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Exploring food waste prevention through advent food consumption: The role of perceived concern, consumer value, and impulse buying

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Every year, about one-third of food intended for human consumption is wasted along the distribution chain, in which advent food contributes a significant portion. Advent food marketing and consumption are suggested as the primary channel to use advent food and reduce food waste. With the booming of the advent food market, it is necessary to explore factors attributed to advent food purchase and food waste reduction behaviors. This study explored what consumer concern and value might influence food waste reduction intention in the context of advent food consumption. Based on a survey of Chinese consumers (N = 509), this study develops a structural equation and tests the hypotheses with consistent Smart-pls software. Results show that, as expected, health concerns, utilitarian value, and impulse buying significantly affect food waste reduction intention. Price concern, utilitarian value, and hedonic value exert direct positive effects on impulse buying, which negatively influence food waste reduction intention. In the mediating effect analysis, impulse buying partially mediates the relationship between price concern and food waste reduction intention. Theoretical and managerial implications and recommendations for future research are discussed.

KEYWORDS

consumer value, impulse buying, food waste reduction, consumer concern, advent food

Introduction

Food loss and food waste are severe phenomena worldwide. Food loss refers to a decrease in the food supply chain, while food waste always happens at the consumption and distribution stage (Hou and Sarigöllü, 2021). Scholars defined food waste as food produced originally for human consumption but not consumed by humans in the end (Thyberg and Tonjes, 2015). Food waste estimates varied vastly in different areas. It ranged from 72 to 541 kg per capita annually across EU countries (Vanham et al., 2015). In China, food wasted in households reaches 14.36 million tons annually, which can fulfill the needs of 350 million people (Zhang and Xu, 2022). Therefore, food waste reduction

can also be regarded as an effective way to leverage the increased worldwide food security. Food waste also substantially impacts the environment and resources, leading to air pollution, land waste, water, and other resources used in producing food. Therefore, more and more governments, organizations, and individuals should pay attention to, advocate, and take measures to encourage food waste reduction behaviors.

Food waste is generated alongside the food supply chain, among which private households are the most significant contributors (Stancu et al., 2016). Previous studies indicate that purchasing planning, cooking, price, and other conditional factors contribute to the generation of household food waste (Diaz-Ruiz et al., 2018). In the markets, food products are always divided into two types, "optimal" and "suboptimal" products, and suboptimal food is regarded as one of the major driving factors of food waste (Melbye et al., 2017). Suboptimal food refers to food below the supermarket standard, which is still edible but does not have an optimal consumer perception (Hooge et al., 2017). Suboptimal food is characterized by its appearance, package status, or shelf-life (Hooge et al., 2017). In literature, suboptimal food characterized as near the expiration date is also called advent food (Hooge et al., 2017; Aschemann-Witzel, 2018). Unlike the other two types of suboptimal food, advent food is perceived as lower quality and has higher health and safety risks (Hooge et al., 2017; Melbye et al., 2017; Jaeger et al., 2018). These perceptions will trigger negative consequences for consumers' attitudes and purchase behavior (Melbye et al., 2017), resulting in more food wasted. Therefore, more and more concerned organizations should pay attention to the redistribution of advent food to reduce food waste and food insecurity.

In 2021, China government issued the "Anti-Food-Waste Law," levying the liabilities of food waste prevention on the government, food producers, food distributors, organizations, educators, and consumers. According to this law, supermarkets, shopping malls, and other food distributors are required to take measures to reduce food waste. In article 12, food retailers and supermarkets are required to set special management requirements on advent food, such as using a special label, displaying it on specified shelves, and selling it on discounts (National People's Congress, 2021). These requirements conform to regulations popular in other developed countries (Huang et al., 2020; Heng and House, 2022). The advent food, or food near the shelf-life, is characterized as short shelf-life, low price, and low freshness (Sun, 2015). Developed countries encourage the circulation of advent food through government regulation and market allocation *via* price discounts or donations. With the rapid economic development, China's food supply has changed from short supply to oversupply, and the food consumption demand has changed from focusing on quantity to considering quality and nutrition simultaneously. The increase of food supply and the upgrading of residents' food consumption demand have led to a severe backlog of food inventory, resulting in a large quantity of advent food. However, the market sales of advent food in China are not optimistic.

On the one hand, consumers' cognitive level of advent food is limited, and their purchase intention is not firm, resulting in a large backlog of advent food. On the other hand, driven by profit, some food enterprises have made some safety events for advent food, such as using advent or expired moon cake fillings to produce new mooncakes in *Nanjing Guanshengyuan Company* and manipulating the date label by *Zhou Heiya, Wuhan*. All these events increase individuals' food safety risk perception and prevent them from buying advent food, resulting in more unsold and wasted food. Therefore, analyzing the determinants influencing consumers' advent food purchase intention is particularly important to improve the circulation efficiency of China's advent food market, realize long-term food security, and develop the food industry sustainably.

Prior studies on food waste mainly focused on three topics: quantification measurements (Vanham et al., 2015; Giordano et al., 2019; Flanagan and Priyadarshini, 2021; Heng and House, 2022); effects of food waste on environment and resources usage; and motivations and policies encouraging food waste reduction behaviors (Diaz-Ruiz et al., 2018; Song et al., 2021). As for advent food, studies focused more on pricing (Aschemann-Witzel, 2018; Giordano et al., 2019; Song et al., 2021), promotion (Aschemann-Witzel, 2018; Jaeger et al., 2018), date label (Samotyja and Sielicka-Rózyńska, 2021), and consumer personal characteristics (Hooge et al., 2017). However, these studies are conducted mainly in off-line circumstances and have fewer considerations of consumer psychologies and values toward advent food and online shopping. In recent years, more and more platforms and retailers have been providing advent food in online stores, such as advent food retailers on platforms like Taobao, JingDong, and Suning Tesco, and e-commerce platforms like Haoshiqi and Linqibao that specializing in advent food selling. The online business will not only increase the availability and diversities of the advent food, but also affect consumers' purchase intention through the online shopping environment, such as utilitarian and hedonic characteristics of e-commerce. Moreover, with the development of economy, people will pay more attention to health and environment protection. Besides price, consumers will take their concern for environment and health in their food purchase and food waste reduction decisions. Therefore, this article seeks to add the attitude stream of food waste reduction literature by exploring consumer concern and consumer value dimensions and their relationship with food waste reduction intention.

