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Young Household Intentions to Prevent Food Waste: An Application of the Theory of Planned Behavior and Health Belief Model

Muhammad Danish Habib[1] | Nadia Ashraf[1] | Festus Victor Bekun[2,3] | Anar Aliyev[4]

[1]Department of Business Administration, Air University Islamabad, Aerospace and Aviation Campus, Kamra, Pakistan | [2]Faculty of Economics Administrative and Social Sciences, Istanbul Gelisim University, Istanbul, Turkey | [3]VIZJA University Warsaw, Poland & Research Center of Development Economics, Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan | [4]Department of International Relations, Nisantasi University, İstanbul, Turkey

Correspondence: Festus Victor Bekun (fbekun@gelisim.edu.tr)

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ABSTRACT

Food waste is a contemporary global issue that obstructs the achievement of many sustainable development goals (SDGs). Despite exponential growth in research related to food waste, there is not enough evidence in developing countries to guide policymakers in creating effective strategies. This research seeks to address the existing research gaps in understanding food waste prevention behavior by utilizing well-known theoretical lenses: the theory of planned behavior (TPB) and the health belief model (HBM). The current study examines food waste prevention intentions of Pakistani households. Data was collected from 607 young households through the convenience sampling technique. The study results validated the propositions of TPB and HBM. This study contributes to the existing literature by providing empirical knowledge related to food conservation by uncovering food waste prevention behavior. The study results are useful for practitioners and policymakers.

1 | Introduction

Human society is consistently involved in various activities related to agriculture, household, and industry. These activities produce unwanted and discarded materials, called "waste" (Tweneboah-Koduah et al. 2020). The depletion of natural resources due to waste causes environmental problems and develops a sense of responsibility among suppliers and consumers to adopt sustainable practices for production and consumption to achieve sustainable development (Jaca et al. 2018; Nangia et al. 2024). Major causes of waste generation are expanding economies, new product developments, new consumption practices, consumerism, income increase, population increase, overconsumption, and poorly planned shopping (Rajendran et al. 2019). Recent studies provide a foothold to comprehend consumer waste behavior in developing and developed countries and demand further exploration to gain more insight into it (Manzoor et al. 2024).

Existing literature regarding waste management covered diverse aspects like e-waste (Yang et al. 2024), hospital waste (Jungbluth et al. 2024), textile waste (Stanescu 2021), and food waste (Ajina et al. 2024). Food waste is at the top of the agenda of global issues such as socio-economic development (Ali et al. 2019), public health (Gawish et al. 2021), environmental concerns (Wang, Huang, et al. 2021; Wang, Wang, et al. 2021), and global sustainability (Cooremans and Geuens 2019). Statistics showed a worldwide surge of 1.3 billion tons of food waste annually, causing an annual economic loss of 940 billion dollars, food insecurity for 870 million people, and the

third-largest proportion of CO_2 emissions worldwide after China and the US (González-Santana et al. 2022). Food waste is associated with several reasons such as sociocultural norms, consumer income, consumer knowledge, consumer habits, and consumer preferences (Chia et al. 2024). These issues can be addressed by practicing effective food consumption and wastage behavior (Schmitt et al. 2021), such as shopping (Dyen et al. 2021), food cooking (Boulet et al. 2021), food storage (Ananda et al. 2021) and leftover food cooking skills (Karunasena et al. 2021).

Consumer food waste significantly contributes to total food waste and food losses across the food supply chain (Dou and Toth 2021). It was found that households accounted for a significant proportion of food waste (Khalid et al. 2019). For instance, statistics showed that one-third of the global food produced is either wasted or lost. It was also found that 61% of total global food waste is from households, representing 79 kg of food per capita and year (Hermanussen and Loy 2024). Consumers and their consumption practices account for the highest share of total food waste (Di Talia et al. 2019; Kasza et al. 2019). Specifically, it was found that end consumers are a major source of total food waste (Stenmarck and Jensen 2016). Available literature identifies and examines several reasons such as subjective norms (Akhter et al. 2024), perceived behavioral control (Ting et al. 2024), environmental concerns (Bhatti et al. 2023), and consumption habits (Chia et al. 2024) as significant contributors to food waste reduction behavior.

The significance of food waste research can be seen in the growing number of publications, interest from international organizations, and several political efforts (Chia et al. 2024; Hermanussen and Loy 2024). Despite exponential growth in research related to food waste reduction (Principato et al. 2021), scholars suggest that existing research related to the determinants of food waste is yet in a nascent stage (Abu Hatab et al. 2022). Hermanussen and Loy (2024) highlighted that the existing body of knowledge and empirical evidence in the context of developing countries is insufficient to inform policymakers to devise suitable interventions and strategies for reducing food waste. The existing literature witnessed a wide range of methods and contexts related to the different stages of the value chain (Cattaneo et al. 2021). In particular, research on cognitive, emotional, and behavioral aspects of consumers' food waste behavior is under-studied and needs more focused attention (Abu Hatab et al. 2022).

