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FROM PLATE TO PLANET: INVESTIGATING THE ROOT CAUSES OF HOUSEHOLD FOOD WASTE IN DEVELOPING NATIONS

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ABSTRACT

Food waste is a global concern. However, it is more prevalent in certain developing nations, e.g. Saudi Arabia, which threaten economic viability, food security and environmental sustainability. This research builds on theory of planned behavior (TPB) and delves into the roots of high rate of food waste at household level in Saudi Arabia using a survey approach. The data collected from 1572 households were analyzed using SEM-AMOS version 23. The results showed that the most predicator of food waste is the consumption culture. Other predictors included absence of proper shopping plans, favorable attitude towards wasting food, perceived behavioral control, subjective norms and social media. Despite religiosity had a significant negative influence on food waste, it was not enough to reduce food waste due to the significant effects of other factors, e.g. culture, shopping plan and social media. This research extends the TPB and adds to un-derstanding the key predictors of food waste at households. Several implications were, therefore, proposed for policymakers and researchers for managing this growing global concern.

KEYWORDS: Food Waste; Food Consumption Culture; Household; Religiosity; Saudi Arabia; Social Media; Theory Planned Behavior.

1. INTRODUCTION

Food waste (FW) reduction is a significant universal issue that has captured the growing attention of policymakers, researchers, and professionals worldwide, owing to its significant impact on sustainable development (United Nations Development Program, 2012). The literature on food loss and waste (FLW) (e.g., Gustavsson et al., 2011; Pfaltzgraff et al., 2013; Food and Agriculture Organization of the United Nations, 2019) has distinguished between the terms of FW and FL. While FL refers to the quality and/or amount of eatable food during food cycle, FW includes any raw or cooked food that is fit for human con-sumption but remains uneatable or is thrown away. This often occurs at the retail or family levels. The concept of FW varies to either avoidable or unavoidable. Gjerris and Gaiani (2013) defined "avoidable" FW as any edible food that could be consumed, but it is discarded, including meal surpluses and leftovers. On the other side, "unavoidable" FW relates to uneatable bits of food, like fruit skins and bones (Parfitt et al., 2010). Notably, recent literature on FLW (e.g., Pfaltzgraff et al., 2013; Baig et al., 2022; Sobaih 2023) has indicated that the amount of FW is considerably greater than that of FL, primarily attributed to consumer behavior. Surprisingly, the Food Waste Index Report (2021) issued by the United Nations Environment Program (2021) highlighted that roughly 931 Mt of FW were generated in 2019. Moreover, the same report confirmed that households are the main source of FW, representing 570 Mt, 61%, while restaurants and retail contributed 26% and 13%, respectively. Around 17% of worldwide food production is potentially wasted. Of these 17%, there are 11% occurs at households' level, 5% in food service, and 2% in retail. This FW translated into a nearly one trillion-dollar loss and the production of 3.3 billion tons of Carbon Dioxide annually. The World Health Organization (2022) noted that nearly 2.33 billion individuals faced moderate to severe food insecurity, while 864 million were classified as experiencing severe food insecurity.

Despite SA has been identified as one of the richest countries globally, it faces several challenges that hinder agricultural development, including limited water resources, low rainfall, high temperatures, and a scarcity of arable land (Baig et al., 2022; United Nations Environment Program, 2021). Consequently, SA depends significantly on imports to cover the food requirements of its people, importing around 80% of its food necessities (Baig et al., 2022). Alarmingly, at least 30% of these imported foods are wasted (Baig et al., 2027), which made SA among top FW rates in the world (Sobaih and Abu Elnasr 2023). Notably, FW ac-counts for approximately 51% of all waste produced in SA (Baig et al., 2022). According to a report by the FAO (2019), this level of FW slightly exceeds the global average, which stands at about 31%. The typical FW per person in SA exceeds 250 kg, over double the worldwide average of 115 kg. Additionally, the av-erage grain eating per human is 158 kg, surpassing the global average of 145 kg. Thus, the government allocates approximately SR 41 billion (around $11 billion) each year exclusively to address FW (Saudi Grains Organization (SAGO), 2019). These figures underscore the urgent need to understand the factors contributing to persistent FW, its sources, implications, and effective strategies for mitigation, despite ongoing government and research efforts to tackle this issue (Sobaih 2023).