This study is structured into four sections. After the introduction in section Introduction, section Literature review and hypotheses development deals with the literature review and hypotheses development. Section Methodology puts forward methods and hypotheses testing. Sections Results and Discussion put forward the results and discussion.

Section Conclusions, implications, and limitations provides the conclusion, managerial and theoretical implications, and limitations.

Literature review and hypotheses development

Numerous studies have explored factors triggering food waste reduction behavior through the lens of behavioral, psychological, and conditional angels. It is also indicated that low prices, great promotion, and product scarcity tend to trigger over-purchase. However, these studies were conducted in the context of regular food purchase and consumption, and less study explores its impacts on advent food consumption. Hence, this study takes advent food as the target market and aims to explore the direct effects of consumer concern and consumer value on their food waste reduction intention, as well as the mediating effect of impulse buying between the consumer concern, consumer value, and food reduction intention. This study contributes to the current study in two points. Firstly, the research hopes to extend the consumer concern, consumer value, and the relevant theoretical framework of food reduction intention to advent food. Secondly, this study tends to better understand the relationship between consumer concern, consumer value, impulse buying, and food waste reduction intention, and the mediating effect of impulse buying between the antecedents and food waste reduction intention will be explored. Figure 1 summarizes the conceptual framework for this study.

This study intends to add to this literature stream by looking at attitudinal drivers for food waste reduction intention in the context of advent food consumption that has received little attention thus far. Advent food is the food served at the end of the supply chain, and the food near the expiry date and beyond shelf-life are the main sources of food waste in the consumption stage (Giordano et al., 2019; Samotyja and Sielicka-Różyńska, 2021). Although more and more governments, retailers, and organizations redistribute the nearly expired date food supply chain through sale, donation, and sharing, consumers' advent food consumption behavioral decisions are also influenced by their personal awareness of health, economy, as well as their perceived impacts of food waste (Hooge et al., 2017; Mehner et al., 2020). Therefore, we attempt to explore the impact of consumer concern and perceived values, and their interplay with impulsive buying of NEF on food waste reduction behavior (Marangon et al., 2016).

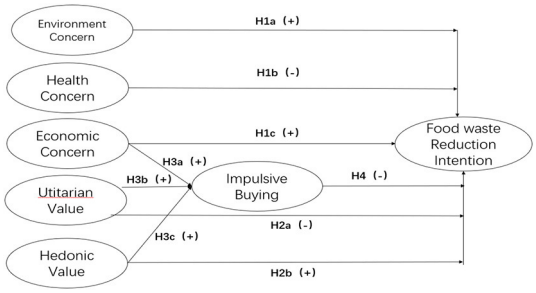

FIGURE 1
Conceptual framework.

Consumer concerns and food waste reduction intention

In the context of food waste generation, consumers' behavioral decisions are influenced by their personal awareness and concerns, as well as the environmental and social consequences of food waste (Vanham et al., 2015; Hooge et al., 2017; Mehner et al., 2020). Across studies, the most important factors that influence consumers' food waste behaviors are their environmental concern, health concern, and economic concern (Marangon et al., 2016).

Environmental concern and food waste reduction intention

It has been widely recognized that food waste may affect the environment by emitting pollutants into the air, invalid use of fertilizers, and the overuse of fresh water, land, and energy (Hall et al., 2009). Earlier studies show that consumers' attitudes toward and awareness of environmental protection are closely related to their intentions to and behaviors in food waste minimization (Visschers et al., 2016). Hence, provoking consumers' environmental awareness and enhancing their pro-environmental attitudes are vital channels for consumers' food waste reduction behaviors (Schmidt, 2016; Melbye et al., 2017). Here, the purchase and consumption of the advent food can be regarded as a pro-environmental behavior because it fulfills its original function of human consumption and avoids becoming animal feed or food waste. Therefore, we propose that the more the consumers care about environmental problems, the higher the food waste reduction intention they hold. Hence we developed hypothesis H1a as:

H1a: Environmental concern is positively related to food waste reduction intention.

Health concerns and food waste reduction intention

Ensuring food safety and keeping healthy is always the basic and the most important affair in consumers'

daily food behavior to tackle obesity and other diet-related health problems related to food consumption (Von Kameke and Fischer, 2018). Sometimes, consumers should balance decreasing food safety risks and reducing food waste (Meah and Watson, 2013). For most consumers, the former always has priority over the latter because they do not want their health hurt (Lahath et al., 2021). In practice, people have different ways to judge whether the food is edible or safe through smell, visual judging, tasting, and checking date labels (Parizeau et al., 2015). Among these measures, people prefer to check the date label before purchasing, cooking, eating, and distributing the food because food manufacturers and distributors must comply with concerned laws and regulations. In the context of advent food, the conflicts between consumption and health risk are more prominent because nearly expired food features decreased appearance and taste and increased health-related risks (Parizeau et al., 2015). When consumers make an advent food purchase decision, the remaining shelf-life period is used to judge health risks.

Moreover, consumers' health risk perception increases as the remaining shelf-life decreases (Newsome et al., 2014). Therefore, consumers with higher health risk reception are less willing to pay for the advent food, leaving the advent food unsold and becoming food waste (Tsiros and Heilman, 2005). Therefore, we proposed hypothesis H1b as:

H1b: Health concern is negatively related to food waste reduction intention.

