insights, they are not exhaustive by any means, and there are clear gaps from in both conceptualization and scope. First, prior studies have primarily focused on cognitive factors such as normative aspects and attitudes to understand food waste behavior (Heidari et al., 2019; Stancu et al., 2016). Affective factors that may shape attitude and impact behavioral decision-making have been less examined, as also noted by Attiq et al. (2021), but evidence does exist, albeit in lesser volume, to support the role of factors related to emotions, such as anticipated pride in affecting the food waste intentions of consumers (Talwar et al., 2022b; Graham-Rowe et al., 2014). While emotions can be both positive and negative, research that differentiates these two emotional camps when examining how they shape consumers' attitudes and intentions against food waste is scarce (e.g., Russell et al., 2017). This study therefore notes and addresses the need to examine in greater detail the role of affective/non-cognitive factors captured through emotions in impacting such attitude and intentions. Second, despite the challenges of predicting complex human behavior (Khan, Ahmed, & Najmi, 2019), past studies have largely focused on examining direct associations between identified variables (e.g., Attiq et al., 2021) and paid little attention to potential intervening mechanisms. Since mediators and moderators are effective intervening variables that can better explicate the path through which independent variables impact dependent variables, as well as the strength of the association between the two, the literature may benefit from an examination of potential mediating paths and moderation effects. Accordingly, this study seeks to examine potential mediating paths that link emotions and intentions. The study also identifies pertinent moderators to test the strength of proposed associations. Finally, while the scholarly literature in the area is growing, some limitations persist in conceptualization and scope. Prior research lacks a sound theoretical basis, with most attempts remaining confined to the theory of planned behavior (TPB) (e.g., Stancu et al., 2016; Talwar et al., 2022a). Due to this, the scholarly interest in the area has largely produced unidimensional results that ignore the complexities of human behavior, thus limiting our understanding of the topic. Certain recent studies have endeavored to expand the theoretical base by utilizing theories such as Stimulus-Organism-Response (SOR) paradigm (Talwar et al., 2022b), Behavioral Reasoning Theory (BRT) (Sharma et al., 2021), the Theory of Interpersonal Behavior (TIB), and the Comprehensive Model of Environmental Psychology (CMEP) (Attiq et al., 2021). This study advances these efforts of diversifying the relatively homogenous landscape of theoretical insights on this topic by using TIB (Triandis, 1979). Of all potential theoretical lenses that could be used to conceptualize the association between variables of interest, we believe that TIB is the most suitable, given the prominence of emotions in this study. In addition, from a methodological perspective, there is a lack of quantitative research, as past studies have largely utilized qualitative approaches such as interviews and observation (e.g., Romani et al., 2017; Okumus et al., 2020). While qualitative research enriches the accumulated knowledge, the paucity of quantitative insights may skew the findings and limit their generalizability. This study addresses this deficit by collecting and analyzing quantitative data through a cross-sectional survey. From the perspective of scope, there exists a rather serious gap in existing food waste literature in terms of examination of food delivery apps (FDAs) and their effect on food waste. FDAs offer numerous affordable and attractive deals (Deals, 2020; Okumus et al., 2018; Zomato, 2020) to their customers, which may attract them to order a lot more food than they need. With the increased accessibility of FDAs and usage of these services across the globe (Ray et al., 2019), scholars note that such over-ordering can result in a substantial amount of waste (Talwar et al., 2022a; Sharma et al., 2021). Recognizing the need to understand how using FDAs for ordering prepared food for delivery can impact food waste generation, this study has focused on FDA users.

Bringing the preceding discussion together, this study proposes to address three research questions (RQs) by analyzing data collected from

561 FDA users: **RQ1.** How, if at all, are emotions, attitudes against food waste, and behavioral intentions to reduce it associated? **RQ2.** Are the associations of positive and negative emotions with attitude and intentions limited to direct effects, or do indirect paths exist as well? **RQ3.** Are there any personal and situational factors that moderate the hypothesized associations?

The study is novel in three key ways. First, it shifts the focus of food waste research from cognitive to affective factors, which have remained comparatively under-explored in the past literature. The usefulness of this contribution is enhanced by the fact that it adds quantitative insights to the limited literature on emotions and their relationships to attitudes and intentions against food waste, which could potentially help concerned stakeholders to formulate effective strategies for reducing consumer food waste. Second, it expands the theoretical insights in the area by going beyond the TPB to conceptualize associations grounded in TIB, thereby linking consumer psychology with food waste. As a result, the study not only consolidates the findings of TPB by modeling attitude-intention association, but also adapts TIB to the FDA context by considering the moderating role of habit and facilitating conditions. Third, it expands the scope of food waste research from distinct at-home and out-of-home dining settings to include the somewhat hybrid setting of FDAs (food prepared out-of-home and delivered to be consumed at home). By doing so, the study expands the scope of FDA research, which has so far retained a technology-acceptance/rejection slant.

2. Theoretical framework and hypothesis development

2.1. Theory of interpersonal behavior (TIB)

This study employed TIB – put forward by Triandis (1979) as an integrated model to posit behavior as a function of intentions, emotions, habits, and facilitating conditions – to explain the impact of emotions on attitude against food waste and intentions to reduce it. The model is also called Triandis' Theory of Interpersonal Behavior, comprising various behavioral factors similar to TPB and the Technology Acceptance Model (TAM). However, TIB differs in that it considers ethical, social, and cultural factors which are not considered by others (Facione, 1993; Gagnon et al., 2003). Its value lies in its consideration of habits and facilitating conditions as antecedents of behavior (Robinson, 2010).