Research (e.g., SAGO, 2023; Aschemann-Witzel, 2015; Pfaltzgraff et al., 2015; Baig et al., 2022) has shown that consumer-related FW is a complex problem impacted by a variety of social, cultural, economic, and geographic variables, as well as food-related behaviors and habits. A review of studies regarding the motivations behind FW (Pfaltzgraff et al., 2015; Schanes et al., 2018; Baig et al., 2022) has identified several factors leading to such consumer behavior. These factors include food consumption culture (Elshaer et al., 2021), lack of consumer awareness (Elshaer et al., 2021; Baig et al., 2022), the influence of social media (Azazz & Elsaher, 2022) impulsive food purchases (Schanes et al., 2018; Sobaih 2023), the role of meal planning (Quested & Luzecka, 2014) personal attitudes towards FW and social influences (Elshaer et al., 2021), food promotions (Baig et al., 2022), religiosity (Elshaer et al., 2021; Sobaih 2023), and demographic variables (Alsawah et al., 2022). Roodhuyzen et al. (2017) outlined the key variables contributing to household food waste, categorizing them into behavioral, e.g. meal planning, purchasing habits, and food preservation techniques, and attribute factors, e.g. age, gender, income level, the presence of children, and knowledge of best-before dates.

FW is a significant global issue, affecting social justice, economic viability, and environmental sus-tainability (Mir et al, 2024). At the same time, reducing FW presents a complex, interdisciplinary challenge that necessitates a comprehensive approach (Kosseva, 2013; Elmenofi et al., 2015). Xue et al. (2021) as-serted that effective actions, policies, and business initiatives aimed at mitigating FW must be grounded in a thorough understanding of its

underlying causes, supported by robust knowledge. While numerous studies have addressed FW internationally (e.g., Mourad, 2016; Muriana, 2017; Filimonau et al., 2018; Sirola et al., 2019), and within SA (Baig et al., 2017; Baig et al., 2017; Elshaer et al., 2021; Baig et al., 2022; Sobaih, 2023; Sobaih & Abu Elnasr, 2023; Sobaih & Abu Elnasr, 2024), they frequently focused on assessing the recent state of FW, identifying its primary determinants, and examining its consequences in the food service sector. Mattar et al. (2018) noted that there is still a significant lack of understanding regarding the attitudes and behaviors of households, in developing nations, related to FW. According to the researchers' knowledge, no studies have specifically explored the impact of behavioral and attitudinal factors collectively on FW production, especially at households in SA. Therefore, this research builds upon the Theory of Planned Behavior (TPB) (Ajzen, 1991) to bridge this gap by adopting an inclusive model to examine how Saudi food consumption culture, religiosity, shopping habits, social media influence, and dimensions of the TPB di-rectly influence the household intentions concerning the intention of wasting food at the Saudi households.

The next parts are planned as follows: The first part introduces the theoretical framework, which reviews the factors contributing to FW in SA and formulates the study hypotheses. Following this, the methods used for data collection and analysis are detailed in section 2. The key findings are then presented and discussed in depth in section 3. Subsequently, the implications of these results are explored in section 4. Section 5 compares the results with earlier studies and section 6 concludes the paper with recommendations for further opportunities.

2. Hypotheses Development

2.1. Food Consumption Culture

Fourst (1985) defined food culture as "the distinct habits and consumption patterns related to food that evolve over generations, often vary by region". In SA, the culture is characterized by generous food traditions and hospitality, which significantly influence FW patterns (Baig et al., 2019). Saudis prioritize welcoming guests with abundant meals, leading to considerable FW during festive occasions such as Eid, weddings, and gatherings (Sillitoe & Misnad, 2014; Elshaer et al., 2021; Sobaih & Abu Elnasr, 2024). The food consumption culture in SA is particularly notable during the Hajj season and Ramadan (Sobaih 2023). Ouda et al. (2017) highlighted that Makkah produces around 5000 tons of FW over just a few days during the Hajj pilgrimage. Research findings (Al-Thani et al., 2017; Baig et al., 2019) have established a relationship between economic status, social position, and consumption patterns in SA. Economic growth, fueled by the country's oil resources, has led to a higher per capita income, prompting people to purchase exceeding the necessary (Al-Thani et al., 2017; Abusin et al., 2020). Cultural factors, supplemented with consumerism behaviour, significantly influence FW (Baig et al., 2019). Higher-income individuals tend to buy excess food, particularly when prices are low, often overlooking the waste generated (Schanes et al., 2018). This consumer culture shapes perceptions of what constitutes excess and acceptable waste disposal (Thyberg & Tonjes, 2016). Ching-Hsu et al. (2020) highlight that addressing FW in modern societies requires more than just reuse and recycling; it necessitates a fundamental shift in consumption behaviors. Recent study by Elshaer et al. (2021) further confirmed that the culture of food consumption is a critical factor influencing individuals' intentions to waste food. Thus, we can suggest:

H1. Food consumption culture would positively impact on FW intention

2.2. Shopping Plan

According to Chia et al., (2024) a planned shopping routine is widely recognized as a factor that impacts the reduction and prevention of household FW. In this regard, Stefan et al. (2013) demonstrated that planning regular list-making can significantly reduce FW creation. In contrast, unplanned shopping often hinders efforts to mitigate and prevent FW, as it can result in excessive or impulsive purchasing. For ex-ample, in Italy, customers who tend to purchase discounted food exhibit a lack of awareness regarding FW and often display carelessness while grocery shopping (2021). Yet, research of Lebanese households found that individuals who frequently purchase food items on special offer tend to waste less (Chalak et al., 2019). This may be explained by the financial constraints faced by consumers who typically purchase discounted groceries, making them more aware of FW (Jörissen et al., 2015). Consequently, adhering to a strict shop plan can impede efforts to reduce FW.