The extant literature about consumer food waste offers various research gaps that need to be addressed. First, consumer behaviors are multidimensional, complex, and difficult to examine (Khan et al. 2019) accurately. Food consumption behaviors are extensively explored under the theoretical lens of the TPB (Akhter et al. 2024; Khorakian et al. 2024; Yuriev et al. 2020). TPB is based on a cognitive approach to probing consumer behavior (Ajzen 2001) and postulates that intention is a significant contributing factor in performing a behavior (Heidari et al. 2019; Mak et al. 2020). As a theoretical approach to understanding food waste, TPB has received heavy criticism (Soorani and Ahmadvand 2019). Scholars argue that the TPB is inappropriate in this context (as food waste is inherently not planned) and have proposed alternative approaches such as the motivation-ability-opportunity model (e.g., Soma et al. 2021; van Geffen et al. 2020). Though TPB is successfully utilized to explain some causes and drivers of food waste (van der Werf et al. 2021) there are some other factors such as emotions, food-related routines (Stancu et al. 2016), risk perception, and trust (Thompson et al. 2018) in explaining how food waste reduction behavior occurs. Several scholars have proposed extensions of the TPB to better capture the consumer food waste phenomenon (e.g., Graham-Rowe et al. 2015; Russell et al. 2017; Stefan et al. 2013). TPB exhibits flexibility and the predictive power can be supplemented through the inclusion of additional predictors as per research context requirements (Costa et al. 2019; Yuriev et al. 2020). Recent studies examine food waste reduction behavior by extending the TPB (Arya et al. 2024) or integrating theories with TPB such as the values-beliefs-norms model (Al Mamun et al. 2024) and health belief model (HBM) (Beressa et al. 2024). The integration of TPB with HBM is useful in explaining both behavioral intentions by TPB and positive behavior aspects through HBM (Beressa et al. 2024).

Secondly, it was found that the literature witnessed deviation in results as research studies utilized different definitions of food waste and adopted different research designs (Hermanussen and Loy 2024). Recent research studies call for further research on this topic for more clarity (Beressa et al. 2024; Chia et al. 2024; Young et al. 2024). Third, methodologically, young consumers as a subject of the study provide an interesting research avenue (Ellison et al. 2019; Mallinson et al. 2016). The analysis of literature related to young consumer food waste behavior showed mixed results. One stream of the research reported that young consumers are more involved in food waste consumption practices (Mallinson et al. 2016). This viewpoint is supported by the fact that older people are more experienced in food management, such as cooking skills, purchasing food items, and storing leftover food (Visschers et al. 2016). Additionally, the lifestyle of young consumers may also result in more food wastage, such as over-ordering (Filimonau and Sulyok 2021), variety seeking (Edwards 2021), and habit of eating (Aydin and Yildirim 2021). The other research stream found that young consumers are more familiar with waste reduction practices such as food recycling (Comber and Thieme 2013) and food waste reduction through reuse and reduction (Kim, Rundle-Thiele, et al. 2020).

The current study examines the food waste prevention intentions of young Pakistani households. This study considers the definition of the young household as the household food waste generated by young consumers (Karunasena et al. 2021). This study contributes to the existing literature by developing an integrative model based on TPB and HBM, which would provide a better understanding of household food prevention behavior (Huang et al. 2020). The current study provides empirical evidence based on the responses of households, which are acknowledged as the top contributors to food waste generation (Li et al. 2021). Further, the study focuses on young households and addresses the contradictory results about young household waste prevention intentions. From a practical point of view, the study results are useful for practitioners and policymakers as food waste is at the top of the agenda of Sustainable Development Goals 2030 (SDGs) (Chakrabarty and Das 2020). In compliance with SDGs 2030, policymakers are interested in developing new policies and targets for reducing food waste and getting researchers' attention to the drivers of the problem (Davenport

et al. 2019). A better understanding of food consumption practices and waste prevention measures is helpful for food waste management (Agbefe et al. 2019; Pellegrini et al. 2019; Singh et al. 2019).

2 | Food Waste Prevention Behavior Intentions in Household

Food waste is common in almost every practice of households, such as planning, shopping, storing, preparing, and consuming (van Geffen et al. 2020). Consumers are usually so busy with their everyday routines that they are unaware of this wastage (Quested et al. 2013). Food wastage is described by sociological and psychological research (Evans 2014); it provides the bases to understand how material, temporal, social, and cultural aspects are associated with food wastage (Moreno et al. 2020). Furthermore, food consumption and wastage are also associated with the properties of the food itself and the substantial infrastructure related to the food supply chain and storage (Waitt and Phillips 2016). Hence, choosing how much to buy, what to buy, and how the food should be treated before it reaches the consumer are important decisions related to food waste that can play a major part.

Several marketing and behavioral theoretical frameworks and models were adopted to study food waste prevention behavior, such as social practice theory (Evans 2012), the theory of interpersonal behaviors TPB (Chen 2017), and the HBM (Mou et al. 2023), self-affirmation theory (Graham-Rowe et al. 2019). Recent literature examines food waste reduction by using a number of theoretical lenses such as the theory of planned behavior (TPB) (Hermanussen and Loy 2024), value-belief-norm, social practice theory (Fraj-Andrés et al. 2023), and theory of interpersonal behavior (Ting et al. 2024). Food waste at the household level contributed to a significant proportion of total food waste (Davenport et al. 2019; Giordano et al. 2019). To date, several studies examine household food waste using cross-sectional, observational, and intervention approaches (Wharton et al. 2021). Most research examines attitudes and behavior toward food waste (Stangherlin and de Barcellos 2018). These behaviors can be attributed to general behavior, such as household food waste (Boulet et al. 2021), or specific aspects, such as reducing, reusing, and recycling.

