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Explaining Factors Influencing Food Waste Behaviors: Application of Planning Behaviors Theory

Sadegh Salehi [1*], Zahra Pazokinejad [1], Prashanth Beleya [2*], Diana Airawaty [3] and Prakash Nadarajah [4]

[1] Department of Sociology of Development, Faculty of Humanities & Social Sciences, University of Mazandaran, Babolsar 47416-13534, Iran.
[2] Department of Logistics and Management, Faculty of Business and Communications, INTI International University, Nilai 71800, Malaysia.
[3] Department of Management, Faculty of Economy, Universitas Mercu Buana Yogyakarta 55753, Indonesia.
[4] Department of Maritime and Logistics, Peninsula College, Penang 40460, Malaysia.

* **Corresponding author:** prashanth.beleya@newinti.edu.my.

ABSTRACT: This study aimed to examine social-psychological factors of FWB among consumers in Mazandaran province, Iran. The theory of planned behavior is theoretical framework of this study. Based on a survey involving 418 samples of consumers, the impacts of attitudes, perceived behavioral control, and contextual factors on FWB were investigated. The results of this study showed that intention did not affect FWB directly; environmental beliefs (15%) and attitudes toward the behavior of reducing food waste (-22%) affect FWB through intention. Shopping habits (12%) and situational factors (26%) influence FWB directly. Subjective norms (-15%) influenced FWB. Based on the findings, FWB varied by sex, age, and income. Strengthening perceived behavioral control and religious teachings in the family, promoting organic packaging, and communicating the impact of food waste marketing can help reduce its disposal.

Keywords: attitudes, subjective norms, situational factors, environmental beliefs, food waste, resource efficiency.

I. INTRODUCTION

Throughout history, food waste has increasingly become a critical issue affecting countries at all stages of development [1, 2]. Approximately 1.3 trillion tons of food are lost or wasted globally each year. Roughly one-third of the food intended for human use ends up being wasted [2, 3]. The need to employ a sociocultural rather than just an individualist or economic approach is perhaps truer in food consumption than any other, because of the special role food plays in constituting culture, identity, and social connection [4]. The fact is that lifestyle and eating habits are social dimensions of consumption that the public may have limited knowledge about the links between them and environmental risks like climate change. From a special psychological perspective, individual consumer shopping/ eating habits are an immediate connection between what is consumed and the societal challenge [5, 6]. Therefore, identifying the drivers behind consumer-level food waste will be more effective for avoidance [6, 7]. Identifying the factors that drive consumer-level food waste is essential for addressing the related environmental, economic and societal challenges [7]. Also, Deeper understanding of FWB can be used to help enhance household food management practices to minimize waste [8, 9].

According to the statistics of the World Food Organization (WFO), Iran holds the highest global rank in per capita food waste generation. The country is one of the three countries with the greatest amount of food waste worldwide. Statistics show that about 30% of food in Iran is lost [10], which is the amount of food for 15 million people, and the value of this volume of waste is estimated between 5 to 8 billion dollars. Iran's share of the total

food wasted in the world annually is reported to be 2.7 percent. Most food waste in Iran is involved to bread, fruits, vegetables, and rice. The per capita consumption of bread is estimated at 180 to 299 kg per year, of which 20 to 30% is removed from the cycle of direct human consumption as dry bread or bakery waste [11]. The results showed that in general, the causes of food waste production at the distribution and consumption stages fall into two main categories; the first category is consumer behavior, including poor economic skills in the family, incorrect understanding of food labels, strong awareness of food hygiene and heightened concern for food cleanliness, lack of desire to consume leftovers, readiness to preserve food, negligence toward food waste or failure to prioritize food waste reduction, disregard for people suffering from hunger or neglect of others' food needs, indifference to environmental issues, and the second category is factors beyond the individual's control, which include: number of household members or family unit size, motivational factors in retail environments, promotion and brand promotion, distance from shopping malls, and reduced frequency of food purchases, family structure and purchasing habits [7, 12, 13]. For example, bread waste was most prevalent in bakeries that were subsidized to buy flour, regardless of bread type. Studies within the community revealed that consumer awareness about transporting, storing and consuming bread plays a key role in minimizing waste. Reforming the education system and consumer culture is important to reduce food waste. Some countries have successful experiences in this area. For example, in order to develop a trained workforce for the Malaysian bread industry, the country's education system can be classified into three principal types, which provide the necessary training in the form of courses leading to certification, educational programs leading to diplomas, and in-service training in industrial factories [14]. A systematic review examined household food waste behavior using data of 42 included studies from 17 countries [15]. The results of this study show that attitudes (sense of self-worth, rise in domestic meal preparation, food choice, marital status, belief in post expiry edibility, unplanning purchases), subjective norms(social norms, variety traditional values, tendency to choose fresh ingredients) and perceived behavioral control(food purchasing habits, structured meal preparation, safe food preservation, household stock control, inclination toward fresh ingredients, rise in domestic meal preparation, controlled buying behavior) were FWB drivers at global level [15].