Grocery shopping planning has become a controversial topic. Supporters of using shopping lists argue that they help reduce FW by preventing impulsive buying and minimizing excess purchases that spoil (Graham-Rowe et al., 2014; Pearson & Perera, 2018). Supporters suggest that when

consumers stick to a planned list, it can effectively limit waste. However, the success of this approach often hinges on consumers' self-regulation. In practice, many shoppers stray from their lists due to attractive promotions or impulse buys (Pearson & Perera, 2018). On the other hand, critics claim that the flexibility of modern lifestyles renders planning ineffective, as unanticipated dining out or takeout can lead to excess food being wasted (Evan 2014). Additionally, families that regularly purchase the same items every week might find them-selves discarding older food to make room for new purchases, highlighting inconsistency between the food provided and the food consumed (Evan 2014). This suggests that a rigid shopping plan may inadvertently contribute to food waste rather than mitigate it. In the context of SA, food shopping is primarily conducted by men, while women are typically responsible for meal preparation (Azazz & Elshaer, 2022). This kind of organization necessitates communication between partners to ensure that purchases align with meal plan-ning. Based on these diverse arguments, we assume that.

H2. The shopping plan would positively impact FW intention.

2.3. Religiosity

Vitell et al. (2018) contended that religiosity affects how customers behave in scenarios encom-passing ethical concerns. Furthermore, a strong association was assured between religious beliefs and individual consumption behavior (Filimonau et al., 2022a). FW reflects an individual's consumption patterns (Shipman & Durmus, 2017). Earlier scholars (Elshaer et al., 2021; Filimonau et al., 2022a; Filimonau et al., 2022b; Qian et al., 2022) argued that religiosity significantly influences individuals' intentions related to FW in a direct and indirect relationship. This assumption is supported by three main factors. Firstly, belief systems serve as a fundamental basis for shaping attitudes and behaviors (Fishbein & Ajzen, 2010). These belief systems encompass normative, behavioral, and control beliefs, which impact individual's actions over various other influencing predictors (Ajzen, 1991). Experiential research (Tan & Vogel, 2008; Minton et al., 2015; Mathras et al., 2016;) has demonstrated that religiosity plays a pivotal role as a core set of beliefs for the believers. Yet, religious beliefs tend to be more universal and enduring across different regions, periods, and actions than attitude. Secondly, the reducing of FW can be seen as a moral commit-ment, potentially stemming from religious beliefs. It is reasonable to assume that individuals who adhere to religious principles may be more aware of and willing to follow guidelines related to minimizing food wastage. In this regard, Elhoushy & Jang (2021) stated that most religions promote mindful eating and discourage food waste. Wasting food is often seen as a moral transgression, which can lead to feelings of guilt for some religious individuals.

Minton et al. (2015) noted that consumption is linked to religious restrictions. However, these doctrines do not imply that individuals will follow them blindly; rather, the degree of a person's religiosity influences their values and reasoning. Additionally, due to cognitive associations, it is believed that religious thoughts can contribute to trends in food waste. Thirdly, earlier research indicated that religious beliefs are strictly linked to personal intentions concerning FW in certain religious nations. In that sense, Parizeau et al., (2015) and Filimonau et al., (2022b) demonstrated that it is often observed that religion significantly influences individuals' inclination to waste food. For instance, interviews with 60 Lebanon rural families revealed that a strong sense of religiosity inspires avoiding FW (Chammas & Yehya, 2020). A study in SA similarly indicated that individual food wastage intentions may be influenced by religious beliefs (Elshaer et al., 2021). Furthermore, a related study in India found that various religious practices can lead to differing reduced intentions to waste food (Dhar et al., 2021). Consequently, the recent study for-mulates the hypothesis below