Price concern and food waste reduction intention

Food price plays an essential role in food consumption and waste reduction. Price-conscious consumers were claimed to waste less food (Williams et al., 2012). In practice, companies always use price discrimination tactics such as rate fences to charge different prices for identical products sold to different customers. In the case of advent food marketing, expiration date-based pricing is a particular form of price discrimination in which the expiration date is used as the rate fence (Hooge et al., 2017). The date-based pricing provides a price-quality trade-off mechanism to consumers, indicating the suboptimal features of the nearly expired food (Tsiros and Heilman, 2005; Hooge et al., 2017). Then consumers with high sensitivity to commodity price would accept the discounted price for degraded perishables and suboptimal food (Song et al., 2021), which may lead to purchase behavior and decreased food waste. Therefore, we developed the following hypothesis H1c as:

H1c: Price concern is positively related to food waste reduction intention.

Perceived values and food waste reduction intention

Perceived value is consumers' evaluations of a product/service (Yang et al., 2021). They are critical factors in consumers' purchasing behavior (Chiu et al., 2014). Previous studies have identified multi-dimensions of perceived values, such as social, functional, emotional, epistemic, cognitive, and conditional (Sheth et al., 1991). In the context of marketing and e-commerce, perceived utilitarian value (PUV) and perceived hedonic value (PHV) are the most studied ones.

Utilitarian value and food waste reduction intention

Utilitarian value is an instrumental or functional value used to meet consumers' basic needs (Hou and Sarigöllü, 2021). It mainly concerns the function and benefits-cost trade-off in buying a product/service. Higher perceived utilitarian value means the higher perceived quality of the product/service to be more practical, helpful, and reliable (Jackson and Xu, 2022), leading to higher purchase intention (Jackson and Xu, 2022). Research on green product and organic food purchase indicate that nutrition-, health- and safety-related attributes are sensed as functional attributes of the food, which lead to a favorite utilitarian attitude and higher purchasing intention toward organic food (Lee and Yun, 2015). When the food is approaching the expiration date, consumers' perception of the food nutrition and food safety decrease, leading to higher food safety risk perception and lower purchase intention (Tsiros and Heilman, 2005; Newsome et al., 2014). In this study, although the advent food is still dietary, the perceived nutrition and function decrease, and the perceived safety risks increase as the remaining shelf-life decreases. All these perceptions decrease consumers' perceived utilitarian value and purchase intention and let the advent food become food waste. Therefore, we developed the following hypothesis:

H2a: Perceived utilitarian value is positively related to food waste reduction behavior.

Hedonic value and food waste reduction behavior

Hedonic value refers to consumers' emotional gratification or sensory experiences toward a particular product/service. Hedonic value can bring the consumers feelings of pleasure, fashion, and surprise (Overby and Lee, 2006). Besides fulfilling their shopping tasks, hedonic consumers also seek a sense of fantasy and fun during the shopping experience (Jackson and Xu, 2022). In online shopping, consumers always meet with entertainment-purpose and out-of-routine experiences that

differ from in-store shopping, which may trigger their hedonic affection and further lead to purchase behaviors (Overby and Lee, 2006; Chiu et al., 2014). In the context of advent food purchasing, when consumers browse the online advent food information in platforms and APPs, they find a large amount of advent food with great price-reduction, domestic and foreign brands, which is scarce in their experiences in off-line shopping. This phenomenon generates excellent shock and surprise, triggers hedonic values, increases food purchases, and minimizes food waste. Therefore, we develop the hypothesis as follows:

H2b: Perceived hedonic value has a positive effect on food waste reduction behavior.

Economic concern, customer values, and impulse buying

Price concern and impulsive buying

While shopping, most consumers pay more attention to price and price comparison, especially people with limited budgets. During online shopping, consumers are more sensitive to price because they can conduct price comparisons conveniently with almost no cost (Huang et al., 2020). When consumers find the price unusually low and attractive, they are likely to buy impulsively (Park et al., 2012; Lahath et al., 2021). In marketing and promotions, retailers always give more discounts for bulk packages or provide special offers (e.g., Buy One, Get One Free), which induce price-sensitive consumers to buy large quantities of products that exceed their consumption needs. In the case of advent food purchases, previous studies indicate that price and date label are the main driving factors of impulse buying (Aschemann-Witzel, 2018; Samotyja and Sielicka-Rózyńska, 2021). With the decreasing shelf-life decreasing, the price decreases sharply, which triggers impulsive buying. Therefore, we propose a hypothesis as follows:

H3a: Price concern has a positive effect on impulse buying.

Utilitarian value and impulse buying

While shopping, consumers' shopping experience and value perception are not only influenced by the product but also by the shopping environment. This is extinct in online shopping, where consumers' purchase decisions and behaviors are greatly affected by the enhanced online transaction efficiency and the smooth functioning of the website (Shen and Khalifa, 2012). The online sellers provide detailed and visualized descriptions of the product and provide functions such as price comparison, comments reviews, and free-return services, which increase consumers' utilitarian values. These measurements make the online transaction process efficient and smooth, trigger the consumers to browse more, and improve the likelihood of impulse purchasing (Park et al., 2012; Gulfraz et al., 2022). Therefore, we posit that consumers tend to buy impulsively when they perceive utilitarian value in online advent food shopping and hence proposed the following hypothesis:

H3b: Perceived utilitarian value has a positive effect on impulse buying.

Hedonic value and impulsive buying

During online shopping, consumers pursue fun, recreation, and even surprises (Holbrook and Batra, 1987), and these perceived hedonic values are regarded as an important antecedent of impulse buying behavior (Parsad et al., 2021). The critical goals of hedonic values, such as the realization of fantasies and a sense of fun, are more critical than buying itself (Holbrook and Batra, 1987; Arnold and Reynolds, 2003). Arnold and Reynolds (2003) have classified hedonic values into six dimensions: adventure, gratification, role, value, social, and idea shopping. Later studies explored the impacts of these dimensions on impulsive buying intention and behavior in different product markets and countries (Lee and Yun, 2015; Parsad et al., 2021). Dimensions of adventure, gratification, value, and idea shopping are the positive motivations in clothing markets, while entertainment, interest, and excitement may be important and effective aspects of hedonic values in fashion markets (Park et al., 2012). All these studies indicate that hedonic values have a positive influence on impulse buying intention and behavior. Therefore, we posit that consumers tend to buy impulsively when they perceive hedonic values in online advent food shopping and proposed the following hypothesis:

H3c: Perceived hedonic value has a positive effect on impulsive buying.