According to the UN's food waste reduction objectives, the primary objective is to minimize food wastage and losses by 50% by 2030. This involves actions at the retail and end-user stages, as well as along the full food supply chain, encompassing post-harvest inefficiencies [16]. Food waste reduction is a crucial element of global sustainability targets 12 (SDGs), which focuses on environmentally responsible consumption and production. SDG 12 also includes additional objectives associated with eco-friendly waste practices and efficient resource utilization [17]. Iran, as a UN member, is anticipated to participation to the global effort to achieve SDG 12.3. This may involve developing national strategies, promoting sustainable practices, and investing in infrastructure to reduce food was allocating resources to improve food logistics [18]. In summary, Iran, like other UN member states, is committed to attaining the UN's target of reducing food loss by 50% by 2030, as part of its broader efforts to fulfill the Sustainable Development targets [16]. The purpose of this research is to build upon existing literature and contribute to a better understanding of food waste practices in Iran, a setting that has received minimal scholarly attention. In Iran, consumer behavior and determinants of WFB have been few Studies. Studies of food waste have been across the three phases of production, distribution, and consumption within domain of agricultural sciences, waste management, and agricultural economy [19-21]. What adds to the necessity of conducting the present study is a 50 % decrease in food loss at the distribution and utilization level, also a reduction in food waste at the production level, as one of the UN goals on the horizon of 2023 [21]. Hence, this inquiry attempts to consider socio-demographic factors of FWB among consumers in Iran. Studies have consistently shown that the socio- economic determinants of waste composition are not fixed. Rather they fluctuate depending on national and regional contexts, shaped by cultural habits and personal perceptions.

II. BACKGROUND THEORY

Theory of planned behavior (TPB)has been used to understand resolutions to participate in a wide spectrum of behaviors [22]. Behavior is any activity that occurs in a person and can be observed and measured by others [23]. From a conceptual perspective, the intention is the introduction of a behavior by a

person [24]. Norms refer to internalized feelings of personal obligation to act in a certain way, often to avoid guilt [25]. In the definition of subjective norms, it is said that altruistic behavior occurs in response to internalized norms in the family or social groups. Moral or subjective norms for environmental behaviors (waste reduction, water or energy consumption, etc.) are activated when an individual believes that irresponsibility will have adverse effects on the value system in society [26]. Environmental beliefs are part of principle beliefs (the internal core of a person's belief system) that influence an extensive range of beliefs and attitudes concerning more specific environmental issues [25]. Study [27] found that Environmental concerns are a variable that is a prerequisite for shaping pro-environmental consumer behavior, especially in shaping positive attitudes towards the need to reduce restaurant food waste. Attitudes are important in TBP because they indicate the context in which an individual evaluates that behavior as desirable or undesirable [26]. Study [28] consider the attitude as sustainable system to be positive and negative evaluations of feeling and the desire to act, appose or agree to a social issue for example water consumption. Perceived behavioral control can have a direct impact on behavior adoption [29]. Perceived behavioral control is the extent to which individuals feel they have the ability and capability to perform a special behavior [30]. For example, [31] found that perceived behavioral control has a significant impact on saving behavior, especially water. This variable refers to the actual control of a behavior. If someone fails to purchase a smart faucet due to insufficient money, they actually have no real control over their behavior, and this negatively impacts the purpose of installing that device (the intention of optimizing consumption) [22]. The Planned Behavior Theory (TPB) model can help forecast consumer and pro-environmental behavior [32] and can explain certain types of food consumption behavior, including food waste. The TPB is predicated on the idea that most consumers behave reasonably. They pay attention to all available information and analyze the consequences of their acts, whether implicitly or explicitly [33].

III. LITERATURE REVIEW

There are numerous social, psychological, and cultural factors that influence responsible behaviors. In the context of food waste behaviors, responsible behaviors can include actions such as buying bread, fruits, and vegetables in amounts sufficient for households' daily needs.

1. SOCIO-ECONOMIC AND PSYCHOLOGICAL FACTORS AFFECTING FWB

Some of researchers like [12, 25, 28, 30, 34] examined the effects of the perceived ascription of responsibility, moral attitude, perceived behavioral control, attitude, and coping appraisal, behavioral intentions, leftover reuse routine. Another barrier is the habits of household members in food consumption. Behavior is not always rational, but is sometimes guided by habits [31]. According to the TPB, impulsive buying occurs when individuals act on sudden urges, without considering their consequences. Emotions drive this behavior, often leading to unnecessary or excessive purchases [35]. Social pressure, marketing tactics and perceived pleasure of spontaneous buying also contribute to impulsive buying [15, 36]. This behavior is beneficial, as it leads to reduced consumption and accumulation of perishable items.

2. CULTURAL INFLUENCING ON FWB

What we eat, how we eat, and food taboos are influenced by cultural context. Values, beliefs, and social customs influence behaviors that lead to food waste [37]. For example [3, 23, 28, 34, 38-40] found that the information use, marketing addiction, subjective norms, moral norms, knowledge, habits have direct and indirect significant effects on FWB. Significantly, human behaviors are guided by individuals internalized cultural values as a desirable standard towards the external world [41, 42]. With regard to food waste, major religions, such as Islam promote values and beliefs against wastefulness [42, 43]. Study of Long et al, 2024 show that religious values and opinions from others also facilitate the formation of a consumer's moral obligation towards food waste prohibition [46]. However, cultural norms conflict with individuals' preferences for fresh food consumption [15, 44]. When individuals become accustomed to consuming only fresh food, they become concerned about safe consumption [15, 45]. Thus, cultural norms, while reinforcing

the preference for fresh food, also lead to increased food waste, as they perceive items that are perceived as less fresh as unhealthy and should be discarded [37, 45, 46].

3. SOCIO-DEMOGRAPHIC CHARACTERISTICS AND FWB

Some researchers believe that "Socio-demographic variables compared to other variables are more readily available and can be applied to segmentation problems with relative ease" [47]. [12, 32] found that behavioral intentions vary depending on age and education. The results of Gharagozloo and Jalili Ghazizade (2023) showed a significant dissimilarity in the number of recyclables in terms number of employees and household members, as well as education [48]. Studies show that food waste behavior differs by gender, with women typically taking more responsibility for meal planning and reducing waste [15, 49]. Food waste generation is directly related to household income level [12, 15, 33, 45].