H3. Religiosity would be negatively related to FW intention

2.4. Social Media

It is argued that social media has a major impact on excessive food purchasing (Aragoncillo & Orús, 2018). This may be referred to the growing popularity of watching food preparation and cooking videos on social media networks. Consumers today create and share content influenced by their personal preferences and experiences. They also provide a negative or a positive word of mouth and cooperate with product suppliers (Khokhar etal., 2019). These behaviors can lead to both excessive food buying and increased food waste (Zafar et al., 2020). Social media platforms are flooded with different contents, and food has become a key indicator of users' daily lives. Millions of posts feature visually appealing food displays, allowing users to showcase their activities and enhance feelings of satisfaction among their followers (Atanasova, 2024). Nonetheless, the effect of social media on societal norms related to green

practices, e.g. minimizing food waste, may have harmful effects. The study by Azazz and Elshaer (2022), concerning the effect of social media usage on excessive buying and intent of FW in SA revealed that social media usage stimulates unnecessary purchasing, subsequently it has a greater intention toward FW. Thus, we suggest:

H4. Social media would positively impact FW intention

2.5. Attitude Toward Behaviour

According to Ajzen (1991) a person's attitude toward a behavior indicates "the level at which they assess the behavior positively or negatively" (p. 188). The theory of planned behavior (TPB) demonstrates how attitudes influence intentions, which in turn affect behaviors. According to this theory, an individual's attitude towards a particular behavior whether favorable or unfavorable significantly impacts their inten-tion to perform that behavior. This intention strongly predicts actual behavior (Fishbein & Ajzen, 2010). Referring to TPB theory, social behaviors can be understood through their underlying antecedents. Therefore, the intention to engage in a behavior has a noteworthy influence on the actual behavior per-formed. Based on TPB, social behaviors can be understood through the foundational factors that precede them. Thus, the intention to engage in a behavior plays a crucial role in determining actual behavior. With respect to FW, people's attitudes affect their intentions towards FW (Stancu et al., 2016). In contrast, Visschers et al. (2016) proposed that the intention to avoid FW can serve as a stimulus of actual FW. Earlier studies (Graham-Rowe et al., 2014; Zamri et al., 2020; Elhoushy & Jang, 2021; Elshaer et al., 2021) have established a positive and direct correlation between personal attitudes and the intent to decrease FW. This relationship is due to the advantages associated with reducing FW, such as financial savings (Quested et al., 2013; Elhoushy & Jang, 2021). Consequently, Individuals' attitudes influence their intention to waste food. Thus, the following hypothesis has been suggested:

H5. Household attitude toward behavior would negatively impact FW intention.

2.6. Subjective Norms

Ajzen (1991) described subjective norms as pressure coming from network, which can influence them to behave in a particular way. As a result, social norms are regarded as a predictor of intentions concerning FW. Earlier research (e.g., Graham-Rowe et al., 2014; Zamri et al., 2020) has indicated a correlation between subjective norms and the intent to decrease FW. Yet, other studies (e.g., Quested et al., 2013; Schanes et al., 2018) have suggested that subjective norms could add a minimal or unimportant effect on FW behavior at the household level, particularly when compared to more observable behaviors. However, Quested et al. (2013) proposed that this pressure from network has a greater influence on the restaurant setting compared to the household setting. Such results are attributed to individuals at the household level cannot evaluate one another's behavior due to the invisibility of FW, while in a dining area which is public, individuals can observe and influence each other's behavior. Based on this discussion, the subsequent hypothesis is for-mulated:

H6. Subjective norms would positively impact FW reduction intention

2.7. Perceived Behavioral Control

The TPB asserts that the main originator of behavior is intention (Ajzen, 1991). According to Ajzen (1991) PBC reflects an individual's belief in their ability to engage in a specific behavior, considering both the facilitating factors and potential barriers that may impact their action. In this regard, Tobler et al., (2011) and Kim et al, (2020) indicated that factors such as inadequate kitchen skills and the time individuals al-locate to preparing shopping items are significant predictors of FW intention. According to the TPB farmwork, PBC has been found to have a direct influence on FW intention. Furthermore, earlier studies (e.g., Russell et al., 2017; Elshaer et al., 2021; Elhoushy & Jang, 2021) showed a significant relationship between PBC and intent related to FW. Hence, it could be hypothesized that:

H7. Perceived behavior control would positively impact FW intention

3. METHODS

3.1. Sample And Procedures

This research addresses the problem of FW in SA; hence, the questionnaire was given to a sample of Saudis at five main regions: Eastern Province, Riyadh, Madinah, Tabuk, and Najran. The questionnaire forms were distributed by the research team at the different shopping malls in these cities. The team was targeting 1500 valid forms, and we distributed 2000 forms and collected 1650 forms. Of these forms, there were 1572 fully completed and valid for data analysis. Data collection started on the first of January 2025 and continued for three weeks. After discussing the purpose of the study, informed written consent was obtained from all participants before they participated in the study to ensure full

compliance with ethical guidelines and ethical approval by the University Ethical Committee.