Impulse buying and food waste reduction intention

Previous studies indicate that marketing stimuli can trigger consumers' impulse buying behaviors (Zhao et al., 2021). In marketing promotion, techniques like price discounts and special offers (e.g., Buy one, Get One Free) are used to encourage consumption. The more the discount and special offers provided, the higher the probability that consumers tend to buy impulsively. These promotion measures, together with great price deduction, may induce and encourage consumers to buy too much (Bond et al., 2013; Priefer et al., 2016). Excessive purchase, which exceeds the real need, may eventually contribute to food waste. That is, impulse purchases lead to excessive shopping, which results in subsequent wastage (Welch et al., 2021). In case of online advent food purchases, the discount of the advent food increases with the decrease of the remaining period of the shelf-life. Besides a great price deduction, most advent food is sold in large packages and/or

favorite special offers. Since the remaining shelf-life of advent food is short, consumers find it hard to eat up all the over-purchased food within limited shelf-life, which would further produce much more food waste. Therefore, we posited the following hypothesis:

H4: Impulse buying has a negative effect on food waste reduction intention.

Previous research indicates that impulse buying can be triggered by marketing stimuli and consumer values, and it will eventually contribute to subsequent food wastage (Lahath et al., 2021). Due to the significant price reduction and purchase conveniences provided in the online advent food market, impulse buying occurs more. Being restricted with short shelf life and the time spent in delivering, advent food bought impulsively is prone to be unconsumed and wasted. Based on the above analysis, we propose the following hypotheses:

H5a/5b/5c: Impulse buying mediates the relationship between price concern/ utilitarian value/ hedonic value and food waste reduction intention.

Methodology

Data collection

We employed a questionnaire survey to collect data and analyze the proposed hypotheses. The target research setting was China, where the advent food market size amounted to 40.1 billion RMB (equivalent to 6.30 billion US dollars) in 2021. We used a snowball survey in *Wenjuanxing,* one of China's most popular survey platforms, to collect data. We first conducted a pilot survey with randomly selected 20 consumers and asked them for comments on the questionnaire. Then we adapted the questionnaire accordingly. The formal survey was conducted from April to June 2020 through the *Wenjuanxing*. We first developed the formal questionnaire in Wenjuanxing, then transferred the link and the QR code (Quick Response code) of the questionnaire through popular social media in China, such as *QQ*, *QQ group*, *Wechat*, *Wechat moments*, and *Post bar*. We asked the receivers to forward the questionnaire to their colleagues, friends, and relatives to expand the coverage and get more attendants. We assured anonymity and provided random *WeChat Red Packet Money* as incentives to the respondents. We received 821 responses, and then we checked the data and excluded those with missing values on the main items and those with identical answers to four successive items (because most of the constructs were measured by four items). We got a useable sample of 509, with an overall net response rate of 62%.

Respondents in this study are more well-educated, with 27% having a bachelor's degree and above. Among the respondents, 43.3% are men and 47.8% are aged between 20 and 35. About 31.2% of the respondents have a household monthly income between RMB 5,000 and 9,000 ($724 and 1,412 equivalently). These data conform to the demographic profile of current advent buyers described in the report "Development of advent food industry and case study of the benchmarking enterprises (2021-2022)",[1] issued by *iiMedia*, a famous advisory organization in China.

Measurement instruments and analysis

Since this study aimed to explore online shoppers' purchase intention of advent food, we set the question by asking "Have you ever purchased products online?" at the beginning of the questionnaire. Then we only included the participants who answered "Yes" to this question as the valid sample. We used established measurement scales adapted from previous studies to fit this research context (Table 1) to ensure the validity of the measurement instruments. We intentionally adapt the items to fit the context of online advent food consumption. A 7-Likert scale was used, with one denoting strongly disagree and seven denoting strongly agree. All the constructs are designed as reflective constructs. We first draw the questionnaire in English by 2 Chinese scholars majoring in environmental management and marketing, respectively. After checking the English version, we asked 2 Chinese teachers majoring in English to translate the English questionnaire into Chinese. Then the four scholars together back-translated the Chinese version into English and carefully compared the first English version and the back-translated one to ensure quality, logic, and clarity (Behling and Law, 2000). We conducted a pilot study and asked the participants to answer the Chinese version and give us feedback information. Then we used the feedback to modify the questionnaire accordingly.

First, we conducted an exploratory factor analysis (EFA) to test the factorial structure of the items in the questionnaire. Measures for the constructs were adapted from existing scales from previous research (Michaelidou and Hassan, 2008; Katt and Meixner, 2020), with the wordings of scale items slightly modified to fit the context of online advent food sales (Table 1). We further conducted the statistical analysis using the software SPSS and Smart-pls 3.0. The environment concern construct was assessed with the three items measuring consumers' evaluation of status, perceived effects, and individuals' responsibilities to environmental problems (Katt and Meixner, 2020). The price concern construct was measured by four items measuring consumers' attention on food sales, promotion, and price comparison (Gil and Soler, 2006). The Health concern construct was estimated with three items measuring consumers' concern for the status of, change in, and responsibility for /her health (Michaelidou and Hassan, 2008). The constructs of

1 Advent Food Market Analysis 2020–2021. Issued by *iiMedia*. Available on: https://baijiahao.baidu.com/s?id=1727963219425737239&wfr=spider&for=pc (accessed March 3rd, 2022).

TABLE 1 Measurement of constructs.