The food-related behaviors are well-studied; still, scholars call for further research for the development of the theoretical framework to further enhance the understanding of food-related behaviors (Adaryani et al. 2025; Wani et al. 2025; Widayat et al. 2025). TPB is a widely used theoretical lens to examine food-related behaviors (Akhter et al. 2024; Ong et al. 2025; Ting et al. 2024); however, the explanatory power of TPB is debatable and explains the interdisciplinary and multifaceted scope of food-related behaviors such as food waste prevention behavior (Heidari et al. 2020). It was found that TPB primarily anchored the cognitive approach and underrepresented the emotion-related factors, particularly in the context of food waste reduction (Filimonau et al. 2020). Some research studies rely on the extended model of TPB and include some other variables such as marketing addiction (Heidari et al. 2019), guilt and shopping routine (Soorani and Ahmadvand 2019), perceived governmental control (Lin and Guan 2021), personal norms, planning habit, and self-identity (van der Werf et al. 2020). While other scholars employed some other theoretical approaches, such as social practice theory (Blichfeldt et al. 2015), value-belief-norm (Farr-Wharton et al. 2014), and motivation-ability-opportunity model (e.g., Soma et al. 2021; van Geffen et al. 2020). Furthermore, integrative models such as the theory of interpersonal behavior (TIB), the comprehensive model of environmental psychology (CMEP), and TPB, and the norm activation model (Obuobi et al. 2022) were combined to assess food waste related behaviors.

3 | Theoretical Background and Hypotheses Development

3.1 | Research Model

The research model was developed by combining the TPB (Mak et al. 2020) and HBM (Beressa et al. 2024). The TPB began as the Theory of Reasoned Action in 1980 to examine a consumer's perception of practice at a particular time and spot (Ajzen 2001). Food waste behavior as the last step of the household food provisioning process is widely explored under TPB. The TPB postulated that behavioral intentions are the antecedents of food waste prevention behavior. Furthermore, cognitive aspects precede behavioral intentions toward food waste (Ajzen 2001). However, recent studies deliberate on the explanatory power of the TPB and warranted the extension of TPB (Adaryani et al. 2025; Ong et al. 2025) or integration of theoretical lenses with TPB (Abu Hatab et al. 2022; Heidari et al. 2020). The HBM is a widely used theoretical lens in explaining health beliefs on prevention behavior (Huang et al. 2020). HBM proposes that consumer perceptions about self-efficacy, threats, and expected outcomes predict consumer behaviors (Yoon and Kim 2016). HBM has been applied to examine sustainable behaviors such as risk prevention behavior (Huang et al. 2020), environmental empathy (Kim and Cooke 2020), intentions toward organic food (Yazdanpanah et al. 2015), green advertising (Yoon and Kim 2016), reusing intentions (Alhamad and Donyai 2021), recycling and consumption prevention (Tchetchik et al. 2021).

3.2 | Integrating TPB and HBM

The TPB and HBM are derived from the expectancy-value framework and postulate that decision-making is a rational process (Gerend and Shepherd 2012). The integration of TPB with HBM is useful in explaining both behavioral intentions by TPB and positive behavior aspects through HBM (Beressa et al. 2024). TPB is solely based on the cognitive approach and ignores the affective and emotion-related factors, particularly in the context of food waste reduction (Filimonau et al. 2020). However, the HBM stresses the significance of perceived benefits (PB) and perceived threats on prevention behavior (Huang et al. 2020). The integration of both theories helps to specify and model the constructs to examine the prevention behaviors (Huang et al. 2020) such as food waste prevention behavior. It was found that combining TPB and HBM enhances

the psychometric properties to explain the behavioral determinants of intentions toward prevention behavior (Gabriel et al. 2019). Huang et al. (2020) claimed TPB and HBM are complementary in some aspects and found that health beliefs are determinants of attitude. This study integrated TPB and HBM to better understand the food waste prevention behavior of young households.

3.3 | Hypotheses Development

TPB successfully predicted food waste reduction behaviors (Mak et al. 2020; Oehman et al. 2022). The theory proposes three determinants: subjective norm, perceived behavioral control, and attitude to explain behavioral intentions such as food waste prevention intentions (Akhter et al. 2024; Shin et al. 2018). Literature showed that subjective norms, perceived behavioral control, and attitude significantly explain food waste-related behaviors (Chen 2017; Soorani and Ahmadvand 2019). However, health beliefs are relatively ignored in the context of household food waste reduction. Health beliefs are regarded as the single most important driver for waste management. HBM, under the behavioral change model, can be used to model the relationship between consumer perceptions about health-related beliefs and behavioral intentions such as waste reduction behavior (Sandhu 2014). HBM utilized two main categories of behavioral beliefs: perceived expectation and threat (Wang, Huang, et al. 2021; Wang, Wang, et al. 2021). Perceived expectations refer to the positive outcomes achieved through sustainable behavior as it pertains to the effectiveness subject to the ratio of PB and perceived barriers (Kim and Cooke 2020). Perceived threat is individual perceptions about severity and susceptibility (Sulat et al. 2018). Perceived threat is the subjective appraisal of negative consequences such as food wastage to the environment, society, and environment (Beressa et al. 2024; Talwar et al. 2021). Perceived susceptibility (PSU) is people's perception of the risk or the chances of encountering health problems, and perceived severity (PSE) is individual seriousness in judging that problem's medical and social consequences (Abercromby et al. 2020). HBM can be utilized in examining pro-environmental behaviors (Yoon and Kim 2016), such as food waste prevention behaviors. The operational definitions of study variables are presented in Table 1.