The current study examines the social and psychological factors that influence people's food waste in their homes. The study uses the extended theory of planned behavior (ETPB) is includes variables such as specific environmental beliefs, situational and structural variables, and shopping routines.

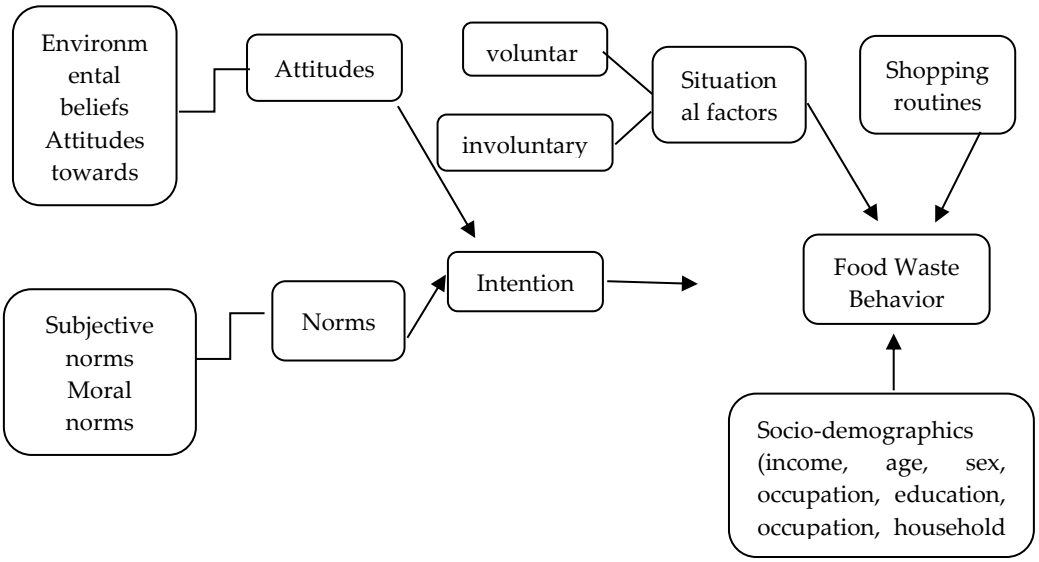

FIGURE 1. Theoretical model of FWB.

- H 1-1. Subjective norms (SN) influence on intention.
- H 1-2. Moral norms (MN) affect intention.
- H 2-1. Environmental beliefs (EB) influence on intention.
- H 2-2. Attitudes towards behavior (AB) have an impact on intention.
- H 3-1. Voluntary dimension of situational factors (VD) affects FWB.
- H 3-2. Involuntary dimension of situational factors (ID) affects FWB.
- H 4. Shopping routines (SR) affect FWB.
- H 5. FWB varies by economic- demographic variables (sex, age, income, occupation, household size, and education).

IV. MATERIAL AND METHOD

1. DATA COLLECTION

A researcher-made questionnaire was used in which items in the form of a Likert scale are used to measure self-reported waste food behavior. Data collection was carried out with students at Mazandaran

University in October 2021 for two weeks. The tool of data collection was an online questionnaire. For the pre-test, 50 people filled out a questionnaire [49]. The time required to complete each questionnaire was 5 to 7 minutes. Pre-test execution time was September 2021. In this survey, we used Snowball sampling via students. Due to the infection of Covid-19, an electronic questionnaire was sent to 45 students through WhatsApp platform and each student gave a questionnaire to 10 people to complete. These 10 people had to be different in terms of demographic characteristics such as sex, age, income, and education. In total, 450 respondents completed the questionnaire. As mentioned, this survey was conducted during the COVID-19 out-break, so interviewers used a convenience sample to complete the questionnaires. Of the 450 respondents who completed the questionnaire, 32 had missing data for bias in response and were excluded from this study. Thus, 418 respondents had complete details for all relevant variables.

2. RESEARCH DESIGN

This study is based on a quantitative method. In this study, we use planned behavior theory. Since we want to collect facts to test the PBT and identify aspects of the social phenomenon of FWB with the help of this theory, we used a survey strategy. Data are of type of ordinal. The most common instrument in the survey is the questionnaire. We used the researcher–made questionnaire with closed questions. Such surveys have the advantage that comparing and calculating the answers is easy because we only deal with a small number of categories [50]. The questionnaire contained measures on food-related behaviors, social-psychological factors, and socio-demographics. This study used Cronbach's alpha method to assess reliability and formal and instrumental validity to evaluate the validity of the questionnaire items, as well as the consistency in respondents' interpretation of the questions' meanings. Food waste behavior (FWB was operationalized with 8 items. First, this question was asked: How frequently do you discard the following food items? The respondents had to determine the extent of their departure in a Likert-type scale (1= always, 2= often, 3= sometimes, 4= rarely, 5= never) for categories of breads, rice, stew, vegetables, fruits, meat and fish, dairy, sauce (α=0.91; M=2.19; SD= 1.24). Self-reported FWB covers the available leftover plate waste in this study. Like FWB, intention (α=0.70; M= 3.67; SD= 1.20) consists of 6 sentences on a Likert scale (1= always - 5= never).