Male respondents were higher than female, i.e. 68 % and 32 % respectively. All respondents were above 20 years, and the vast majority (64 %) were between 22 and 40 years old. This is followed by re-spondents aged between 41 and 60 years old (30%). Few respondents were above 60 years old (6 %). All respondents were holding high school education or above. Most of them were holding university degrees (81 %). The rest were either postgraduate (14 %) or high school (5%). Respondents have a high monthly income as 42 % of them have a monthly income between SR 10000 and 20000 (i.e. USD 2.660 and 5320). A good proportion of respondents (36 %) were receiving a monthly income between SR 20001 and 30000 (i.e. USD 5321 and 7978), 17 % were receiving a monthly income between SR 30001 and 40000 (i.e. USD 7979 and 10642) and 4 % received a monthly income above SR 40000 (USD 10642). The household size of respondents varies. For example, 55 % were between 7 and 9 members, 26 % were between 4 and 6 members, 10 % were 12 members or more and 7 % were between 3 and 4 members. Housman (68 %) were more re-sponsible for food shopping that housewife 32%). Respondents eat almost either inside (49%) or outside (51%) their home at food service outlets.

3.2. Instrument And Data Analysis

The research used proper scale to ensure that the collected data is valid and reliable. The food con-sumption culture, subjective norms and food waste intention scales were adopted from Aktas et al., (2018). The shopping plan scale was adopted from Li et al., (2021), religiosity scale from Bhuian et al., (2018) social media scale from Xu et al., (2012), attitude towards behavior scale and perceived behavioral control scale from Halder et al., (2016). The research scale is presented in Appendix 1.

Exploratory analysis is used to assess the quality of measurement scales to validate their reliability. Thus, principal component analysis was adopted. This is followed by confirmatory analysis to validate the findings obtained from the exploratory data analysis. As a final step, structural equation models (SEM) were adopted to test relationship between the eight variables.

4. RESULTS

Based on Table 1 below, responses from the questionnaires had ad a range of values from 1 to 5. Their means ranged from 2.93 to 4.41, with standard deviations from 1.227 to 1.470, meaning that data is scattered and distributed as normal. In addition, the first-order model shows an x^2/ddl ratio equal to 2.515, which is well below 3. The SRMR indicates a value of 0.0371, while the RMSEA has a value of 0.031 because of residuals near zero. The CFI, TLI, NFI and IFI have respective values of 0.942, 0.951, 0.951, 0.962 close to 1. These results suggest that the adjustments made to our model are quite acceptable. The results of the first order are shown in figure 1. All factors have factors loading above 0.7 and none was omitted from analysis. The results of Skewness and kurtosis coefficients contradicted the null hypotheses (Kline, 2015) by indi-cating satisfactory values. In the light of these results, we note that all distributions and variables were equally distributed (Table 1).

Table 1: Descriptive Statistics.

Abr.	Minimum	Maximum	Mean	St. Deviation	Skewness	Kurtosis
Food Consumption Culture						
FCC1	1.0	5.0	4.37	1.361	-1.302	.412
FCC2	1.0	5.0	4.41	1.374	-1.289	.467
FCC3	1.0	5.0	2.99	1.293	-1.277	.426
Shopping Plan						
SP4	1.0	5.0	3.28	1.319	-1.367	.143
SP5	1.0	5.0	3.33	1.345	-1.112	.186
SP6	1.0	5.0	3.32	1.382	-1.049	.123
SP7	1.0	5.0	3.79	1.401	-1.163	.027
SP8	1.0	5.0	3.42	1.328	-.961	.057
SP9	1.0	5.0	3.21	1.302	-.938	.101
Religiosity						
R10	1.0	5.0	4.29	1.406	-1.832	.543
R11	1.0	5.0	3.72	1.463	-1.844	.532
R12	1.0	5.0	3.53	1.470	-1.772	.642
R13	1.0	5.0	3.49	1.309	-1.615	.697
R14	1.0	5.0	3.51	1.328	-1.663	.567
R15	1.0	5.0	3.63	1.337	-1.481	.593
R16	1.0	5.0	2.93	1.326	-.998	.665
Social media						
SM17	1.0	5.0	4.38	1.227	-1.126	.197
SM18	1.0	5.0	3.72	1.231	-1.133	.222
SM19	1.0	5.0	3.57	1.239	-1.145	.365
SM20	1.0	5.0	3.88	1.252	-1.074	.450
Attitude						
A21	1.0	5.0	4.05	1.389	-1.279	.534
A22	1.0	5.0	3.92	1.375	-1.327	.521
A23	1.0	5.0	3.87	1.296	-1.061	.534
A24	1.0	5.0	4.03	1.272	-1.288	.563
Subjective Norms						
SN25	1.0	5.0	3.76	1.302	-1.461	1.161
SN26	1.0	5.0	3.83	1.319	-1.402	1.048
SN27	1.0	5.0	3.94	1.351	-1.493	1.327
SN28	1.0	5.0	4.22	1.362	-1.518	1.132
SN29	1.0	5.0	4.28	1.293	-1.561	1.113
SN30	1.0	5.0	3.62	1.280	-1.539	1.103
SN31	1.0	5.0	3.52	1.263	-1.491	.977
Perceived Behavioral Control						
PBC32	1.0	5.0	4.39	1.367	-.946	1.093
PBC33	1.0	5.0	4.26	1.381	-.951	1.062
PBC34	1.0	5.0	3.84	1.412	-.983	1.119
PBC35	1.0	5.0	3.29	1.423	-.919	.965
Food Waste Intention						
FWI36	1.0	5.0	3.89	1.362	-1.427	.527
FWI37	1.0	5.0	3.73	1.383	-1.442	.551
FWI38	1.0	5.0	3.19	1.394	-1.405	.583
FWI39	1.0	5.0	3.57	1.403	-1.398	.496