The consumers' efforts in the form of time, energy, capabilities, equipment, and money put into the prevention of food waste can be regarded as a cost. The efforts may result in social status, knowledge, and health, which can also be considered as a cost (Özel and Kozak 2017). It was found that perceived cost (PC) is significantly associated with behavioral intentions (de Souza Meira and Hancer 2021; Wang, Huang, et al. 2021; Wang, Wang, et al. 2021). For instance, waste reduction behaviors like energy saving, gas emissions, and food waste reduction behaviors encourage consumers to prevent food waste (von Kameke and Fischer 2018). Moreover, fulfillment for social status, knowledge, and health encourages consumers to prevent food waste (Özel and Kozak 2017). Thus, it can be postulated that:

H1a. *PC is positively related to attitude toward waste prevention.*

H2a. *PC is positively related to behavioral intentions toward waste prevention.*

Similarly, perceived value (PV) induces waste prevention attitude and behavioral intentions and increases waste reduction behavior (Hou and Sarigöllü 2021). When Consumer perceives the high value of sustainable practices such as food waste reduction, they are more inclined toward a waste prevention attitude and intentions (Kim, Hall, and Kim 2020). Furthermore, consumers may perceive more value in avoiding discarding useable food (do Carmo Stangherlin et al. 2020). Thus it can be proposed that:

H1b. *PV is positively related to attitude toward waste prevention.*

H2b. *PV is positively related to behavioral intentions toward waste prevention.*

In line with HBM, it can be argued that individual health-related beliefs such as PB, perceived risk, and perceived

TABLE 1 | Definitions of study measures.

Study measure	Definition	References
Waste prevention behavior intentions	The likelihood of reducing food waste.	Adel et al. (2022)
Attitude toward waste prevention	An evaluation of performing a food waste reduction behavior.	Luu (2020) and Ng et al. (2021)
Perceived cost	The sum of money, equipment, capabilities, and energy in practicing food waste prevention behavior.	Özel and Kozak (2017)
Perceived value	The perception of the merits and desirability of food waste prevention behavior.	Hou and Sarigöllü (2021)
Perceived benefits	The environmental, financial, and health benefits due to food waste prevention behavior.	Clark et al. (2003)
Perceived susceptibility	The potential impact associated with food waste.	Yang et al. (2022)
Perceived severity	The damage caused due to food waste.	Liao et al. (2019)

threats are significantly associated with prevention behaviors (Beressa et al. 2024; Huang et al. 2020). It is evident from research studies that more favorable perceptions about environmental, financial, and health benefits are more inclined toward pro-environmental behavior (Clark et al. 2003). The favorable perceptions about benefits gained from pro-environmental behavior will encourage the adoption of eco-friendly behavior, such as waste prevention (Steg and Vlek 2009). Similarly, research studies also establish that perceived risk is significantly associated with behavioral intentions (Thompson et al. 2018). The perceptions associated with the damage caused due to food wastage encourage consumers to practice food prevention practices (Liao et al. 2019). Research studies found that perceptions about threats are associated with behavioral intentions toward environmental problems (Ottman et al. 2006). It was also found that perceived threat significantly correlates with behavioral change (Witte and Allen 2000). Following the above argument, it can be postulated that perceptions of benefits and perceived threats (susceptibility and severity) are predictors of food waste prevention behavioral intentions. Thus it can be proposed that:

H1c. *PB is positively related to attitude toward waste prevention.*

H1d. *PSU is positively related to attitude toward waste prevention.*

H1e. *PSE is positively related to attitude toward waste prevention.*

H2c. *PB is positively related to behavioral intentions toward waste prevention.*

H2d. *PSU is positively related to behavioral intentions toward waste prevention.*

H2e. *PSE is positively related to behavioral intentions toward waste prevention.*

Attitude has been examined as a fundamental aspect of environmental behaviors (Akhter et al. 2024; Yuriev et al. 2020). Many studies found attitude as a significant predictor of pro-environmental behavior (Mak et al. 2020), such as food waste reduction behavior. Attitude is an evaluation of performing a specific behavior. TPB postulated attitude as a construct leading to behavioral intentions (Ajzen 2001). Some research studies found attitude as a significant mediator between consumer perceptions and behavioral intentions (Luu 2020; Ng et al. 2021). Thus, based on the cited literature, it can be proposed that:

H3. *Attitude toward waste prevention is positively related to behavioral intentions toward waste prevention.*

H4. *Attitude toward waste prevention mediates between PC and behavioral intentions toward waste prevention.*

H5. *Attitude toward waste prevention mediates between PV and behavioral intentions toward waste prevention.*

H6. *Attitude toward waste prevention mediates between PB and behavioral intentions toward waste prevention.*

H7. *Attitude toward waste prevention mediates between perceived susceptibility and behavioral intentions toward waste prevention.*

H8. *Attitude toward waste prevention mediates between perceived severity and behavioral intentions toward waste prevention.*

4 | Methods

The type of the study is explanatory as the research aimed to develop a causal relationship between key determinants (PC, PV, PB, perceived risk, perceived threat) and attitude toward waste prevention and waste prevention behavioral intentions. The nature of the study is a quantitative and theoretical model, and hypotheses were tested using empirical data. Kindly see Figure 1 for details on study methodological schematic.