To operationalize the variable of consumer intent, the studies of [34, 51, 52] were used. As much as possible, I aim to consume all the food I choose for myself. I usually avoid discarding leftover food. I'm not inclined to eat refrigerated leftovers. Do not buy a damaged product or food package. I throw away food that has already been opened. I do not consume food that has expired today.) (i) Shopping routines (α= 0.58; M= 2.97; SD= 1.18) were measured with 4 statements in a five-point Likert scale (1= always - 5= never). When you go shopping, you first check what is in the kitchen. (When I buy food, I buy more than I need. It happens that I buy unnecessary food.) (ii) I usually buy food when it is reasonably priced. The pattern of definition of these items was studied by [51, 52]. Attitudes towards behavior (α=0.82; M= 4.21; SD=0.92) are another variable that were measured with 3 items (1= strongly disagree - 5= strongly agree). It is not right to throw away food while others may be hungry. I think wasting food is immoral. I get upset when I see food in the trash. To operate this variable, the studies performed by [38, 52] have been used. Environmental beliefs were operationalized with 3 sentences (α = 0.78; M= 3.86; SD= 1.17) in the form of a Likert scale (1= strongly disagree - 5= strongly agree). Environmental beliefs comprising 2 items taken from the New Ecological Paradigm (NEP): The earth has only limited room and resources; We are approaching the limit of the number of people the earth can support and 1 item made by the researcher (others have as much right to eat and drink as we do) [53]. To measure social norms, 3 items were used for moral norms (α=0.82; M=3.80; SD=0.92). Discarding food while others go hungry feels morally wrong. I feel satisfied when I consume food that might otherwise go to waste. Discarding food leaves, me with a guilty conscience. And 4 items for subjective norms (α= 0.56; M= 4.37; SD= 0.94) in the form of Likert scale (1= strongly disagree - 5= strongly agree). My family is sensitive to food waste. (Because I eat all my food, my relatives think I am an overeater. I do not care what others think if I am in a restaurant and I have not eaten my whole meal.)iii My friends react negatively to throwing away the whole food I got from the café. Respectively in the case of moral ones. Situational/contextual factors include 6 items that were divided into two categories after factor analysis:

Voluntary factors and involuntary factors. The respondents should answer this question: to what extent does each of the following reasons lead you to discard food?)

Voluntary factors (α=0.82; M=3.58; SD=1.17) that are related to a person's desire and taste. These factors included 3 items (to be full, Lack of time, Dislike of food*). In addition, involuntary factors that are not under the control of the person and imposed on the individual by society, such as poor-quality food packaging or spoilage of food, which is referred to here as involuntary factors. Involuntary factors included 3 items (low-quality refrigerator freezer, low-quality food products, and improper packaging) (α= 0.78; M= 3.20; SD= 1.22).

Table 1. Report factor analysis results for low-α scales.

Variables	Indicators (Items)	Factor loading
Moral norms KMO=0.68 BT=598.53 Sig=0.000	Discarding food while others go hungry feels morally wrong.	0.77
	I feel satisfied when I consume food that might otherwise go to waste.	0.83
	Discarding food leaves, me with a guilty conscience.	0.64
	I do not care what others think if I am in a restaurant and I have not eaten my whole meal.*	0.67
Shopping routines KMO=0.50 BT=87.877 Sig=0.000	When you go shopping, you first check what is in the kitchen	0.71
	When I buy food, I buy more than I need.	0.70
	It happens that I buy food that is unnecessary.	0.70
	I usually buy food when it is reasonably priced.	0.80

Kaiser-Meyer-Olkin (KMO) shows that data are suitable for factor analysis. For both variables, factors were used only when their factor load was more than 0.50.

V. DATA ANALYSIS

1. QUANTITATIVE DATA ANALYSIS

The research hypotheses were tested in the SPSS software. Sex has only 2 categories (Male, female), and the independent t-test is used. Other variables like education (postgraduate, bachelor, high school, elementary school, middle school, illiterate), Income (under 2 millioniv toman,2-4 million toman, 5-7 million toman, 8-10 million toman, over 10 million toman), household size (2 individual, 3, 4 and 4<), Occupation (employer, unemployed and housekeeper) have more than 2 categories, the one- way analysis of variance is used. Correlation coefficient r reflects the degree and direction of a linear connection between two data sets (interval scale) [54]. Generally, before conducting a regression test, regression assumptions are required. The first and most important presupposition of regression is the linearity of the correlations between predictor variables and predicted variable. Based on what has been proposed in the correlation coefficient r, there are linear relationships between predictor variables and predicted variables. Also, the distribution of the dependent variable for groups is normal. In addition, Camera statistics- Durbin-Watson have been used to measure the independence of the residual correlations (The value of this statistic is between 0 and 4). If the residuals do not correlate with each other, this statistic will be close to 2. With the help of multivariate regression, one can study the linear relationship between sets of independent variables with a dependent variable. The current research assessed statistical test results at the 0.05 significant level.

Table 2. Descriptive statistics of food items discarded by households.

	Rice	Bread	Stew	Veg	Fruits	Meat	Dairy	Sauce
Mean	2.26	2.58	2.22	2.20	2.09	1.75	2.11	2.37

SD	1.15	1.17	1.11	1.13	1.13	1.11	1.20	1.18
Skewness	0.722	0.357	0.761	0.696	0.868	1.48	0.946	0.7477
Kurtosis	-0.324	-0.748	-0.53	0.257	0.33	1.339	0.004	-0.577

The coding of the food waste behavior variable was reversed. (Always = 1- never = 5). The average for all food items is almost 2. In other words, respondents often discard the food items listed in Table 1.

2. *LINEAR RELATIONSHIPS WITH PEARSON CORRELATION*

Table 3 shows the linear relationships with Pearson Correlation of the variables of the study.