Prior studies have employed TIB to explain emotions and how they impact behavioral intentions in various contexts such as healthcare (e.g., Gagnon et al., 2003; Godin et al., 2008; Kupfer et al., 2019), travel, and tourism (Pronello, 2018). Although few studies have used TIB to examine emotions-food waste relationship (e.g., Russell et al., 2017; Attiq et al., 2021), its efficacy in explaining the impact of emotions on consumers' decisions in different settings makes it a suitable conceptual anchor for this study. TIB provides an acceptable theoretical basis upon which to examine emotions and has a long history of predicting several factors, including attitudes (Lewis et al., 2008) and behavioral intentions (Graham-Rowe et al., 2014), and has been applied successfully in the past to examine consumer food waste in household (e.g., Attiq et al., 2021). FDAs are also a way of procuring food for consumption at home, and so TIB may be applied to explain food waste in the FDA setting.

To adapt TIB to the context of FDAs, and to better explain the attitude-intention association that is well-documented in the seminal literature, this study models emotions as antecedents of both intentions and attitude and examines the moderation effect of habits and facilitating conditions on the strength of hypothesized associations. *Emotions* are assessed in two categories, positive and negative; *habit* is operationalized as the decision to buy more food than necessary in order to take advantage of special offers; and *the facilitating conditions*, the convenience and ease of access that FDAs offer, are captured in belief that food ordered through these platforms often goes to waste.

2.2. Attitude and behavioral intentions

Attitude, the evaluation of an experience, task, product, or service (Ajzen, 1991), is understood to be highly influential in consumers' choices (Koklic et al., 2019; Wang et al., 2018). Scholarly literature offers a long history of empirical evidence supporting the association between attitude and intentions, with a favorable or unfavorable feeling about performing a certain behavior demonstrating a significant impact on behavioral intentions (e.g., Baker & Crompton, 2000; Neff et al., 2015).

The same association has been found to exist in different food waste settings, suggesting that individuals' disposition (attitude) towards food waste impacts their behavioral intentions to reduce waste, as has indeed been shown by studies that found a significant correlation between attitude and intentions to reduce waste (Stefan et al., 2013; Graham-Rowe et al., 2015). Based on this precedent, we believe that an *attitude against food waste* – the perception that wasting food is inherently negative and bad – will increase FDA users' behavioral intentions to reduce it. Hence, we posit:

H1. *Attitude against food waste correlates positively with behavioral intentions to reduce food waste.*

2.3. Emotions, attitude, and behavioral intentions

Emotions are defined as the directional (i.e., positive or negative) reactions to an object or activity (Forgas, 1994) and are well documented in the scholarly literature for predicting numerous factors, including feelings and attitudes (Lewis et al., 2008), as well as pro-environmental behaviors and conservation-based practices (Bissing-Olson et al., 2016).

In the case of food-related decision-making, past studies have linked emotional states with attitudes towards food consumption (e.g., Wu et al., 2016), food practices (Pérez-Villarreal et al., 2019), food choices (Gutjar et al., 2014), and food purchase intentions (Bagozzi et al., 2016). Scholars also argue that negative emotions arising from the guilt of wasting food can motivate individuals to avoid doing so (Graham-Rowe et al., 2014). Based on the relevance of emotions in pro-environmental behavior and food-related decision-making, we argue that emotions should be considered while modeling food waste behavior. Building upon this contention, we speculate that the attitude-intentions relationship can be better conceptualized by understanding how consumers' emotions shape their attitudes. In this regard, we suggest that consumers' positive or negative emotions aroused by food waste will contribute to shaping their attitude against food waste. Although our anticipation is grounded in past findings, our suggestion remains speculative, extrapolated from the extended literature, since the association remains untested for FDAs. Expecting the potential association, we posit:

H2. *Positive emotions associated with food waste correlate negatively with attitudes against food waste.*

H3. *Negative emotions associated with food waste correlate positively with attitudes against food waste.*

Scholars have argued that emotions can be instrumental in providing motivational momentum, which subsequently results in behavioral intentions (Ali & Amin, 2014). Prior literature has also confirmed the key role of both positive and negative emotions (e.g., pride and guilt) in driving intentions to exhibit pro-environmental behaviors (Bissing-Olson et al., 2016) and other behavioral intentions (Attiq et al., 2021; Kim and Hall, 2019; Soscia et al., 2019). Despite these studies, it is currently not known to what extent positive and negative emotions associated with food waste can translate into predicting behavioral intentions to decrease it. For example, Russell et al. (2017) considered the impact of positive and negative emotions on intentions, but contrary to their proposed model, the results indicated that negative emotions towards food waste lead to an increase in it. Russell et al. (2017) acknowledged that there is a shortage of research on this topic and recommended further empirical analysis to examine this apparent

paradox of emotions. Recent studies have continued to underscore the need to examine impact of emotions on food waste-generation (e.g., Septianto et al., 2020). Taking cognizance of the need, this study proposes the following hypotheses:

H4. *Positive emotions associated with food waste correlate negatively with behavioral intentions to reduce food waste.*

H5. *Negative emotions associated with food waste correlate positively with behavioral intentions to reduce food waste.*

2.4. Mediation effect of attitude against food waste

Consumer behavior studies indicate that different factors predict attitude, which then translates into behavioral intentions (e.g., Lee & Yun, 2015) but also serves as a key mediator in various relationships in different settings (e.g., Ryan & Casidy, 2018; Sharma et al., 2021; Tsai et al., 2016). A study on functional food reported that trust predicted purchase intentions via purchasing attitude, thus confirming the mediation potential of attitude (Huang et al., 2019). Furthermore, a study on halal food purchase reported that attitude mediated norms- intentions association (Garg and Joshi, 2018). This provides us adequate basis to expect the mediating role of attitude against food waste in the present context as well, even though there is no *a priori* in the limited FDA literature, and we suggest that the association between emotions and intentions is likely to be mediated by attitude against food waste. Thus, we posit:

H6a. *Attitude against food waste mediates the association between positive emotions and behavioral intentions to reduce food waste.*

H6b. *Attitude against food waste mediates the association between negative emotions and behavioral intentions to reduce food waste.*

2.5. Moderation effect

2.5.1. Ordering more to take advantage of special offers

FDAs are online aggregators (Gunden et al., 2020; Kaur et al., 2022) that operate interfaces similar to other online shopping portals. To attract more users and encourage continued usage, they frequently offer discounts and bulk buying benefits (Jain, Anthony & Patil, 2020). For instance, Zomato, one of the top FDA service providers in India, offers discounts as high as 50 % and many cashback bonuses (Zomato, 2020). Such offers can persuade users to order higher quantity than they can reasonably consume, resulting in the increased possibility of food waste (Sharma et al., 2021). This is in concordance with other food-related findings which suggest that shopping habits induced by special offers often result in poor food management practices, which ultimately lead to waste (Ponis et al., 2017). However, such discounts are often an integral strategy of the FDA business, as although the special offers of FDA service providers change by region, consumers are likely to choose FDAs that provide the best offers (Gupta, Roy, Kumar & Arora, 2019).