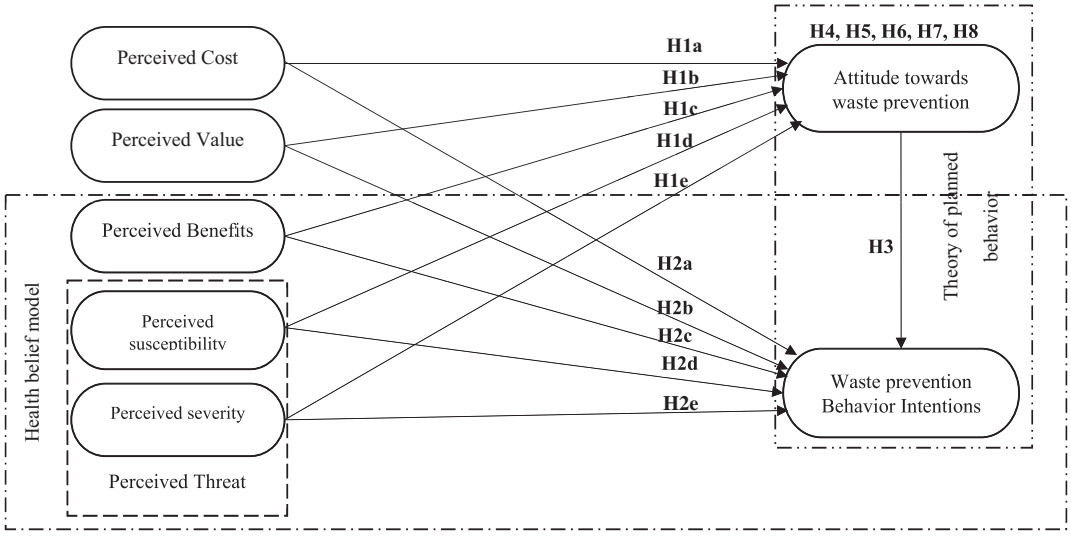

FIGURE 1 | Research framework.

4.1 | Data Collection

A questionnaire was developed by adapting a scale from the existing literature to collect data from the respondents. A total of 607 responses were collected through an online survey using Google Forms. A convenience sampling strategy was utilized to gather data from young households. In this study, young households represent the households comprising young consumers (Karunasena et al. 2021). Studies considered the convenience sampling technique appropriate for examining consumer behavior (Al Falah et al. 2024; Jamshed and Uluyol 2024; Mehnaz et al. 2024), specifically in food-related behaviors (Chen and Chao 2025; Ishra et al. 2025; Xu et al. 2024). The convenience sampling techniques offered the benefits of cost-effectiveness, time efficiency, accessibility, outreach, anonymity, and privacy (Sgroi et al. 2024). However, there are some limitations of convenience sampling, such as sampling bias and self-reported responses (Sgroi et al. 2024), that should be considered while interpreting the results for generalizability. It was ensured to recruit a representative sample while collecting data through an online survey. The sampling bias was addressed by selecting a well-aligned breakup of the sample with the demographic composition of the target population for better representativeness of the sample across regional and demographic segments. Screening questions were used to select a representative sample that closely matched the target population. The eligibility of being a representative/qualified sample is established by asking screening questions such as household, Pakistani, and age. To address the issue of self-reported responses, respondents were encouraged to voluntarily participate by providing a brief about the anonymity and confidentiality of their responses. The issue of social desirability bias is addressed through a questionnaire structure in which items are randomized to restrict the participants from relating them to specific categories (Li et al. 2020). This procedure helps in gathering responses from interested and serious respondents (Khan, Ahmed, & Najmi 2019) and recruiting a representative sample.

4.2 | Measurement Scale

An online questionnaire was developed by adapting measurement scales from existing literature. PC was estimated utilizing a four-item scale (e.g., I am willing to participate in food waste prevention practices if it does not require too much time) adopted from Ma et al. (2020). PV was estimated through a four-item scale (e.g., I believe that food waste prevention practices are vital to saving the planet) adopted from Kim, Hall, and Kim (2020). PB were estimated utilizing a four-item scale (e.g., If I prevent food waste, it will strengthen the economy of the country) adopted from Tajeri moghadam et al. (2020). A three-item scale (e.g., I think due to food wastage, we will have a shortage of food soon) adopted from Tajeri moghadam et al. (2020) was utilized to measure PSU. The PSE was estimated with a four-item scale (e.g., If food wastage continues the same way, we will soon experience a food war) adopted from M. Wang, Huang, et al. (2021), Wang, Wang, et al. (2021) and Tajeri moghadam et al. (2020). Attitude toward food prevention (ATT) was estimated through a four-item scale (e.g., Food waste prevention is an affirmative behavior) adopted from Kim, Hall, and Kim (2020). Behavioral intentions toward food prevention (BI) were estimated through a four-item scale (e.g., I intended to prevent food waste at home) adopted from Kim, Hall, and Kim (2020).

4.3 | Study Sample

Prior literature suggests mixed results related to younger consumers, as some studies found that young consumers are more involved in food wastage (Stapleton and Cole 2018). In comparison, other studies found that young customers are more careful about food waste (Zepeda and Balaine 2017) and are more worried about food waste decrease (Comber and Thieme 2013). Accordingly, considering young households as the subject of study would offer more interesting results. Young households are recruited for this study. Young households are considered more appropriate for this study for many reasons, as demographically, young households represent around half (51.25%) of the total population (Pakistan Bureau of Statistics 2018). The study of young consumers is more interesting and fruitful for practitioners and policymakers as they may serve as change agents in the coming decades (Kim et al. 2013). These young consumers are more aware and have basic knowledge about food waste and associated concepts, which yields more accurate responses (Ghinea and Ghiuta 2019). Therefore, examining the young household's intentions toward food waste reduction behavior is significant. The respondent profile is presented in Table 2.

The sample size, which consisted of 607 responses, was considered reasonable. For sample size selection, different criteria were considered for sample size sufficiency. For structural equation modeling, a 300 sample size is enough (Yi et al. 2025), or a minimum of five responses for each item (Wolf et al. 2013) or a sample size of 100 to examine 10 different structural paths (Wahab et al. 2022) or a sample of 10 times greater than the independent variables in the model (Laato et al. 2020). According to Kline (2017) sample size of 200 is adequate to perform structural equation modeling. Considering a larger sample size is preferable as it helps overcome sampling errors and enhances validity. Furthermore, a sample size greater than 200 respondents leads to less standard error (Hox et al. 2017). We surpassed the suggested criteria and used a sample size of 607, as it is recommended that a larger sample is helpful to overcome sampling errors (Yi et al. 2025).