Table 3. Pearson correlation for predictor and predicted variables.

Var	1	2	3	4	5	6	7	8	9
1.Waste food behaviors	1	0.10	0.17	0.083	0.13	0.17	0.012	0.017	0.012
2.Intention	0.10	1	0.17	0.14	-0.011	0.047	0.19	0.047	-0.011
3.Shopping routines	0.17	0.17	1	-0.018	-0.010	0.082	0.30	0.080	-0.009
4.Environmnetal beliefs	0.083	0.14	-0.018	1	0.11	-0.017	-0.011	0.44	0.57
5. Voluntary factors	0.13	-0.011	-0.010	0. 11	1	-0.009	-0.006	-0.008	-0.006
6.Involuntary factors	0.17	0.047	0.082	-0.017	-0.009	1	-0.009	-0.050	0.22
7. Attitudes towards behavior	-0.012	0.19	0.30	-0.011	-0.006	-0.009	1	-0.008	-0.006
8. Moral norms	-0.017	0.047	0.080	0.44	-0.008	0.050	-0.008	1	0.66
9.Subjective norms	-0.012	-0.011	-0.009	0.57	-0.006	0.22	-0.006	0.66	1

Pearson's correlations in Table 3 indicate significant positive associations between WFB and their behavioral determinants intention, environmental beliefs, attitudes towards behavior, subjective norms, moral norms, shopping routines, voluntary factors, and involuntary factors.

3. *LINEAR REGRESSION ANALYSIS*

The results of multiple regression analysis are shown in Table 4.

Table 4. Regression (stepwise)- dependent variable: FWB.

First sub-model	Variables	Regression Coefficient ß	T	p-value	Variance threshold	VIF
Direct effect food waste behavior	Constant		9.801	0.000		
	AB	-0.22	-4.58	0.000	0.68	1.47
	Age	-0.18	-4.39	0.000	0.94	1.22
	EB	0.15	3.37	0.001	0.86	1.05
	SN	-0.15	-2.99	0.003	0.66	1.51
	VF	0.14	3.17	0.002	0.81	1.22
	IF	0.12	2.87	0.004	0.86	1.16
	SR	0.12	2.83	0.005	0.94	1.06
	R=0.50	R^2= 0.24	Durbin Watson=1.41	F= 21.17	Sig=0.000	
Second sub-model	Variables	Regression Coefficient ß	T	p-value	Variance threshold	VIF

Direct effects on intention	Constant		10.33	0.000		
	AB	0.20	4.35	0.000	0.91	1.09
	EB	0.12	2.69	0.000	0.91	1.09
	R=0.27	R^2= 0.71	Durbin Watson=1.69	F= 18.08	Sig=0.000	

About 24% of the variance in FWB could be explained by attitudes toward behavior, age, environmental beliefs, subjective norms, voluntary dimension of situational factors, involuntary dimension of situational factors, and shopping routines. Attitudes toward behavior have the greatest impact on FWB (ß = - 0.22; p< 0.001). As the attitude towards food loss is negative. As indicated in the result, H 2-2. Attitudes towards behavior (AB) have a significant impact on intention is confirmed but in a negative direction. Considering the significance level (P<0.001), H- 5a, assuming the influence of household size and age on FWB, is confirmed with the effect of age on FWB only [h1]. There is an inverse relationship between age and food waste generation. The voluntary dimension of situational factors has had a significant impact on FWB (ß = 0.14; p< 0.001). Thus, hypothesis 3-1 is empirically confirmed. Subjective norms hurt food waste behaviors (ß = -0.15; t= -2.99; p< 0.005). Therefore, H 1-1. Subjective norms (SN) influence on intention is confirmed, but the direction of effect was reversed. If the internal deterrent forces are stronger, food waste is less likely to be produced. Hypothesis of 2-1. Environmental beliefs (EB) influence on intention is confirmed (ß = 0.15; p< 0.005). The involuntary dimension of situational factors was significantly associated with FWB (ß = 0.12; p< 0.005). Thus, it confirms hypothesis 3-2. Also, hypothesis 4 was supported (ß = 0.12; p< 0.005). So, shopping routines had effect on FWB. The second sub-model supports the impacts of AB and EB on intention as a mediated variable. Also, attitudes toward behavior (AB) influenced intention (ß=0.20; p<0.01). Also, the influence of environmental beliefs on FWB is positive (ß = 0.12; p< 0.001).

4. ONE-WAY ANALYSIS OF VARIANCE

H 5. FWB differs by socio-demographic variables (income, occupation, household size, and education). To examine the correlation between income, occupation, education, and FWB, one-way analysis of variance was used as it can be seen in Table 5.

Table 5. The result of the statistical tests between the FWB and the independent variables under study.

Parameter	Waste food behaviors	Squared residuals	DF	Mean Square	F	Sig	Eta-squared
Income	Inter- group	8.249	7	2.760	1.349	0.225	0.020
	Intra-group	1.562	458	1.193	0.659	0.683	
	Total	9.811	465				
Education	Inter- group	13.33	6	2.22			0.002
	Intra-group	1.54	458	1.97			
	Total	14.87	464				
Household size	Inter- group	6.91	4	1.72	0.513	0.726	0.004
	Intra-group	1.55	460	0.68			
	Total	8.46	464				
Occupation	Inter- group	5.12	2	1.76	0.110	0.89	0.000
	Intra-group	1.072	453	0.58			
	Total	6.19	455				

There is no significant relationship between education, occupation, and FWB (p> 0.05). This means there isn't a statistically significant distinction between the means of the different levels of the predictors in Table 5.