Construct	Indicator	Item
Price_concern	PC1	I try to buy food items that are on sale in online shops.
	PC2	I pay attention to sales promotions when purchasing online.
	PC3	I compare food prices from different brands when purchasing online.
	PC4	I compare food prices with different delayed shelf life when purchasing online.
Health_concern	HC1	I care about my health a lot.
	HC2	I'm alert to changes in my health.
	HC3	I take responsibility for the state of my health.
Impulse_buying	IB1	I often buy food beyond my specific shopping goal in online shopping.
	IB2	I always buy too much food than I need or can eat when purchase online.
	IB3	I buy food according to how I feel at that moment in online shopping.
	IB4	"Buy now, think about it later" describes my food shopping behavior.
Utilitarian_value	UV1	Advent food is less nutritional (reverse coding).
	UV2	Using platforms would make it easier for me to engage in online transactions
	UV3	Price comparison function provided by the platform is useful.
	UV4	The platform can help me to buy better items in price or quality.
Hedonic_value	HV1	I go shopping to keep up with the new fashions.
	HV2	While shopping, I want to see what new products are available.
	HV3	While shopping, I feel a sense of adventure.
Environment_ concern	EC1	I think environmental problems are serious these days.
	EC2	I do not think that environmental problems will affect my life personally.
	EC3	I think we have the responsibility to protect the environment.
Food waste reduction intention	FWRI1	I always try to eat all purchased foods.
	FWRI2	I always try to reduce less food waste.
	FWRI3	I always try to use all leftovers.
	FWRI4	I try to keep food waste to be a minimum

consumers' hedonic construct and utilitarian value construct were estimated with three and four items, respectively. They measured the nutrition, the facilitation, and the function that the platform provides for the consumers, as well as the ease of use, comparison functions, novelty, and excitement functions (Arnold and Reynolds, 2003; Park et al., 2012; Nghia et al., 2021). The mediator impulse buying construct was measured by over-purchase and unplanned purchase behaviors (Chen, 2019; Zheng et al., 2019). The dependent construct food waste reduction intention was measured by four items measuring consumers' food waste concerning behaviors of food eating, waste reduction, and leftover treatment (Visschers et al., 2016; Chen, 2019).

Data analysis and results

We used SPSS 23.0 and Smart-pls 3.0 to analyze the data. Since the data were collected through a single source, a common method of bias (CMB) might threaten the effectiveness of the study. Here we used two statistical methods, i.e., Harman's one-factor test and the full collinearity test, to analyze the CMB. The results of Harman's one-factor test show that all the items were divided into seven components, accounting for 73.39 % of the variance. Of the seven constructs, the first one explains 15.55% of the variance, conforming to the benchmark of 30%. In the full collinearity test, the VIF values ranged between 0.56 and 2.87 below the benchmark of 3.3. Therefore, we can conclude that the CMB is not serious in this study and the data is fit for further analysis.

Results

Measurement model testing

As the model fit is always a controversial issue in PLS-SEM (Sarstedt et al., 2022), following Dijkstra and Hensler's (2014), we conducted the Consistent-PLS program to test the hypotheses. We first tested the consistent construct liability and validity. Construct liability is used to measure the consistency of the indicators using Cronbach's alpha and composite reliability. We dropped four items (IB1, PC2, HC3, and HV2) because the loading values of these four constructs are below 0.7. Then we conducted the consistent-PLS again to test the liability and validity. As shown in Table 2, Cronbach's alpha values were between 0.78 and 0.93, all above the valid threshold of 0.7 (Amaro and Duarte, 2015). Moreover, the composite reliability values were from 0.78 to 0.93, higher than the suggested benchmark of 0.6 (Bagozzi and Yi, 1988). Therefore, a good level of reliability is confirmed.

Then we assessed the convergent and discriminant validity to measure how these constructs related to each other by using the factors' outer loadings and the average variance extracted (AVE). Results showed that the AVE values ranged between 0.54 and 0.76, all above the threshold value of 0.5. We used the Fornell–Larcker criterion and the heterotrait–monotrait ratio (HTMT) to assess the discriminant validity. As shown in Table 3,

TABLE 2 Result of convergent validity.

Construct	Item	Factor loading	Cronbach's Alpha	rho_A	Composite Reliability	AVE
Impulse_buying	IB2	0.73	0.86	0.88	0.86	0.61
	IB3	0.85				
	IB4	0.82				
Price_concern	PC1	0.86	0.86	0.87	0.86	0.76
	PC3	0.85				
	PC4	0.93				
Environment_concern	EC1	0.76	0.81	0.83	0.82	0.60
	EC2	0.70				
	EC3	0.87				
Health_concern	HC1	0.83	0.81	0.81	0.81	0.68
	HC2	0.82				
Hedonic_value	HV1	0.90	0.78	0.78	0.78	0.54
	HV3	0.80				
Utilitarian_value	UV1	0.86	0.91	0.91	0.91	0.72
	UV2	0.84				
	UV3	0.92				
	UV4	0.76				
Food waste reduction intention	FWRI1	0.85	0.93	0.93	0.93	0.76
	FWRI2	0.89				
	FWRI3	0.86				
	FWRI4	0.89				

TABLE 3 Results of discriminant validity heterotrait–monotrait ratio.

Constructs	IB	EC	EV	HC	HV	UV	FWRI
IB	***0.8043***						
EC	0.5618/.5613	***0.8786***					
EV	0.6123/.6039	0.8224/.6152	***0.7735***				
HC	0.4198/.416	0.4662/.4661	0.445/.4413	***0.8248***			
HV	0.4287/.4272	0.6728/.6726	0.7025/.7159	0.4432/.4413	***0.8506***		
UV	0.5342/.5269	0.7182/.7182	0.6465/.6466	0.5722/.5718	0.8421/.834	***0.8474***	
FWRI	0.5867/.5833	0.6948/.6953	0.6922/.6914	0.5263/.5266	0.6194/.6183	0.7222/.7208	***0.8710***

IB, Impulse_buying; EC, Price_concern; EV, Environment_concern; HC, Health_concern; HV, Hedonic_value; UV, Utilitarian_value; FWRI, Food waste reduction intention.
Figures in bold and italic are square roots of AVE; figures on the left are the HTMT values, and figures in the right are the correlation values of two constructs.

the results of the Fornell–Larcker criterion analysis indicate that the square roots of AVEs of each construct are all higher than their correlation values, ensuring the discriminant validity. Moreover, all the HTMT values were below the threshold of 0.85. Therefore, we can conclude that all the constructs had good reliability and validity.