It is therefore possible that consumers become accustomed to ordering more food than they need in order to take advantage of lucrative and attractive FDA offers. Although such an association remains unexamined so far, examining the moderation effect of the habit of ordering more to take advantage of special offers is likely to improve existing understanding of the association between emotions, attitude, and intentions. In other words, it is likely that the strength of the said associations will change due to the moderation effect of this habit. We therefore posit:

H7a. *The negative association between positive emotions and behavioral intentions to reduce food waste is moderated by the consumers' tendency to order more to take advantage of special offers.*

H7b. *The positive association between negative emotions and behavioral intentions to reduce food waste is moderated by the consumers' tendency to order more to take advantage of special offers.*

H7c. *The positive association between attitude against food waste and behavioral intentions to reduce food waste is moderated by the consumers' tendency to order more to take advantage of special offers.*

2.5.2. Belief that food ordered via FDAs often goes to waste

Several studies have emphasized that an appreciable proportion of global food waste comes from the consumer side (Graham-Rowe et al., 2014, 2015; Romani et al., 2017), with some scholars placing the household share of global food waste at over 50 % (Aschemann-Witzel et al., 2018). Past research indicates that the main driver of household food waste is over-purchasing. In agreement, existing scholarship has confirmed that shopping behavior manifested through the excess purchase of food items contributes extensively to household waste generation (e.g., Aschemann-Witzel et al., 2020). Such over-purchases are often driven by impulse buying (Stefan et al., 2013), which occurs in online environments as well, and at very high rates: according to Saleh (2017), over 80 % of shoppers sampled reported buying impulsively. Impulse shopping in the online environment is influenced by different factors such as portal characteristics, atmospheric cues, and user mood (Chen et al., 2019; Zheng et al., 2019), which may act as facilitating conditions.

Drawing upon this evidence from studies on food and online buying behaviors, we speculate that the convenience and ease of access offered by FDAs (Alalwan, 2020) serve as facilitating conditions which entice consumers to use the services more frequently. When using the services, the discounts would then encourage them to order more food per order. In addition, although food consumption volume differs from person to person and is influenced by factors such as package and plate shape, lighting, variety of food (Wansink, 2004), and hunger level, users of digital ordering systems may be more likely to over-order because actual portion size cannot be visualized. Due to these factors – more frequent ordering, attractive discounts on larger quantities of food, and inaccurate estimations of portion size – it follows that when food is ordered online, there is an increased chance that, in the aggregate, consumers order more food than they can reasonably consume. When FDA users witness or experience this frequently, it may affect the associations between their emotions, attitudes, and intentions. In other words, the strength of association between the hypothesized variables may vary depending on the belief that the food ordered via FDAs often goes to waste. Hence, we posit:

H8a. The negative association between positive emotions and behavioral intentions to reduce food waste is moderated by the belief that food ordered via FDAs often goes to waste.

H8b. The positive association between negative emotions and behavioral intentions to reduce food waste is moderated by the belief that food ordered via FDAs often goes to waste.

H8c. The positive association between attitude against food waste and

behavioral intentions to reduce food waste is moderated by the belief that food ordered via FDA often goes to waste.

2.6. Control variables

A review of past studies indicates the influence of certain socio-demographic factors on food-related decision-making (Flagg et al., 2014; Ricciuto et al., 2006). These variables may have a confounding effect and therefore must be controlled for. Age and gender are the most classic control variables used in structural equation modeling (SEM)-based studies, and have also been used in various food-related studies as well (e.g., Bianchi, 2017). They are furthermore termed vital when it comes to online shopping intentions (Lian & Yen, 2014). Other food-related research has used education as the indicator of choice in measuring the dietary choices of households (Kumar et al., 2021; Ricciuto et al., 2006). Existing studies specifically on food waste behavior have considered the confounding effect of age, gender, education etc. (e.g., Talwar et al., 2021a). Following these examples, we have identified age, gender, and economic condition as control variables.

The proposed associations are presented in Fig. 1.

3. Method

3.1. Data and methods

Data for testing the proposed model were collected through a two-part survey, with the first part seeking socio-demographic details about the respondents, and the second part contained items related to two independent variables – positive emotions and negative emotions – and two dependent variables – attitude and behavioral intentions. Positive emotions were measured through four items and negative emotions were measured through three items adapted from Russel et al. (2017). Attitude was measured through four items and behavioral intentions was measured through three items adapted from Ajzen (1991). All items were measured on a five-point Likert scale. The two moderating variables, *ordering more to take advantage of special offers* and *belief that food ordered via FDA often goes to waste*, were measured dichotomously (Yes or No).