Table 6. The result of Post Hoc test (Tukey) for household size, income, occupation and education.

Household size [I]	**Household size [j]**	**Average Difference (I-J)**	**Std. Error**	**p-value**	**95% CI****	
					Min- limit	**Max-limit**
More than 4 people	4	-1190.55229	2207.83738	.949	-6883.3426	4502.2380
	3	25.30259	2516.17947	1.000	-6462.5312	6513.1364
	2	2831.10813	3108.64102	.799	-5184.3560	10846.5722
4	More than 4 people	1190.55229	2207.83738	.949	-4502.2380	6883.3426
	3	1215.85488	2201.09567	.946	-4459.5522	6891.2620
	2	4021.66042	2859.59998	.496	-3351.6647	11394.9856
3	More than 4 people	-25.30259	2516.17947	1.000	-6513.1364	6462.5312
	4	-1215.85488	2201.09567	.946	-6891.2620	4459.5522
	2	2805.80554	3103.85651	.803	-5197.3220	10808.9330
2	More than 4 people	-2831.10813	3108.64102	.799	-10846.5722	5184.3560
	4	-4021.66042	2859.59998	.496	-11394.9856	3351.6647
	3	-2805.80554	3103.85651	.803	-10808.9330	5197.3220
Income level [i]	Income level [j]	Average Difference (I-J)	Std. Error	p-value	95% CI** Min- limit	Max -limit
Less than 2 *million tomans	2-4	-1957.85791	3238.32497	.997	-11549.0161	7633.3003
	5-7	3873.84854	3163.00785	.884	-5494.2380	13241.9351
	8-10	489.80283	3509.45673	1.000	-9904.3840	10883.9897
	11-15	4543.61364	3908.44041	.908	-7032.2692	16119.4965
	16-20	4544.41364	6458.20206	.992	-14583.2645	23672.0918
	up20	4543.61364	6214.40783	.991	-13862.0032	22949.2305
2-4 million tomans	Less than 2 million tomans	1957.85791	3238.32497	.997	-7633.3003	11549.0161
	5-7	5831.70644	2245.84536	.129	-819.9602	12483.3731
	8-10	2447.66073	2712.10054	.972	-5584.9443	10480.2657
	11-15	6501.47154	3211.71437	.401	-3010.8723	16013.8154
	16-20	6502.27154	6061.97794	.936	-11451.8838	24456.4269
	up20	6501.47154	5801.55733	.922	-10681.3791	23684.3222
5-7	Less than 2 million tomans	-3873.84854	3163.00785	.884	-13241.9351	5494.2380
	2-4	-5831.70644	2245.84536	.129	-12483.3731	819.9602
	8-10	-3384.04571	2621.70924	.856	-11148.9329	4380.8415
	11-15	669.76510	3135.75816	1.000	-8617.6143	9957.1445
	16-20	670.56510	6022.07992	1.000	-17165.4217	18506.5519
	up20	669.76510	5759.85568	1.000	-16389.5750	17729.1052
8-10	Less than 2 million tomans	-489.80283	3509.45673	1.000	-10883.9897	9904.3840
	2-4	-2447.66073	2712.10054	.972	-10480.2657	5584.9443
	5-7	3384.04571	2621.70924	.856	-4380.8415	11148.9329

	11-15	4053.81081	3484.91710	.907	-6267.6954	14375.3170
	16-20	4054.61081	6211.04778	.995	-14341.0544	22450.2760
	up20	4053.81081	5957.14742	.994	-13589.8611	21697.4828
11-15	Less than 2 million tomans	-4543.61364	3908.44041	.908	-16119.4965	7032.2692
	2-4	-6501.47154	3211.71437	.401	-16013.8154	3010.8723
	8-10	-669.76510	3135.75816	1.000	-9957.1445	8617.6143
	16-20	-4053.81081	3484.91710	.907	-14375.3170	6267.6954
	up20	.80000	6444.89988	1.000	-19087.4802	19089.0802
16-20	Less than 2 million tomans	-4544.41364	6458.20206	.992	-23672.0918	14583.2645
	2-4	-6502.27154	6061.97794	.936	-24456.4269	11451.8838
	5-7	-670.56510	6022.07992	1.000	-18506.5519	17165.4217
	8-10	-4054.61081	6211.04778	.995	-22450.2760	14341.0544
	11-15	-.80000	6444.89988	1.000	-19089.0802	19087.4802
	up20	-.80000	8054.79315	1.000	-23857.2061	23855.6061
More than 20 million tomans	Less than 2 million tomans	-4543.61364	6214.40783	.991	-22949.2305	13862.0032
	2-4	-6501.47154	5801.55733	.922	-23684.3222	10681.3791
	5-7	-669.76510	5759.85568	1.000	-17729.1052	16389.5750
	8-10	-4053.81081	5957.14742	.994	-21697.4828	13589.8611
	11-15	.00000	6200.58265	1.000	-18364.6700	18364.6700
	16-20	.80000	8054.79315	1.000	-23855.6061	23857.2061
Occupation[i]	Occupation[j]	Average Difference (I-J)	Std. Error	p-value	95% CI Min limit	Max limit
Employed	Unemployed	212.98814	1664.12374	.991	-3700.1017	4126.0780
	Housekeeper	-702.56044	1869.14463	.925	-5097.7450	3692.6241
Unemployed	Employed	-212.98814	1664.12374	.991	-4126.0780	3700.1017
	Housekeeper	-915.54858	2014.93788	.892	-5653.5574	3822.4603
Housekeeper	Employed	702.56044	1869.14463	.925	-3692.6241	5097.7450
	Unemployed	915.54858	2014.93788	.892	-3822.4603	5653.5574
Education[i]	Education[j]	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Under diploma	Diploma	-3623.76546	2968.63836	.827	-12120.8855	4873.3546
	Associate degree	1640.42409	4578.95549	.999	-11465.8993	14746.7475
	bachelor	-1544.04449	2707.89934	.993	-9294.8524	6206.7634
	maser	1638.40779	4509.14850	.999	-11268.1074	14544.9229
	PhD	1637.43279	8705.17813	1.000	-23279.3588	26554.2244
diploma	Under diploma	3623.76546	2968.63836	.827	-4873.3546	12120.8855
	Associate degree	5264.18955	4277.59392	.822	-6979.5480	17507.9271
	Bachelor	2079.72097	2159.55904	.929	-4101.5750	8261.0169