Model fit: ($\chi 2$ (772, N = 1572) = 1942 $p < 0.001$, normed $\chi 2 = 2.515$, RMSEA = 0.031, SRMR = 0.0371, CFI = 0.942, TLI = 0.951, IFI= 0.962, NFI = 0.951, *** $p < 0.001$.

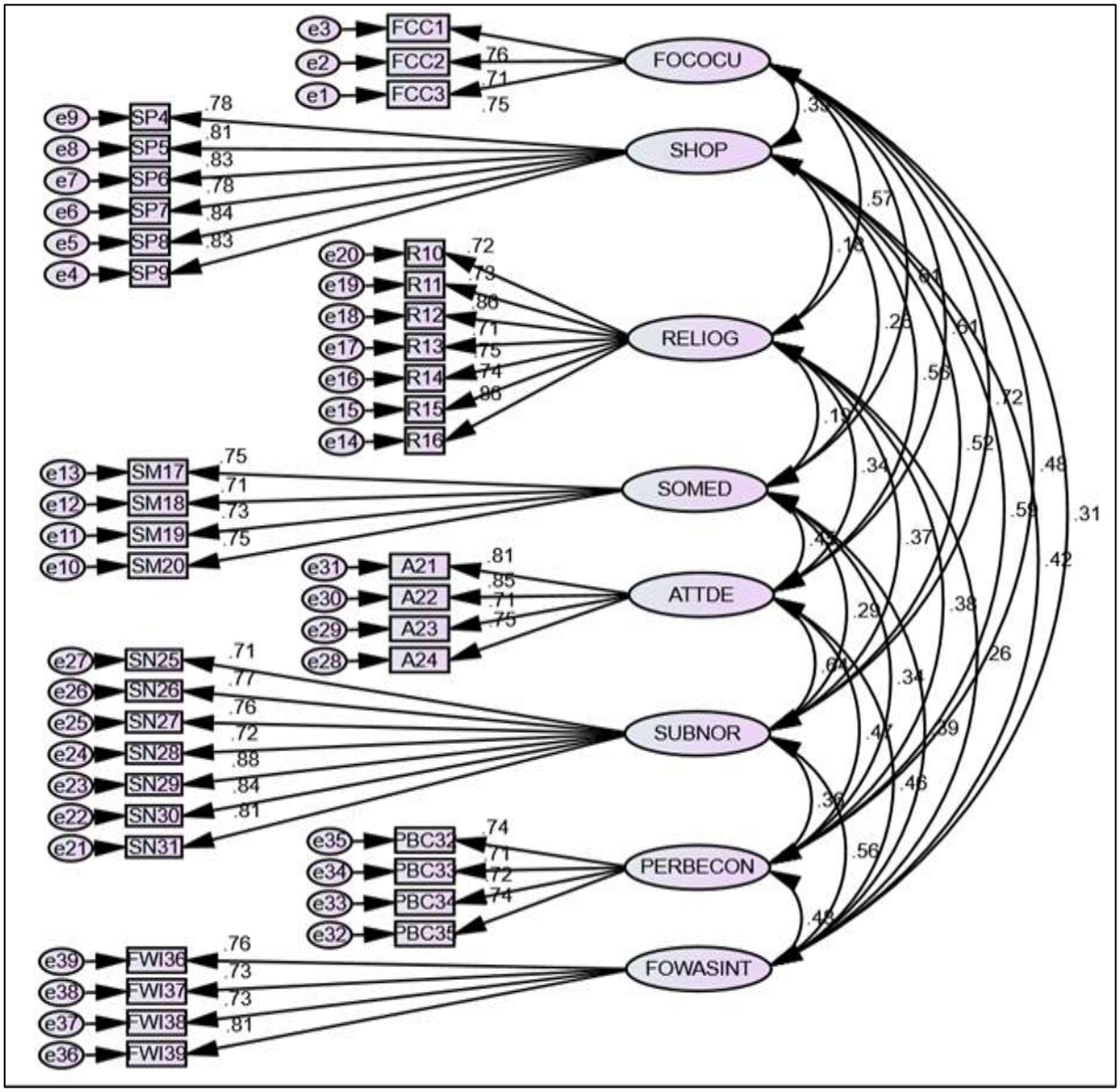

Figure 1: The first-order model (The standardized regression weights of the first-order model resulted from AMOS software).