Structural model testing

Direct hypotheses testing

Results of the direct hypotheses are presented in Table 4. Firstly, concerning the effects of consumer concern on food waste reduction intention, we can find that the path coefficient from environment concern ($b = 0.177$, $t = 1.64$) over food waste reduction intention is not significant. Thus, H1a is not supported. Moreover, we have observed a direct and significant effect from construct health concern ($b = -0.1008$, $t = 2.356$) and price concern ($b = 0.8129$, $t = 10.4228$) toward food waste reduction intention; thus, hypotheses H1b and H1c are supported. Secondly, concerning the effects of consumer values on food waste reduction intention, the results indicate that the path coefficient from utilitarian value ($b = -0.1466$, $t = 1.4649$) and hedonic value ($b = 0.0217$, $t = 0.2337$) does not influence food waste reduction intention. Therefore, H2a and H2b are both rejected. Thirdly, concerning the decedents of impulsive

TABLE 4 Path coefficients of the structural model.

Description	Std. beta	*t*-value	Decision
H1a: Env-concern -> food waste reduction intention	0.1771	1.644	Rejected
H1b: Health-concern -> food waste reduction intention	−0.1008	2.356*	Supported
H1c: Price-concern -> food waste reduction intention	0.8129	10.423***	Supported
H2a: Util-val -> food waste reduction intention	−0.1466	1.465	Rejected
H2b: Hedonic-val -> food waste reduction intention	0.0217	0.234	Rejected
H3a: Price-concern -> Imp-buy	0.4009	5.764***	Supported
H3b: Util-val -> Imp-buy	0.3543	3.211**	Supported
H3c: Hedonic-val -> Imp-buy	−0.1392	1.269	Rejected
H4: Imp-buy -> food waste reduction intention	−0.1253	2.391*	Supported

***$p < 0.001$, **$p < 0.005$, *$p < 0.01$.

buying, the results indicate that price concern ($b = 0.4009$, $t = 5.7636$) and utilitarian value ($b = 0.3543$, $t = 3.2106$) affect food reduction intention positively and significantly, supporting H3a and H3b. However, the coefficient of the hedonic value ($b = -0.1392$, $t = 1.269$) is negative and insignificant, indicating that H3c is rejected. Lastly, impulsive buying ($b = -0.125$, $t = 2.391$) negatively influences food waste reduction intention. Thus, H4 is supported.

Test of mediating effect

Consumer concern and consumer value affect food waste reduction intention indirectly, and impulse buying has a mediating effect. According to the principle proposed, the mediation effect analysis was conducted by using a consistent PLS bootstrapping procedure. The coefficients, *t*-values, and the bootstrap bias-corrected confidence intervals are demonstrated in Table 5. The results show that the confidence interval of H5a lies between −0.1002 and −0.0096 and is significant at 0.05%, supporting H5a. This indicates that impulse buying only partially mediates the relationship between price concern and food waste reduction intention. However, the confidence intervals for H5b and H5c straddle in between zero, indicating insignificant effects.

Predictive power and model fit

The results of the structural model exhibited good, acceptable fit indices (SRMR = 0.041, $\chi^2 = 781.613$, NFI = 0.911). Then we used two methods to measure the predictive power of the model. First, we used coefficients of determination

TABLE 5 Results of mediation analysis.

Description	Std. Beta	T_value	Decision
H5a: Price-concern -> Impulse buying-> Food waste reduction intention	−0.051	2.246*	Supported
H5b: Utilitarian value -> Impulse buying -> Food waste reduction intention	0.017	1.0424	Rejected
H5c: Hedonic value -> Impulse buying ->Food waste reduction intention	0.0444	1.8179	Rejected

*$p < 0.01$.

TABLE 6 Partial least squares predict (PLS-predict).

Item	PLS	LM	PLS-LM	Q^2 _predict
IB2	1.2892	1.273	0.0162	0.2275
IB3	1.2553	1.2378	0.0175	0.2251
IB4	1.2466	1.2331	0.0135	0.1664
FWRI1	0.9686	0.9518	0.0168	0.5393
FWRI2	0.911	0.9006	0.0104	0.5771
FWRI3	0.9471	0.9237	0.0234	0.5203
FWRI4	0.9225	0.9174	0.0051	0.5875

(R^2) to measure the model's predictive power. The adjusted R^2 falls between 0 and 1. The higher the value, the higher the predictive accuracy level (Hair et al., 2021). The adjusted R^2 for impulse buying and food waste reduction intention were 0.348 and 0.803, respectively, explaining 34.8 and 80.3% of the variance, respectively. Second, we followed Shmueli et al. (2019) and further employed the PLS-predict method to check the predictive relevance of the proposed model. We conducted a sample-based PLS-predict with a 10-fold procedure and then compared the item differences between the linear regression (LM) and the difference (PLS-LM). In these analyses, the rule of thumb includes: (1) if all the item differences are more minor than the item value in LM, then there is a strong predictive power, and vice versa for no predictive power; (2) if the majority (minority) of the item differences is lower than the item values in LM, then there is a moderate (low) predictive power. As shown in Table 6, all the item differences (PLS-LM) were lower than the item value in LM, indicating a strong predictive power of this model. Therefore, the above analyses indicate that this study achieved high predictive power and good model fit.

Discussion

Consumer concern and value substantially affect food reduction intention, especially in the household food

consumption criteria. However, the extant literature still lacks studies to uncover how these concerns and values influence consumers' food waste reduction intention in the context of advent food consumption. This study aimed to explore the precedents of consumers' food waste reduction intention and the mediation effect of impulse buying between the precedents and food waste reduction behaviors.