	Master degree	5262.17325	4202.78439	.811	-6767.4373	17291.7838
	PhD	5261.19825	8550.50306	.990	-19212.8676	29735.2641
Associate degree	Under Diploma	-1640.42409	4578.95549	.999	-14746.7475	11465.8993
	Diploma	-5264.18955	4277.59392	.822	-17507.9271	6979.5480
	Bachelor	-3184.46858	4100.94073	.971	-14922.5725	8553.6353
	Master degree	-2.01630	5460.53260	1.000	-15631.6738	15627.6412
	PhD	-2.99130	9233.91154	1.000	-26433.1741	26427.1915
Bachelor	Under Diploma	1544.04449	2707.89934	.993	-6206.7634	9294.8524
	Diploma	-2079.72097	2159.55904	.929	-8261.0169	4101.5750
	Associate degree	3184.46858	4100.94073	.971	-8553.6353	14922.5725
	Master degree	3182.45227	4022.84747	.969	-8332.1257	14697.0302
	PhD	3181.47727	8463.51037	.999	-21043.5898	27406.5443
Master degree	Under Diploma	-1638.40779	4509.14850	.999	-14544.9229	11268.1074
	Diploma	-5262.17325	4202.78439	.811	-17291.7838	6767.4373
	Associate degree	2.01630	5460.53260	1.000	-15627.6412	15631.6738
	Bachelor	-3182.45227	4022.84747	.969	-14697.0302	8332.1257
	PhD	-.97500	9199.49505	1.000	-26332.6476	26330.6976
PhD	Under Diploma	-1637.43279	8705.17813	1.000	-26554.2244	23279.3588
	Diploma	-5261.19825	8550.50306	.990	-29735.2641	19212.8676
	Associate degree	2.99130	9233.91154	1.000	-26427.1915	26433.1741
	Bachelor	-3181.47727	8463.51037	.999	-27406.5443	21043.5898
	Master degree	.97500	9199.49505	1.000	-26330.6976	26332.6476

*1 million Toman = US$20 **Confidence Interval.

A Tukey post hoc test showed that there is not significance values haven't been generated for the mean differences between pairs of the various levels of the Household size, Income level, Occupation and Education in Table 6.

5. INDEPENDENT T-TEST

The test of hypothesis (5) can be seen in Table 7. There is no significant difference in FWB by sex ($p>0.05$). The means of FWB are (males= 18.03) and (females= 17.41). This means hypothesis 5 isn't confirmed in the case of gender.

Table 7. Comparison differences in FWB by sex.

t-test for Equality of Means					
T	**df**	**sig**	**Mean difference**	**St. Error difference**	**Cohen's *d***
0.860	333.049	0.39	0.62075	0.72215	0.029

V.CONCLUSION

The study aims to examine the factors that influence household food waste behavior in Mazandaran province in Iran. In the present study, attitudes towards behavior and environmental beliefs have the most effect on intention, while norms (subjective and moral norms) have not affected it. Linear hierarchical regression analysis on FWB showed that about 50 % of the variability in FWB could be captured by attitudes towards behavior, age, environmental beliefs, subjective norms, voluntary dimension of situational factors, involuntary dimension of situational factors, and shopping routines. There is no relationship between intention and FWB. Among variables, attitudes toward behavior had the most effect (ß = - 0.22; p< 0.001), and involuntary factors and shopping routines (ß = 0.12; p< 0.005) had the least effect on FWB. In the context of this study, the variable of intention had no effect on FWB and attitudes, age, environmental beliefs, subjective norms, voluntary dimension of situational factors, involuntary dimension of situational factors, and shopping routines were stronger determinants of this behavior. Contrary to [12, 23, 39] in our study, intention is not a determinant of FWB. However, it does mediate environmental beliefs and attitudes toward behavior. But this result is in line with [3, 28].

This result implies the importance of environmental factors in predicting FWB, as [3, 23, 28, 34, 40] suggested. Unlike the results obtained by [38-40], there is no variation between the socio-demographic variables (Income, education, occupation, sex, and household size) and the self-reported food waste behaviors of respondents. There is a direct correlation between age and FWB. With an increase in age, self-reported FWB decreased. This finding was resistant to findings from [38, 39]. Their results show that being older was associated with less food waste behavior [15]. The reason why older people waste less is explained to be because of attitudes toward food waste that wasting food is wrong [24]. In the present survey, the size household did not affect self-reported FWB. This result is inconsistent with findings of [15, 33]. In our study, self-reported FWB did not differ by sex. This finding wasn't consistent with the findings of [28]. They found that being male was associated with more FWB. According to the theories of rational action and planned behavior, behavior is a function of beliefs and perceptions. Beliefs and perception such as attitudes, subjective norms and perceived behavioral control [31]. Therefore, behavioral changes are ultimately the result of changes in beliefs. In order to influence behavior, we need to give people information that will cause changes in their beliefs. If attitudes and mental norms do not change, we cannot expect a change in behavior.