The initial survey was piloted with 15 respondents representing the target group. The pilot test assessed content clarity and confirmed an acceptably brief completion time of 15–20 min. The sequence and wording of items were amended as a result of the pilot. The quality of response was checked by authors and an expert group comprising three

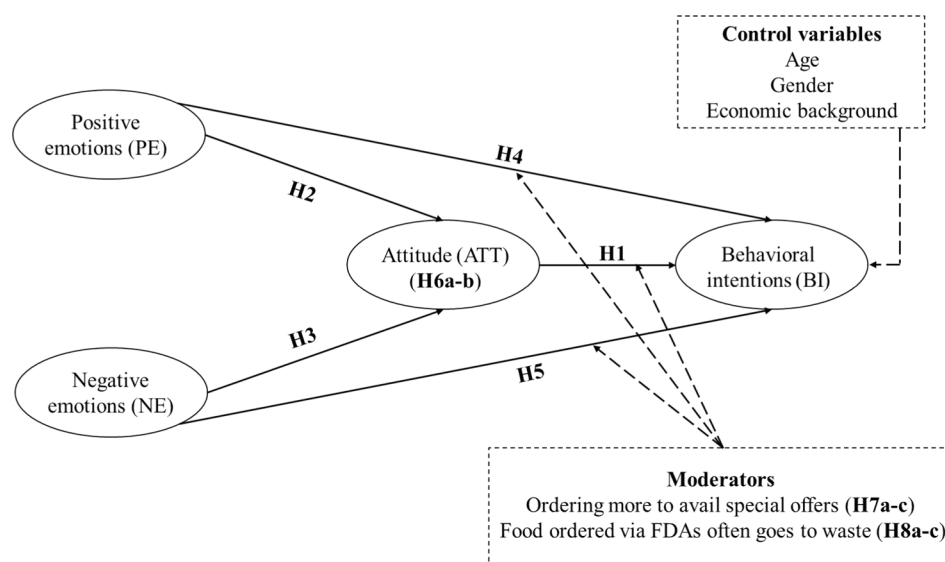


Fig. 1. Research model.

University professors and researchers, who also assessed the content validity.

Respondents for the final survey were required to meet two screening criteria: they needed to reside in India, and needed to order food via any FDA at least twice a week. The choice of India for data collection was motivated by two key reasons: (a) it ranked very high in the world for annual household food waste in 2020 (Tiseo, 2021), and (b) the online food delivery market in India is poised to expand considerably to reach a size of about 13 billion USD by 2025 (Keelery, 2022), which might further increase food waste.

Of the 600 responses, 39 incomplete ones were removed. In the remaining 561 responses, 52.9 % of the respondents were male, between 25 and 32 years in age, with a mean age of 28.34 [SD = 2.45 years]. 52.9 % of the respondents were male. 43 % of respondents were post-graduates, and 40.6 % were graduates. 52.6 % of the respondents belonged to the high-income group, and the rest belonged to middle and lower-income groups.

3.2. Data analysis

Following the recommendations of Anderson and Gerbing (1988), data were analyzed using structural equation modeling (SEM). First, confirmatory factor analysis (CFA) was conducted to evaluate the measurement model, followed by an assessment of the structural model to test the hypothesized relationships. Finally, PROCESS macro was used to analyze the proposed mediation and moderation effects.

4. Results

4.1. Data diagnosis

To begin with, kurtosis and skewness values were examined and found to be in conformance with the recommended parameters, indicating that the data followed normal distribution. To further ascertain data suitability, multicollinearity was also examined (Kock & Lynn, 2012). The two relevant values conformed to the suggested thresholds, with variance inflation factor (VIF) being less than three and tolerance being >0.1. Thus, multicollinearity was not an issue.

In addition to ascertaining that the multivariate characteristics of the data met the requirements of SEM, the data was also test against the threat of common method bias (CMB) following the suggestions of Podsakoff et al. (2003). The results of Harman's single factor test revealed that a single factor accounted for 35.14 % total variance, well below the recommend upper limit of 50 %, thereby confirming that CMB was not an issue.

4.2. Validity and reliability analysis

The measurement model reported a good fit, since all relevant indices ($\chi^2/df = 3.31$, $CFI = 0.96$, $TLI = 0.95$, $GFI = 0.95$, $AGFI = 0.92$, $RMSEA = 0.06$) conformed to the threshold recommended by Hair, Hult, Ringle, & Sarstedt (2016). Next, the validity and reliability statistics were evaluated against the recommended thresholds (Hair et al., 2016). First, factor loadings (Table 1) were checked to confirm that they were higher than the desired cut-off of 0.5. Composite reliability values for each of the constructs were then examined and found to exceed the recommended threshold of 0.70, as displayed in Table 2. Similarly, the average variance explained (AVE) scores, as seen in Table 2 exceeded 0.50, as recommended (Bagozzi & Yi, 2012). Finally, discriminant validity was confirmed, as for each construct the square root of the AVE was higher than the corresponding correlations, and the inter-correlation values were less than the indicated cut-off.

4.3. Hypothesis testing

None of the three control variables – age, gender, and economic

Table 1

Factor loadings for the measurement and structural model.

Study Measures	Measurement items	CFA	SEM
Positive emotions (PE)	PE1: I feel optimistic when I throw away food since it is natural and biodegradable	0.74	0.74
	PE2: I feel proud when I throw away food since it is natural and biodegradable	0.88	0.88
	PE3: I feel content when I throw away food since it is natural and biodegradable	0.89	0.89
	PE4: I feel relaxed when I throw away food since it is natural and biodegradable	0.82	0.82
Negative emotions (NE)	NE1: I feel frustrated when I throw away food	0.76	0.76
	NE2: I feel anxious when I throw away food	0.77	0.76
	NE3: I feel guilty when I throw away food	0.78	0.79
Attitude against food waste (ATT)	ATT1: I think wasting food waste is bad	0.76	0.76
	ATT2: I think wasting food waste is harmful	0.76	0.76
	ATT3: I think wasting food waste is unpleasant	0.75	0.75
	ATT4: I think wasting food waste is unsatisfying	0.76	0.76
Behavioral intentions to reduce food waste (BI)	BI1: I intend to reduce food waste in my home in the next week	0.65	0.64
	BI2: If I have an opportunity, I will reduce food waste in my home	0.84	0.85

Table 2

Validity and reliability analysis.