Consumer concerns and food reduction intention

The first set of hypotheses were based on the direct effects of the consumer's concerns food waste reduction intention. The data supported the hypothesized effect of health concerns on food waste reduction intention. The result highlights that consumers who care more for their health will hold lower food waste reduction intentions, which conforms to previous studies (Visschers et al., 2016). Previous studies found that consumers with higher health consciousness may waste more perishable food to minimize the foodborne illness risks (Neff et al., 2015; Visschers et al., 2016; Shahzad et al., 2022), which leads to lower food waste reduction intention. We assumed that consumers are confronted with the dilemma of food waste avoidance and health protection. Moreover, most consumers value health over environmental protection and they would prefer health risk avoidance behaviors to environment protection behaviors. This has been certified in the studies of perishable food consumption. In the case of our study, it is also confirmed because the mean value of participants' health concerns is 4.5, much higher than 3 for environmental concerns. Here the advent food can be regarded as perishable foods in that they both have short edible time and tend to be wasted in a short time later. Therefore, consumers perceive higher food safety risks for advent food since they are approaching the end of shelf-life. Furthermore, the shorter the remaining shelf-life, the higher the perceived food safety risks (Song et al., 2021). Secondly, we can see in our study that environmental concern ($b = 0.017$, $t = 1.644$) has a positive and insignificant effect on consumers' waste reduction behaviors. In existing studies, environmental concerns' effects on food waste reduction are inconclusive. The first type of study confirmed the significant effects of environmental concern, including environmental attitudes, moral norms, and other motives, on food waste reduction intention (Schmidt, 2016; Melbye et al., 2017).

Moreover, the second type presents a weak or insignificant influence on environmental concern toward food waste reduction intention (Neff et al., 2015; Qi and Roe, 2016). The result of this study demonstrates an insignificant effect and conforms to the second study type. Previous studies show that among the predominant food waste reduction intention, the effect of environmental concern ranked behind other factors such as money-saving and health care. Moreover, none of the consumers valued environmental concern as an essential factor when they were asked to link food production to greenhouse gas emissions (Neff et al., 2015; Qi and Roe, 2016; Chen, 2019). Third, this paper analyzed the effect of economic concern on food waste reduction intention and found a significant and negative result. It does not conform to previous studies, in which saving money is always a major motivation for food waste reduction (Neff et al., 2015). For people in their frugality or financial considerations, cheap price, great price deduction, and great sales promotion may trigger their purchase intention. The possible reasons may attribute to the characteristics of advent food as "low price, de-branding, good quality, and basic function." In the case of advent food markets, when compared to normal food, advent food is always sold in greater price deduction with great sales promotions, such as "buy one get one more," or in bulk packages. In our survey, the mean of item price_concern4, which measures consumers' comparison between delayed shelf-life and price reduction, equals 5 and is much higher than other items in price_concern, indicating that consumers care for delay shelf life and tend to evaluate the price with the retain of the shelf life. Hence, consumers with great price consciousness tend to buy excessive advent food. Consumers who bought large amount of advent food would hardly eat up the food within the limited shelf-life, which makes the advent food become food waste in the end.

Consumer values and food reduction intention

The second set of hypotheses analyzed the direct effects of consumer values on food waste reduction intention. The result indicated a negative effect of utilitarian value on food reduction intention. This was the comprehensive effect of the two functions. On the one hand, consumers perceived less functional and nutritional attributes in advent food, which may reduce their purchase intention and further make the advent food waste (Aschemann-Witzel, 2018; Jaeger et al., 2018). In our survey, we set item UV1 to measure consumers' perception of the nutritional value of advent food. The mean of UV1 was only 3, which indicated that consumers perceived less nutrition and function, leading to less food waste reduction intention.

On the other hand, platforms of online commerce can provide some convenient measures for consumers, such as detailed information on price deduction and edible period information, price comparison, and identical product comparison measures. Then consumers can use these tools and measures to browse for advent products of interest, which may trigger consumers' purchase intention and further reduce food waste. In this study, the consumers paid more attention to the functional and nutritional attributes of advent food,

which reduced their intention to purchase and further made the advent food unsold and become food waste. However, the hedonic value had no significant effect on food waste reduction intention, which contrasts with previous studies (Zheng et al., 2019; Katt and Meixner, 2020). The conceivable reason may be that, unlike formal and fresh products, advent products lacked product diversity (measured with HV2 and HV3) and fashion attributes (measured with HV1), which decreased their hedonic value and hardly triggered consumers' positive affect, and led to less advent food purchase and lower food reduction intention.

Economic concern, consumer value, impulse buying, and food reduction intention

The third set of hypotheses explored the effects of price concern and consumer value over impulse buying, as well as the mediating effect of impulse buying between the forementioned precedents and food waste reduction intention. The results showed strong direct effects of price concern and utilitarian value on impulse buying, as well as a significant mediating effect of impulse buying between price concern and food reduction intention. The results conformed to the pyramid of previous research (Tsiros and Heilman, 2005; Parizeau et al., 2015; Lahath et al., 2021; Welch et al., 2021; Jackson and Xu, 2022).

In the context of online advent food sales, the e-commerce retailers provided the expiration time-based price, in which the shorter the shelf-life, the lower the price. They also provided sales promotions like a bulk package or "buy one get one free." These substantial price reduction and sales promotion measures based on the expiration date could greatly trigger consumers to buy impulsively, especially for people with high sensitivity to commodity prices and those with a high preference for price judgment (Song et al., 2021). The study also confirmed the positive and significant effects of utilitarian value on impulse buying, which was in line with previous studies (Zheng et al., 2019; Parsad et al., 2021). In the e-commerce of the advent food markets, the platforms provided important information, such as the original price, the current price, the price cut percentage, as well as the remaining shelf-life either by date or by delay.