In our study, [28, 38, 39] found that situational factors captured the variance of household waste food. Study [24, 35] revealed that contextual factors significantly contributed to 17% of the variance of food waste behaviors. Therefore, Hypotheses of (3-1 and 3-2) were confirmed. Also, according to hypothesis (4), shopping routines influenced FWB. The present findings also supported this hypothesis and were congruent with previous literature [28]. There is no relationship between intention and FWB. Individuals see waste food planning as time-consuming or unnecessary [15], which leads to spontaneous and excessive purchases [12, 15]. This may be due to subjective norms, social pressures or cultural norms of consumerism in community or social circles. In the absence of prioritization of food management by family and peers, people may follow prevailing norms rather than pursue environmentally responsible practices [15, 36]. In this context, social norms that emphasize sustainability and waste reduction can encourage practices loke portion control and the creative reuse of leftovers [44, 45, 55]. Based on results of research [12], people who are more aware of the correct food storage show more environmental behavior of reducing food waste. Also, the way of packaging and the expiration date have a positive and meaningful relationship with the environmental behavior of waste reduction. Involuntary factors significantly influenced food safety perceptions. Involuntary factors that are not under the control of the person and imposed on the individual by society,

such as poor-quality food packaging or spoilage of food. Therefore, the lack or restriction of support opportunities is another involuntary factor in Iran. The problems such as insufficient facilities or awareness can deter people from engaging in domestic composting or waste sorting. In some of studies, production of household waste or tourist behaviors associated with waste production and littering has been considered as an indicator of social disorder and in the form of the broken window theory [56], affected by habit, lack of facilities, dirty environment, lack of awareness, weak normative control, and individual irresponsibility [56, 57].

Our study shows that food waste reduction interpositions should concentrate on perceptions, attitudes, perceived behavioral control, shopping routines, and situational factors. The culture of hospitality in Iran shows that Iranians are under severe social pressure to consume food, so they consider their food waste to be negligible, and other factors, such as maintaining the reputation of the guest, good preparation, and sub-cultures, prefer to waste food. Also in Iran, large families waste relatively more food. It may be because large families are more united, as more events take place in these families such as birthday gatherings [53], wedding, Ramazan and Norouz events. In such cases, more food than small families become food waste [12, 33]. In Iran, social influence from key groups such as family and friends play a significant role in shaping individual behavior. Or in hospitalities, the host share additional food with guests or needless, this practice can decrease food loss and foster collective responsibility by reallocation of excess food to vulnerable populations served by food banks and shelters. Therefore, the unique cultural moderators (e.g., "Hospitality norms) can weaken the intention-FWB link. It also means promoting nutritional awareness and informed food choices by providing them with information that would allow them to enhance household planning behaviors [58]. It is necessary to warn of the societal, economic, and environmental consequences of food loss so that this issue becomes more tangible for consumers, and the reduction of food waste can be the priority in food consumption behavior [58]. Given that family, friends, and relatives, as well as radio and television, were the most common among respondents to gain awareness of food waste, it is better to use these resources and more information channels to raise awareness among households, for example, Iranian government and NGOs should discourage consumers from excessive consumption via information publicity.

A common misconception among consumers is that expiration dates reflect food safety rather than quality, whereas they are often intended to reflect optimal quality. Phrases such as “Best Date”, “Date of Sales to “and “Expiration Date” are widely misunderstood [12]. The improvement of packaging is related including the adaptation of sizes, the increase of shelf life of food and the improvement of storability [58]. Also, missing the expiration dates a root cause of food waste, it must be taken into account that such behavior may cause food waste, which can lead to overbuying of food products [Ibid]. It is suggested that information and training on behaviors of reducing and preventing food waste production in young and adolescent age groups and women should be considered to promote environmental behaviors of reducing food waste. Consumers are often unaware of the total financial worth of food that they waste. This includes the psychological costs of wasting food (of both required time and resources on one side and food on the other side), which are often different from cost of goods in the market (food pricing in the marketplace), which themselves are different from actual costs (costs also including market externalities) [15]. Also, we add environmental costs (reduction of natural resources, water shortage or climate changes) [Ibid]. Policymakers and other market actors should promote new social norms of sufficiency and raise awareness about the cumulative impact of food waste. For example, the percentage of water, energy, or other costs used to prepare food should be listed on the food packaging to inform the consumer. This can affect consumers' purchasing decisions and shopping habits.

This study has two limitations. Firstly, the survey sample was opportunistic rather than a randomly selected subset of the population. One of limitations of sample, id generalizability. Hence, expanding the diversity and scope of study samples is essential to fully understand the complexities of food waste at both local and national levels. Secondly, this study relied on self-reported food-wasting behaviors, which presents challenges such as response bias. These reports may not accurately reflect actual behavior, as they are based on participants’ own perceptions and assessments. Therefore, it is suggested that future surveys use standard household food waste behavior questionnaires. Study [59] argued that the Household Food Waste

Questionnaire has been developed to address these challenges. The study employs a pre-announcement to raise awareness about food waste, focuses on a short and specific time frame (i.e. the past week), and includes detailed product categories. In contrast, previous surveys typically relied on general questions without specifying a time period or product category [59].

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Author Contributions

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Conflicts of Interest

The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Data Availability Statement

Data are available from the authors upon request.

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