	CR	AVE	MSV	ASV	BI	NE	PE	ATT
BI	0.71	0.56	0.55	0.32	0.75			
NE	0.81	0.59	0.55	0.34	0.74	0.77		
PE	0.90	0.69	0.01	0.01	0.04	0.12	0.83	
ATT	0.84	0.58	0.46	0.29	0.64	0.68	-0.07	0.76

Note: Composite reliability = CR, Average variance extracted = AVE, Maximum shared variance = MSV, Average shared variance = ASV, Behavioral intentions to reduce food waste = BI, Positive emotions = PE, Negative emotions = NE, Attitude against food waste = ATT.

background – exerted any significant confounding influence on the dependent variable.

Coming to the structural model, results (Fig. 2 and Table 3) indicated support for the association of attitude and intentions (H1) ($\beta = 0.26$; $p < 0.001$). Similarly, a negative correlation was found between positive emotions and attitude (H2) ($\beta = -0.15$; $p < 0.001$), and a positive correlation was found between negative emotions and attitude (H3) ($\beta = 0.69$; $p < 0.001$). The association of positive emotions with intentions (H4) was not supported ($\beta = -0.01$; $p > 0.05$), but results did support a correlation between negative emotions and intentions (H5) ($\beta = 0.57$; $p < 0.001$). Hence, of the five hypotheses proposing direct associations, four were supported: H1, H2, H3, and H5. The model explained 49.2 % of the variance in attitude and 57.8 % of the variance in intentions.

4.4. Mediation analysis

The results (Tables 4 and 5) indicated that attitude had no mediation effect on positive emotions-intentions association, but it partially mediated negative emotions-intentions relationship. Thus, only H6b was supported.

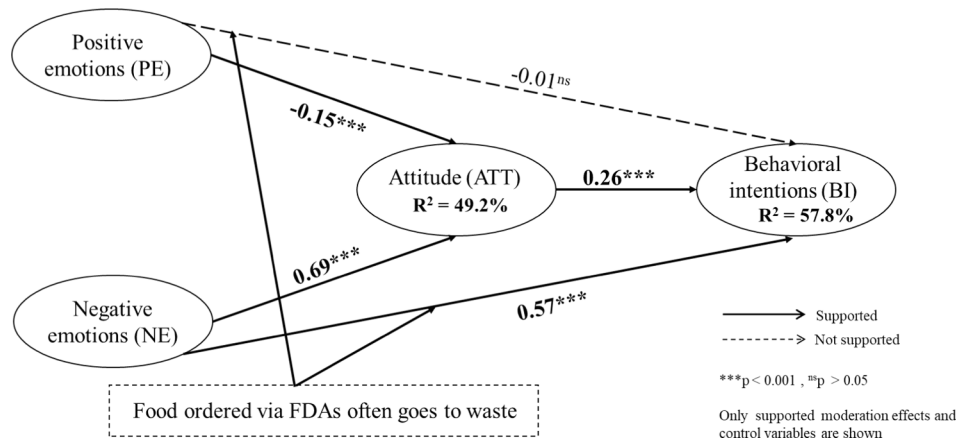


Fig. 2. Results of hypotheses testing.

Table 3
Results of hypotheses testing.

Hypothesis	Path	β	Significance	Support
H1	ATT → BI	0.26	<0.001	Yes
H2	PE → ATT	-0.15	<0.001	Yes
H3	NE → ATT	0.69	<0.001	Yes
H4	PE → BI	-0.01	>0.05	No
H5	NE → BI	0.57	<0.001	Yes

Table 4
Mediation analysis.

PE → ATT → BI						
	β	se	t	p	LLCI	ULCI
PE → ATT	-0.04	0.03	-1.28	0.20	-0.0935	0.0198
PE → BI	0.07	0.03	2.40	0.02	0.0125	0.1255
ATT → BI	0.57	0.04	13.48	0.00	0.4853	0.6509
The total effect of PE → BI	0.05	0.03	1.46	0.15	-0.0168	0.1130
NE → ATT → BI						
	β	se	t	p	LLCI	ULCI
NE → ATT	0.49	0.03	16.09	0.00	0.4296	0.5490
NE → BI	0.42	0.04	10.39	0.00	0.3432	0.5032
ATT → BI	0.29	0.05	6.17	0.00	0.1968	0.3808
The total effect of NE → BI	0.56	0.03	16.24	0.00	0.4962	0.6328

Table 5
Indirect effects between dependent and independent variable.

	Effect	se	LLCI	ULCI
PE → ATT → BI	-0.02	0.02	-0.0551	0.0124
NE → ATT → BI	0.14	0.03	0.0825	0.1988

4.5. Moderation analysis

Results revealed that *ordering more to take advantage of special offers* did not moderate the association of positive emotions, negative emotions, and attitudes with behavioral intentions to reduce food waste, thereby indicating that hypotheses H7(a-c) were not supported. In comparison, the moderation effect of the variable *belief that food ordered via FDA often goes to waste* on the association of positive ($\beta = 0.19$; $p < 0.01$) and negative ($\beta = 0.17$; $p < 0.01$) emotions with intentions was confirmed, indicating support for H8(a-b). However, it did not moderate attitude-intentions association ($\beta = 0.11$; $p > 0.05$), hence, H8(c) was not supported. These results are presented in Figs. 3a, 3b.

5. Discussion

This study addressed the identified gaps in the existing scholarly literature on food waste. Utilizing the theory of interpersonal behavior (TIB) as the conceptual foundation, the study proposed three research questions to address these gaps. To respond to RQ1, which questioned the association between emotions, attitude, and intentions, five hypotheses (H1-H5) proposing a direct association of positive and negative emotions with attitude and intentions and a direct association of attitude and intentions were tested by analyzing data collected from 561 active FDA users in India. Results confirmed statistical support for H1, H2, H3, and H5.