4.1. Convergent And Discriminant Validity

Once the results of the confirmatory factor analysis have been determined, it's time to test whether the variable items are correlated. To do this, it is necessary to calculate convergent validity, through the CR, and the AVE. As Table 2 shows, convergent validity was assured. As for discriminant validity, this involves verifying the square root of the AVE for each factor that must be more than the relationship it has with the other factors or not. Table 2 presents that discriminant validity was ensured for the eight constructs (Hair et al, 2017).

Table 2: Convergent And Discriminative Validity

Factors	CR	AVE	MSV	ASV	1	2	3	4	5	6	7	8
FCC (*a = 0.895)*	.784	.548	.536	.427	**.736**							
FCC1	.76											
FCC2	.71											
FCC3	.75											
SP *(a = 0.963)*	.921	.659	.530	.441	.645**	**.812**						
SP4	.78											
SP5	.81											

SP6	.83											
SP7	.78											
SP8	.84											
SP9	.83											
R *(a = 958)*	.910	.592	.537	.429	.628**	.661**	**.769**					
R10	.72											
R11	.73											
R12	.86											
R13	.71											
R14	.75											
R15	.74											
R16	.86											
SM *(a = 0.915)*	.825	.541	.534	.478	.732**	.641**	.640 **	**.735**				
SM17	.75											
SM18	.71											
SM19	.73											
SM20	.75											
A *(a = 0.934)*	.862	.611	.540	.459	.641**	.617**	.628 **	.718 **	**.782**			
A21	.81											
A22	.85											
A23	.71											
A24	.75											
SN*(a = 0.962)*	.919	.618	.527	.513	.715**	.728**	.733 **	.731 **	.683**	**.786**		
SN25	.71											
SN26	.77											
SN27	.76											
SN28	.72											
SN29	.88											
SN30	.84											
SN31	.81											
PBC *(a = 0.914)*	.818	.529	.540	.448	.537**	.672**	.640 **	.729 **	.735**	.701 **	**.727**	
PBC32	.74											
PBC33	.71											
PBC34	.72											
PBC35	.74											
FWI (*a = 0.926)*	.844	.575	.527	.440	.652**	.687**	.665 **	.645 **	.612**	.726 **	.655 **	**.758**
FWI36	.76											
FWI37	.73											
FWI38	.73											
FWI39	.81											

CR = Composite Reliability; AVE = Average Variance Extracted; MSV = Maximum Shared Value; ASV=Average Shared Value

As recommended by Fornell & Larcker (1981), correlation variables should be larger than off-diagonal values. This implies that the discriminant validity of the factors has been respected. In addition, the diagonal values, representing the square roots of the factor-specific AEVs (Table 2, in bold), should not exceed the intercorrelation scores for each variable. The results of correlations presented in Table 3.

Table 3: Correlations (Developed By SPSS)

		FCC	SP	R	SM	A	SN	PBC	FWI
FCC	Pearson Correlation	1							
	Sig. (2-tailed)								
	N	1572							
SP	Pearson Correlation	.645**	1						
	Sig. (2-tailed)	.000							
	N	1572	1572						
R	Pearson Correlation	.628**	.661**	1					
	Sig. (2-tailed)	.000	.000						
	N	1572	1572	1572					
SM	Pearson Correlation	.732**	.641**	.640**	1				
	Sig. (2-tailed)	.000	.000	.000					
	N	1572	1572	1572	1572				
A	Pearson Correlation	.641**	.617**	.628**	.718**	1			
	Sig. (2-tailed)	.000	.000	.000	.000				
	N	1572	1572	1572	1572	1572			

SN	Pearson Correlation	.715**	.728**	.733**	.731**	.683**	1		
	Sig. (2-tailed)	.000	.000	.000	.000	.000			
	N	1572	1572	1572	1572	1572	1572		
PBC	Pearson Correlation	.537**	.672**	.640**	.729**	.735**	.701**	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		
	N	1572	1572	1572	1572	1572	1572	1572	
FWI	Pearson Correlation	.652**	.687**	.665**	.645**	.612**	.726**	.655**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	
	N	1572	1572	1572	1572	1572	1572	1572	1572
**. Correlation is significant at the 0.01 level (2-tailed).									