4.4 | Method of Data Analysis

The data were performed by using covariance-based structural equation modeling CB-SEM alongside Hayes' PROCESS to test the mediation with the help of AMOS 24 and IBM SPSS 24. CB-SEM was considered a suitable data analysis for two reasons. First, CB-SEM allows the estimation of measurement and structural models simultaneously. The second data met the requirements of sample size, normality, multicollinearity, and common method bias (Talwar et al. 2020).

5 | Data Analysis

Before data analysis, missing values, outliers, and normality tests were performed for the data set. The data set was clean of

TABLE 2 | Profile of respondents.

Demographic	Category	Frequency	Percentage (%)
Gender	Male	326	54
	Female	281	46
Age	Less than 25	261	43
	26–30	185	31
	31 and above	161	26
Education	Matric/Intermediate	110	18
	Bachelor	212	35
	Masters	169	28
	Above Masters	116	19
Monthly income	≤100,000	138	23
	100,001–150,000	121	20
	150,001–200,000	98	16
	Above 200,000	250	41

Note: $N = 607$.

TABLE 3 | Descriptive statistics.

	Min	Max	Mean	SD	Skewness		Kurtosis	
PC	1.00	5.00	3.48	1.07	−0.83	0.10	−0.44	0.20
PV	1.00	5.00	3.25	1.02	−0.46	0.10	−0.78	0.20
PB	1.00	5.00	2.83	0.96	0.17	0.10	−0.78	0.20
PSU	1.00	5.00	3.15	1.04	−0.36	0.10	−0.78	0.20
PSE	1.00	5.00	3.40	1.08	−0.56	0.10	−0.71	0.20
ATT	1.00	5.00	3.29	1.04	−0.55	0.10	−0.72	0.20
BINT	1.00	5.00	3.25	1.01	−0.43	0.10	−0.66	0.20

outliers and missing values. Furthermore, skewness and kurtosis were used to check the shape of the data for normality. The skewness and kurtosis values met the criteria of ±3, demonstrating the data's normality. The results of descriptive statistics are presented in Table 3.

5.1 | Multicolinearity Analysis

The measure variance inflation factor (VIF) is utilized to examine the multicollinearity of the data. The result of the multicollinearity analysis (Table 4) revealed that the data has no problem with multicollinearity as all the values of VIF are lesser than the suggested range of 4 by O'brien (2007).

TABLE 4 | Multicollinearity analysis.

	Collinearity statistics	
Constructs	**Tolerance**	**VIF**
PC	0.306	3.264
PV	0.324	3.082
PB	0.465	2.150
PSU	0.320	3.129
PSE	0.367	2.724
ATT	0.349	2.865

Note: Dependent variable: BI.
Abbreviations: ATT, attitude toward waste prevention; BI, waste prevention behavioral intentions; PB, perceived benefits; PC, perceived cost; PSE, perceived severity; PSU, perceived susceptibility; PV, perceived value.

5.2 | Measurement Model

The estimates of the measurement model are shown in Tables 5 and 6. The measurement model is estimated to assess confirmatory factor analysis by examining factor loads, composite reliability, and validity of data. The results of model fit indices are in support of good fit as $\chi^2/df = 2.49$; GFI = 0.94; AGFI = 0.91; NFI = 0.93; CFI = 0.96; RMSEA = 0.052. The results also

TABLE 5 | Results of the measurement model.

Constructs	Items	FL	A	CR	AVE
Perceived cost	PC1	0.651	0.874	0.846	0.580
	PC2	0.786			
	PC3	0.794			
	PC4	0.804			
Perceived value	PV1	0.754	0.878	0.854	0.595
	PV2	0.810			
	PV3	0.805			
	PV4	0.711			
Perceived benefits	PB1	0.710	0.786	0.821	0.535
	PB2	0.706			
	PB3	0.718			
	PB4	0.788			
Perceived susceptibility	PSU1	0.787	0.874	0.811	0.589
	PSU2	0.767			
	PSU3	0.747			
Perceived severity	PSE1	0.776	0.896	0.848	0.583
	PSE2	0.818			
	PSE3	0.778			
	PSE4	0.674			
Attitude	ATT1	0.793	0.890	0.835	0.561
	ATT2	0.769			
	ATT3	0.796			
	ATT4	0.624			
Behavioral intention	BI1	0.545	0.857	0.785	0.500
	BI2	0.703			
	BI3	0.765			
	BI4	0.739			

Note: χ^2/df = 2.49; GFI = 0.94; AGFI = 0.91; NFI = 0.93; CFI = 0.96; RMSEA = 0.052.

support the reliability and convergent validity of data as Cronbach's alpha > 0.70, composite reliability > 0.7, and AVE > 0.5 (Hair et al. 2013).

5.3 | Fornell–Larcker Discriminant Validity

Fornell–Larcker discriminant validity test was performed to establish the discriminant validity of the variables (Fornell and Larcker 1981). Results (see Table 5) support the discriminant validity of study variables (Hair et al. 2014). Subsequently, Table 6 provides details on the Fornell–Larcker discriminant validity analysis.