Support for H1 is in concordance with food waste literature in different settings (e.g., Graham-Rowe et al., 2015). This finding implies that FDA users who feel that wasting food is bad, harmful, unpleasant, and unsatisfying will have higher intentions to reduce it. Support for H2, proposing a negative positive emotions-attitude association, suggests that if FDA users think that discarding edible food leftover from a meal is not harmful to nature, they are less likely to develop an attitude against food waste. In other words, feelings of pride, contentment, relaxation, and/or optimism when throwing away unconsumed food will reduce FDA users' commitment to avoiding food waste. Although no prior study has directly investigated such a link, the result is logical and quite plausible, and is supported by Neff et al. (2015) who contended that people do not feel bad about discarding food when they compost it. Feelings of positivity associated with the disposal of leftover food may be also driven by the desire to only eat fresh food or to avoid illness that older food might cause.

Positive emotions were found to have any association with intentions, contrary to H4. One reason behind this outcome could be that FDA users who feel positively about food waste do not hold a strong enough view about food waste to contemplate their future intentions in any way. In other words, users with a relaxed view of food waste may not feel the urge to alter their intentions to reduce food waste in their homes. Another plausible explanation for such a finding could be the variation in users' feelings and perceptions, which may not have an impact on attitudes and intentions simultaneously, as also observed by past studies (e.g., Amaro & Duarte, 2015). However, nothing can be stated conclusively until the association has been examined in different settings and with a larger dataset. In comparison, both H3 and H5 were supported by the results. Statistical support for these two associations, in addition to extrapolation from prior evidence (e.g., Attiq et al., 2021; Pérez-Villarreal et al., 2019) implies that the guilt, anxiety, and frustration that the FDA users experience when they throw edible food will strengthen their attitude and intention to reduce such waste.

To respond to RQ2, hypotheses H6(a-b) proposing the mediation effect of attitude on emotions-intentions association were tested.

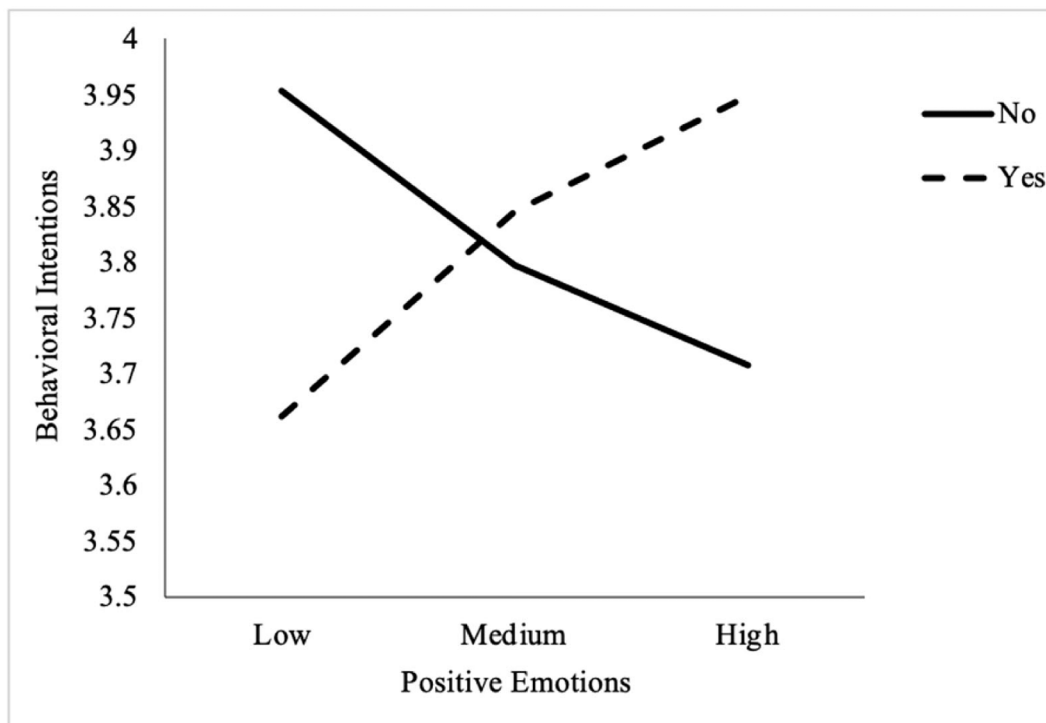


Fig. 3a. The moderation effect of belief that food ordered via the FDA often goes to waste.