Furthermore, the platform also provided a price comparison of the food of the same kind. These measures facilitated consumers in information browsing and decision making, thus leading to impulse buying (Park et al., 2012). Moreover, categories and brands of advent food provided online were more fruitful than those displayed in onsite stores. There were even lots of imported food with famous foreign brands of snacks, wine, and beverages, which are always scarce and unavailable in offline advent stores or advent food shelves in supermarkets. Hence, both the product availability and quantity availability increased consumers' utilitarian value as availability and positive emotion, and this further triggered consumers to purchase more than needed and purchase unplanned foods, ending in impulse buying (Zhao et al., 2021). Hypothesis 4, proposing the negative effect of impulse buying on food waste reduction intention, was supported, which was in line with previous studies like Bond et al. (2013), Priefer et al. (2016), and Welch et al. (2021). Although advent food consumption could make good use of nearly expired food and reduce food waste, impulse buying triggered by great price reduction, sales promotion, and utilitarian values would lead to over purchase and unplanned purchases, leading to more food waste. If consumers could not eat up the over-purchased advent food within the short remaining shelf-life, there would be large quantities of food waste left. Moreover, the delivery process in online buying usually lasts for 3–5 days in China. If the delivery is blocked, the remaining shelf life left for consumers is further limited, and it is a challenge for consumers to eat up advent food with shortened shelf life, and hence the food waste increases.

Concerning the mediating effects, the results indicated that impulse buying only mediated the relationship between price concern and food waste reduction intention proposed in H5a. It suggested that impulse buying significantly indirectly affected food waste reduction intention through price concern. On the one hand, great price concern and price reduction may trigger the purchase intention of advent food which contributes to less food waste. However, excessive or over purchases induced by significant price reduction may result in more food unconsumed and become food waste in the end. Therefore, an increase in impulse buying may offset the positive effect of advent food consumption. Furthermore, an increase in food waste reduction intention may rely on price consciousness and impulse buying tendency combined.

Conclusions, implications, and limitations

This study sought to explore the effects of consumers' psychology-related aspects toward food waste reduction intention in the online advent food marketing. Using a survey conducted in China, consistent PLS structural equation analysis was employed to analyze the data and test the research model. The empirical results revealed that consumers' health concerns and price concerns significantly affected food waste reduction intention, as hypothesized. We also found that price concern and utilitarian value affect impulse buying positively and significantly. However, impulse buying was only found to mediate the relationship between price concern and food waste reduction

intention. Based on these findings, we provide policy and managerial implications.

Managerial and theoretical implications

Managerial implications

This study can provide findings of relevance to policymakers, retailers, and platforms of advent food. Here, we concluded three concrete points. First, it is advisable to develop consumers' environmental concerns and decrease health risk perception through education, policy publicity, and information notification. In this study, health concerns had a negative and significant effect on food waste reduction intention, while environmental concerns did not significantly influence food waste reduction intention. Hence, the government should: (1). enhance the education on environment protection, food security, and food safety; (2). publicize the impacts of food waste on the environment and natural resources' utilization, such as land, air, water, and others (Hall et al., 2009); (3). publicize knowledge concerning advent food consumption in schools and public situations. The sellers should carefully follow the national or regional provisions concerning the shelf-life label of advent food and check the delay of the advent food to reduce consumers' food safety perception. Moreover, it is advised to post the national or regional provisions of advent food and the knowledge of food security checking in the advent food APPs and online stores to popularize and remind consumers of relevant knowledge concerning nutrition, labeling, storage, and consumption tips of advent food to reduce the advent food safety risk perception level. They can even use live broadcasting in the online store to attract consumers' interests and publicize the knowledge.

Second, the retailers should take measures to balance the positive and negative effects of price concern on food waste reduction intention. On one hand, the study shows that price concern has a significant and positive effect on food waste reduction intention. On the other hand, impulse buying offsets this effect. Therefore, we advise the retailers to consider these factors when they set the price and sales promotion strategy. The shelf-life-based price mechanism should be continued with detailed analyses to balance the positive and negative aspects of advent food purchase. In sales promotion, it is advised to consider measures like smaller package sizes or provide promotion packages that put various commodities in one package rather than only one type in bulk package. Moreover, the retailers can provide reminders in the online store. For example, before consumers check out, tips will pop up automatically to remind the consumers to check the remaining shelf-life of the selected advent food and count the quantities of the commodities selected to avoid the purchase.

Third, the utilitarian value was found to affect impulse buying directly, and impulse buying further decreases consumers' food reduction intention. Therefore, the feasible way for the retailers is to trigger consumers' utilitarian value while discouraging impulse buying at the same time. Furthermore, it is suggested to instill traditional thrift culture and guilty feelings about wasting food in consumers through education and publicity (Qi and Roe, 2016; Liao et al., 2018; Katt and Meixner, 2020).

Theoretical implications

This study contributes to research on food waste reduction behavior from psychological perspectives and advances the current understanding of advent food purchase by offering two main contributions to the literature. First, this study contributes to exploring the main motivations on how to promote advent food consumption to protect the environment in the context of online advent food consumption. Past literature investigating the motivations for food waste reduction behaviors mainly was conducted in the context of ordinary food. Literature has ignored the importance of advent food consumption in food waste reduction. The study explored the effects of multiple dimensions of consumer psychologies, such as consumer concern and value, on advent food purchase and food waste reduction, which had been overlooked in food products redistribution and food waste management. Second, this study evaluated the effect of impulse buying in association with consumer concern and values, which was much less examined in previous research on food waste reduction. Therefore, this study proposes understanding the impact of consumer concern and value in marketing advent food to reduce food waste.

Limitation

Although we had some interesting findings and implications, there are still some limitations. Firstly, this research measured consumers' adoption intention rather than actual adoption behavior. Results of previous studies had demonstrated a gap between adoption intention and actual adoption behavior indicating that behavioral intention may not always trigger actual behavior. Therefore, researchers should measure consumers' actual behavior and analyze the influence factors. Secondly, the measurement items were all adopted from foreign studies. As we know, there are significant cultural differences in food consumption between China and foreign countries. For example, Chinese consumers are more likely to follow Confucian culture, in which face protection and Collectivism may induce much more food waste (Liao et al., 2018). Hence, we suggested developing the constructs that fit the Chinese context. Furthermore, cross-countries research is suggested to enrich the conclusions.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

CL is responsible for conceptualization, methodology, software, data curation, writing—original draft preparation, software, validation, and writing—reviewing and editing. XW is responsible for data processing and manuscript revision. LQ is responsible for the investigation and data curation. SL is responsible for methodology and software. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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