5.4 | Results of Hypotheses Testing

The structural model was estimated to analyze the research hypothesis (H1a–H2e). Results obtained from the structural model are presented in Table 7. The results of model fit indices are in support of good fit as χ^2/df = 2.57; GFI = 0.91; AGFI = 0.889; NFI = 0.90; CFI = 0.95; RMSEA = 0.067. The results illustrate that PC showed a significant and positive impact on attitude toward waste prevention ($\beta = 0.412$, $p < 0.01$), which supported H1a. PV has a significant and positive impact on attitude toward waste prevention ($\beta = 0.406$, $p < 0.01$), supporting H1b. The PB have a significant and positive effect on attitude toward waste prevention (ATT) ($\beta = 0.172$, $p < 0.01$) in favor of H1c. H1d is confirmed as a perceived subspecialty (PSU) positively and significantly impacts the attitude toward waste prevention ($\beta = 0.181$, $p < 0.01$). H1e is also accepted as a PSE and showed a positive and significant relationship with attitude toward waste prevention ($\beta = 0.321$, $p < 0.01$). Furthermore, the results revealed that PC has a positive and significant effect on waste prevention behavioral intentions (BI) ($\beta = 0.308$, $p < 0.01$), which confirmed H2a. For PV and waste prevention behavioral intentions ($\beta = 0.333$, $p < 0.05$), the results revealed a positive and significant effect and confirmed H2b. The results also supported H2c as PB are proven to be a significant and positive predictor of waste prevention behavioral intentions ($\beta = 0.251$, $p < 0.01$). Perceived subspecialty has a positive and significant effect on waste prevention behavioral intentions ($\beta = 0.194$, $p < 0.01$), thus supporting H2d. The PSE is found to be a significantly positive predictor of waste prevention behavioral intentions ($\beta = 0.187$,

TABLE 6 | Fornell–Larcker discriminant validity.

	CR	AVE	MSV	MaxR (H)	PC	PV	PB	PR	PT	ATT	BI
PC	0.846	0.580	0.304	0.855	**(0.761)**						
PV	0.854	0.595	0.335	0.859	0.067	**(0.771)**					
PB	0.821	0.535	0.320	0.825	0.476	0.527	**(0.731)**				
PSU	0.811	0.589	0.335	0.812	0.517	0.579	0.369	**(0.767)**			
PSE	0.848	0.583	0.230	0.855	0.343	0.411	0.464	0.411	**0.763**		
ATT	0.835	0.561	0.320	0.846	0.551	0.534	0.566	0.424	0.428	**(0.749)**	
BI	0.785	0.500	0.298	0.801	0.423	0.465	0.530	0.546	0.480	0.349	**(0.693)**

Note: The bold values in parentheses are the square root value of AVE of given variables.
Abbreviations: AVE, average variance extracted; MSV, maximum shared variance.

$p < 0.05$), supporting H2e. Furthermore, results also confirmed H3 as attitude toward waste prevention (ATT) is proven to have a significant and positive effect on behavioral intentions for waste prevention ($\beta = 0.54$, $p < 0.01$). The results showed that the variance explained (R^2) by the structural model was 34% for attitude toward food waste prevention and 48% for waste prevention behavioral intentions.

5.5 | Mediating Analysis

In this study, mediation analysis is performed using PROCESS Model 4 with a bootstrapping technique that enhances the analysis's statistical power (Preacher and Hayes 2004). The bootstrapping technique is now widely used in marketing after establishing stronger grounds in the psychology research paradigm. The bootstrapping technique allows researchers to examine and control the stability of the data by providing simplicity in its application. This study repeats the bootstrapping technique 5000 times. Results were analyzed on the recommended criteria that total effect (c), direct effect (a), and indirect effect (b) should be significant, and a confidence interval (CI) of 95% for the indirect effect does not include zero (Preacher and Hayes 2004; Shrout and Bolger 2002). The results are shown in Table 8. Results support H4–H8.

TABLE 7 | Results of hypotheses testing.

Hypotheses	Estimate	*p*	Supported
H1a: PC → ATT	0.412	***	Yes
H1b: PV → ATT	0.406	***	Yes
H1c: PB → ATT	0.172	***	Yes
H1d: PSU → ATT	0.181	***	Yes
H1e: PSE → ATT	0.321	***	Yes
H2a: PC → BI	0.308	**	Yes
H2b: PV → BI	0.333	**	Yes
H2c: PB → BI	0.251	***	Yes
H2d: PSU → BI	0.194	**	Yes
H2e: PSE → BI	0.187	**	Yes
H3: ATT → BI	0.540	***	Yes

Note: $\chi^2/df = 2.57$; GFI = 0.91; AGFI = 0.89; NFI = 0.90; CFI = 0.95; RMSEA = 0.067. ***$p < 0.01$, **$p < 0.05$.

6 | Discussion

This research examined the theoretical mechanism of food waste prevention intentions by using TPB and HBM and provided empirical results based on the responses of young households. The study findings suggest a significant and positive association between consumer perceptions (cost, value, benefits, and threat) and attitudes toward waste prevention behavior. The study results favor the proposition that consumer perception about the cost of damage caused due to food waste encourages customers to prevent food waste (Beressa et al. 2024; Khorakian et al. 2024).

The study results align with the existing research findings (Graham-Rowe et al. 2015; van der Werf et al. 2020). These findings suggested that young households believe that the coming generations must pay for significant food waste. The findings also support a significant association between PC and behavioral intentions toward food waste prevention. The favorable perceptions about cost trigger more positive behavioral responses toward sustainable behaviors such as food prevention. This showed that favorable perceptions such as less money, time, and waste prevention efforts encourage households to practice such behaviors. In line with the TPB, the PV is significantly associated with food waste prevention behavior (Kochan et al. 2016). This depicts that when consumers have favorable perceptions about the value related to food reduction, it encourages consumers toward food waste prevention practices. Recognizing the value associated with food waste, such as climate change, hunger, and wastage of natural resources, stimulates consumers to adopt sustainable practices such as food waste reduction practices. When consumers give more value to the hazardous effects of waste, they get more involved in effective planning of purchasing and cooking food items, reducing food consumption, and recycling leftover food to prevent food waste.