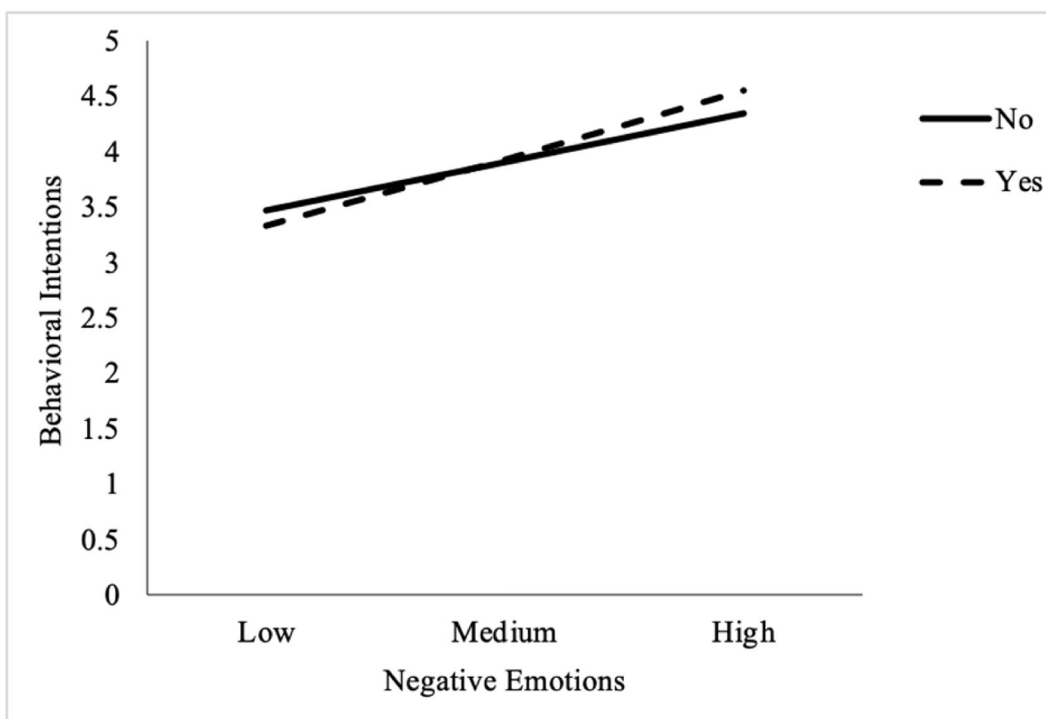


Fig. 3b. The moderation effect of belief that food ordered via the FDA often goes to waste.

Analysis confirmed the partial mediational effect of attitude on negative emotions-intentions association (**H6b**). The findings further imply link between guilt, anxiety, and frustration (representing negative emotions towards food waste), attitude, and intentions. This outcome highlights the complexity of human decision-making, which cannot be understood without consideration of intervening mechanisms. This result reinforces past findings in different contexts on the mediating potential of attitude

(e.g., [Sharma et al., 2021](#); [Tsai et al., 2016](#)). In contrast, **H6a**, proposing the mediation effect of attitude on positive emotions-intentions association was not supported. This outcome, while contrary to anticipation, is intuitively understandable when considering the non-significant association between positive emotions and intentions proposed by **H4**. The statistically insignificant results pertaining to positive emotions, both in the case of direct association with intentions and in the case of indirect

association with intentions through attitude, indicate that positive emotions towards food waste are less intense and less likely to impact future behavior. Rather, they simply affect the attitude against food waste, which captures only a momentary, immediate disposition.

Finally, to address **RQ3**, the moderation effect of the personal factor of habit (*ordering more to take advantage of special offers*) and the situational factor of facilitating conditions (*belief that food ordered via FDAs often goes to waste*) on the association of emotions and attitude with intentions was examined.

The results did not reveal any statistically significant interaction effect of *ordering more to take advantage of special offers*, thereby indicating that none of the three moderation hypotheses (**H7a-c**) were supported. This outcome implies that FDA users' habit of capitalizing on promotional deals and offers does not play any buffering role between their emotions, attitude, and intentions. A potential explanation for this result could be that the users are driven by hedonic temptations to order larger quantity of food than sufficient for consumption, with lower prices providing the necessary economic rationale for this indulgence. Such spur-of-the-moment ordering may not necessarily alter their food waste-related emotions, attitudes, and intentions. Another possibility is that users have a well-established routine of reusing leftovers and so order a larger quantity with the intention to eat a portion of it later. In this case, users would not associate over-ordering with food waste in any way, but this argument should not be accepted at face value, as in the aggregate it is accepted that ordering larger than required amount of food contributes to waste in a very real way. Thus, it is observed that empirical studies with larger and more diverse datasets are needed to better understand these dynamics. Consideration of aspects such as biological factors and neurological responses (i.e., appetite) could further improve the understanding, as could an examination of cultural context and the factors driving purchase behavior.

The results of moderation analysis confirmed support for **H8a-b**, implying that facilitating conditions offered by FDAs moderate the association of both positive and negative emotions with intentions. Support for **H8a** indicates that observing frequent wastage of food ordered through FDAs lowers the negative association of users' positive emotions with their intentions to reduce waste, such that users with strong positive emotions towards food waste will demonstrate a weaker negative association of these emotions with intentions if they observe frequent wasteful disposal of food ordered through FDAs. Support for **H8b** implies that observing frequent wastage of food ordered from FDAs increases the positive association of negative emotions with intentions to reduce waste, such that users with strong negative emotions towards food waste will demonstrate a stronger association of these emotions with intentions to reduce food waste if they observe frequent wastage of food ordered from FDAs. Thus, the same facilitating conditions that are likely to attract users with strong emotions towards food waste to order more food from FDAs appear to be instrumental in positively impacting their intentions. **H8c**, proposing the moderation effect of *belief that food ordered via FDAs often goes to waste* on the association of attitude and intentions, was not supported. One potential reason for this statistically non-significant moderation effect may be that the attitude-intentions association is well-established and withstands any moderation effect. However, we recommend that the effect of different moderators on the strength of association between these two variables be examined more comprehensively in a variety food waste settings before conclusively deciding that their association cannot be moderated by personal or situational variables.

6. Study implications

6.1. Theoretical implications

Our study offers four inferences for theory. First, it addresses the research gap in terms of the limited availability of theory-based findings in the underlying literature by utilizing TIB (Triandis, 1979). So far,

scholars in the area have predominantly used TPB for conceptualization (e.g., Talwar et al., 2022a), and the need to expand theory-based insights in the area has been emphasized by recent studies contending that eating behavior is quite complex, and conceptualizing it as a reasoned process limits understanding (e.g., Kitunen et al., 2019). In response, some recent studies have made efforts to expand the theoretical base of research in the area, but such efforts have been limited. This study therefore contributes to these efforts and to the goal of broadening the theoretical basis in this field. At the same time, by utilizing TIB in the present context, the study has also extended the theoretical applicability of TIB to a very contemporary and relevant area of sustainability.

Second, this study is among the first empirical attempts to investigate food waste-related emotions, attitudes, and intentions with FDAs as context. Due to this, the study enriches the FDA literature by contributing the food waste perspective to an area dominated by technology acceptance research (Kang & Namkung, 2019) and usage intentions (Belanche et al., 2020; Troise et al., 2020). Its contribution is enhanced by the fact that the study considers the oft-neglected role of behavioral tendencies (emotions), individual actions, values, and beliefs related to FDAs. Furthermore, the literature on the link between the benefits of FDA and the preponderance food waste is narrow. This study attempts to remedy this deficit by exploring the interplay of constructs like emotions, attitudes, and behavioral intentions towards food waste in the FDA context.

Third, the study has responded to the call for further empirical investigation of the consequences of negative emotions (Russell et al., 2017) and broadened the limited food waste literature on the emotions-intentions link. It has also addressed the dearth of research on positive and negative emotions, despite their significance in conservation behaviors (e.g., Graham-Rowe et al., 2014; Russell et al., 2017). In addition, the results indicate that positive emotions toward food waste have a more transient impact that does not extend to intentions. This finding offers novel path for future research.

Finally, the study has addressed a contextual gap by testing the model in the Eastern cultural and emerging economy context of India, thus adding to context-specific knowledge in the area. Existing scholarly literature has examined emotions, values, and beliefs in Western cultural settings and developed countries (Graham-Rowe et al., 2014; Russell et al., 2017), and so the findings of this study serve the dual purpose of offering insights related to usage and culture of digital food delivery systems while also explicating the role of emotions, attitudes, and intentions related to food waste in an emerging economy such as India.

6.2. Practical implications

The study provides three practical implications for food service managers, stakeholders, local and national organizations, and policymakers. First, the results affirm the instrumental role of emotions in shaping attitudes and intentions related to food waste at the individual level. Because emotions are often connected with personality, creativity, and mood (Trnka et al., 2016) and are considered to alter food waste behaviors (Russell et al., 2017), the study findings provide cues that can be useful for policymakers and communities to strengthen waste reduction attitude and intentions. In this regard, the findings suggest that leveraging negative emotions such as guilt can act more effectively in enhancing food waste-related attitudes and intentions. Prior studies have also found that shame as a self-conscious emotion is effective in motivating individuals to take various social actions and responsibilities (Salice & Sánchez, 2016), strengthening this suggestion.

Second, the study lays the foundation for developing possible interventions to mitigate food waste (Stangherlin & de Barcellos, 2018). The insights in this regard come from the moderation effect of a real-time decision variable, *belief that food ordered via FDAs often goes to waste*. Since the results of the moderation analysis indicate that observing frequent wastage of food ordered via FDAs reduces the negative association of users' positive emotions with their intentions

and increases the positive association of negative emotions with intentions, the study suggests that posters and other communication material for discouraging food waste should contain images of food being thrown away or piles of discarded food.

Third, the study provides insights to FDA service providers about users' food waste behavior. With corporate social responsibility and sustainability initiatives becoming buzzwords, especially with the promulgation of sustainable development goals (SDGs) in 2015 (United Nations, n.d.), understanding the food waste behavior of FDA users can help service providers make more effective and context-specific decisions to leverage their competitive advantage without tarnishing their image by being seen as promoters of food waste as a result of their business' facilitating conditions. In this regard, since the study discusses that positive emotions of FDA users are potentially driven by their desire to avoid food unsafe for consumption, FDA service providers can contribute to reducing food waste on the supply side by labeling food packs with *safe-to-consume* dates as well as specific storage instructions. The study also suggests that the food containers should be made of material that can be refrigerated and reheated as is, so that leftovers do not need to be transferred into another container. Such simple actions may increase the likelihood that FDA users store and consume their leftovers, rather than discarding them. This may allow FDA businesses to avoid having to change the promotional schemes for which they are often targeted.

7. Limitations and future avenues for research

Despite its noteworthy inferences, the study has certain limitations that must be acknowledged. First, from a methodological perspective, it was conducted using a self-report instrument in the metropolitan cities of India. Although the study sampled a large number of respondents, the specific context and geography may make it challenging to generalize the findings. To address this limitation, we suggest that future researchers undertake similar studies in neighboring economies that share similar cultures and value systems, such as Nepal, Pakistan, Bangladesh, and Sri Lanka, to test the universality of our framework and findings within the region. Furthermore, since this study focused on respondents living in developed urban areas of India, scholars may find it interesting to consider investigating a similar framework in smaller cities and towns where FDA services are available.

Second, from a theoretical perspective, this study has considered only one theory (TIB) to model behavior. This might provide limited insights into consumer behavior, which is quite complex. Past research has acknowledged that online food delivery users' behavioral intentions can be better modeled through the integration of multiple theories (Troise et al., 2021); as a result, we recommend that future researchers consider integrating other consumer behavior theories, such as behavioral reasoning theory (BRT) (Westaby, 2005), with TIB to investigate drivers of food waste in online ordering settings.

Third, from the perspective of scope, this study is limited to examining two broad types of emotions, a single attitude, a single intention, and two moderating factors. To provide deeper insights, future studies may include additional pertinent variables to expand the proposed model. For instance, the inclusion of food availability and food price as factors in the framework would result in a better understanding of societal differences, and the significance of emotions could then be made available for reference in theory and practice. Furthermore, prior literature has indicated variations in food waste in single-person households versus multi-person households (e.g., Lebersorger & Schneider, 2011), and so future researchers can investigate how food waste emotions vary in their strength and impact across different types of household. There are multiple other moderators, such as a leftover reuse routine, that can

be examined to help develop interventions for increasing awareness about food waste and how to avoid it. Future researchers can offer more robust findings by not only suggesting an intervention but also conducting an additional longitudinal study to test the efficacy of suggested interventions.

CRedit authorship contribution statement

Fauzia Jabeen: Writing – review & editing, Visualization, Validation, Formal analysis, Conceptualization. **Amandeep Dhir:** Writing – review & editing, Validation, Supervision, Conceptualization. **Nazrul Islam:** Writing – review & editing, Writing – original draft, Validation, Supervision, Conceptualization. **Shalini Talwar:** Writing – review & editing, Writing – original draft, Supervision, Conceptualization. **Armando Papa:** Writing – review & editing, Visualization, Validation, Supervision.

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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