The study results support a significant association between PB and attitude to prevent food waste. The study findings are in line with Schanes and Stagl (2019) and Dixon et al. (2019). Consumer perceptions about the benefits gained by practicing waste reduction practices motivate the consumer to consider sustainable practices actively (Yuriev et al. 2020). The more

TABLE 8 | Mediation effects of attitudes toward waste prevention behavior.

PATH	Total effect	Direct effect	Indirect effect	95% CI	
				lower level	Upper level
PC → ATT → BI	0.589**	0.712***	0.549***	0.327	0.458
PV → ATT → BI	0.624***	0.744***	0.530***	0.322	0.466
PB → ATT → BI	0.612***	0.667***	0.555***	0.312	0.435
PSU → ATT → BI	0.602***	0.694***	0.534***	0.307	0.439
PSE → ATT → BI	0.540***	0.594***	0.681***	0.343	0.480

Note: ***$p < 0.01$, **$p < 0.05$.

favorable perceptions about benefits gained may enforce them to prevent their food wastage and mitigate the adverse effects of food wastage. The results also support a significant and positive association between perceived benefits and threat, which derives food waste prevention behavior. The study's finding validates the existing research results of DiPietro et al. (2013) and Filimonau et al. (2020). Consumers with favorable perceptions about benefits and threats associated with food waste influence food waste prevention attitudes and behavior. The recognition of benefits and threats due to food wastage restricts consumers from performing food waste practices. The results also favor the significant mediating effect of attitude between consumer perception and waste prevention behavioral intentions.

6.1 | Study Implications

The research findings offer several theoretical contributions. The current research adds to the existing body of knowledge by developing an integrative model combining the TPB and HBM, which offers deeper insights into household food prevention behaviors (Beressa et al. 2024; Khorakian et al. 2024). The integration of TPB and HBM enhances the psychometric properties to explain behavioral determinants of intentions and overcome the explanatory power of TPB (Gabriel et al. 2019). The research model was tested on the data collected from young households representing household food waste generated by young consumers. The study results address the contradictory results about young household waste prevention intentions (Li et al. 2021).

From a practical point of view, the study results are useful for practitioners and policymakers as food waste is at the top of the agenda of Sustainable Development Goals 2030 (SDGs). In compliance with SDG 2-Zero Hunger, study results are useful for policymakers in developing new policies to combat hunger and targets for reducing food waste. Study results showed that it is important to highlight the long-term burden caused by food waste on future generations to motivate consumers for food waste reduction. Practitioners should focus on promoting food waste reduction in relation to broader societal values, like reducing hunger and resisting climate change to increase consumer engagement. Study results also supported that highlighting the benefits, both personal and collective, of reducing food waste, such as conserving resources and saving money, can encourage more households to adopt food waste reduction behaviors. Study results also reveal that practitioners should raise awareness about the social, health, and environmental risks associated with food waste to make consumers more mindful of their consumption practices. Finally, fostering positive attitudes through education on the rewards of reducing food waste—both personally and for the planet—can shift consumer intentions toward more sustainable food practices.

7 | Conclusion

This study examines food waste prevention behavior among young household consumers. The research model was based on TPB and HBM and tested with 607 household consumers. The study results offer multiple theoretical and practical implications. The key theoretical implication of the study is to develop an integrative model based on TPB and HBM to enhance the psychometric properties to explain the behavioral determinants of intentions toward prevention behavior. Second, considering young consumers as a subject of study addresses one of the methodological gaps in the prior food waste reduction literature. Third, study results contribute to one of the agenda items (i.e., food security) of SDGs (Chakrabarty and Das 2020) and help design an action plan. The results showed a need to develop consumers' positive perceptions to motivate them to act sustainably and reduce waste. Practitioners should include the benefits and costs of food waste behaviors in advertising and educational programs to develop positive perceptions about food waste prevention. Recognizing the costs and benefits associated with unnecessary food waste develops a strong perception of wrongness and encourages consumers to adopt sustainable behaviors. Furthermore, awareness of threats and benefits associated with wasteful practices may encourage consumers to adopt more sustainable practices and reduce their wasteful acts to save others from danger through individual behavior.

7.1 | Limitations and Future Recommendations

The study has some notable limitations. The current study collected data from a convenience sampling technique; however, it was ensured that the right chunk of the population (sample size) was determined, which reflects the representative sample. The study results are based on self-reported measures, and behavioral intentions are measured rather than actual behavior, which may cause social desirability bias. The study results may require careful interpretation, as self-reported responses may affect the quality and generalizability of results in other contexts (Schmidt 2016). Additionally, the data was collected from young households only. Study findings come with certain cautions related to the generalizability to other age groups and cultures. This limitation invites research scholars to consider other age and cultural groups to warrant the generalizability of results to other cultures and age groups. To better understand food waste prevention behavior, actual behavior may provide better results. Thus, we recommend examining actual waste prevention behaviors. Future research may also extend its scope by examining other variables related to emotions, norms, motivation, or protection to increase the explanatory power of the research model.

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Ethics Statement

Authors mentioned in the manuscript have agreed for authorship read and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.

Consent

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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