4.2. The Results Of Research Hypotheses

Once the validity and reliability of the scale have been verified, structural equation modelling is required to test the impact of our seven independent variables on FWI. The model has a chi-square ratio on its x^2/ddl degree of freedom equal to (2.5). This is a very acceptable result, since it is less than 3. As for the RMSEA index, it is equivalent to 0.031, which is very acceptable as it is very close to 0. The indices NFI = 0.991, TLI = 0.991, IFI=0.989, RFI=0.987 and CFI = 0.996 certify the values suggested to confirm a excellent fit. The SRMR is equivalent to 0.0183, which is tolerable as it is also near zero. All hypotheses were examined, showing significant relationships with $p < 0.001$ and $p < 0.05$ (Table 4, Figure 2).

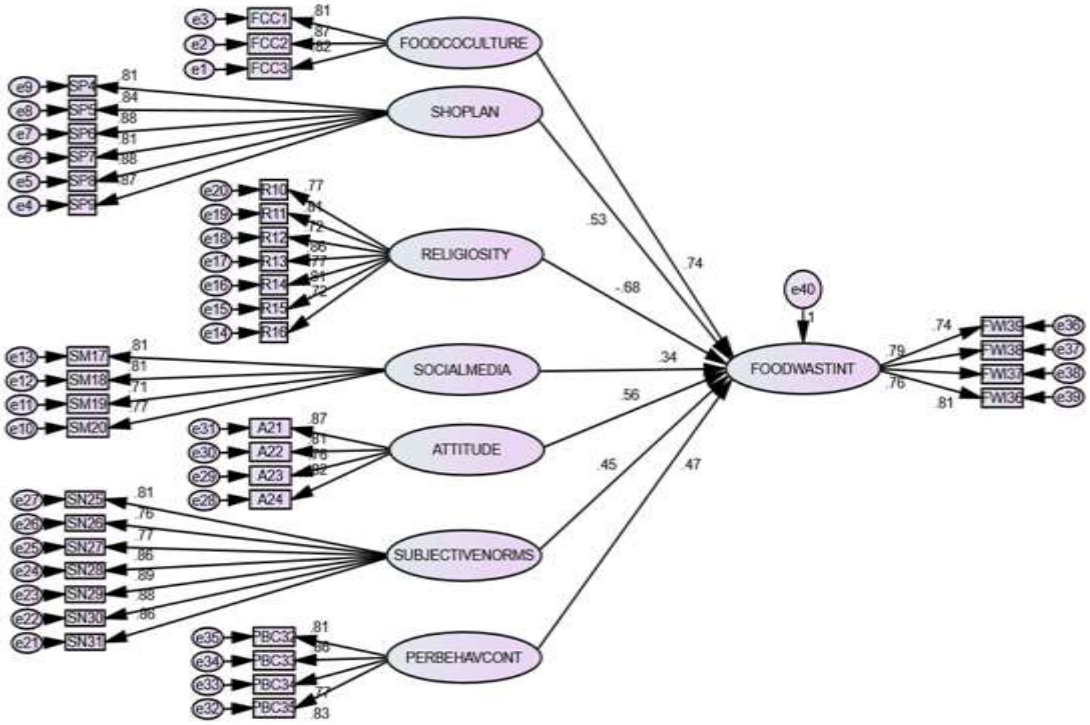

Figure 2: The Structural Model (The Structural Model That Shows The Causal Relationship From AMOS Software).

Table 4: Result Of The Structural Model.

Hypotheses	(β)	P	(t-V)	Hypothesis
H1: Food consumption culture would positively impact FW intention.	.739	***	7.367	Supported
H2: The shopping plan would positively impact FW intention.	.529	***	5.742	Supported
H3: Religiosity would be negatively related to FW intention	-.680	***	6.683	Supported
H4: Social media would positively impact FW intention.	.339	***	9.441	Supported
H5: Household attitude toward behavior would negatively impact FW intention.	.559	***	9.537	Supported
H6: Subjective norms would positively impact FW reduction intention.	.450	0.02	14.045	Supported
H7: Perceived behavior control would positively impact FW intention.	.470	0.01	11.954	Supported

"Model fit: (χ2 (700, N = 1572) = 1750 p < 0.001, normed χ2 = 2.5, RMSEA = 0.031, SRMR = 0.0221, CFI = 0.996, TLI = 0.991, IFI= 0.989, NFI = 0.991, *** p < 0.001".

The findings attest that the FCC significantly and positively influences FWI (β= +0.739, p <0.001), the SP significantly and positively impacts FWI (β = +0.529, p < 0.001), the R significantly and negatively influences FWI (β= - 0.680, p < 0.001), the SM significantly and positively affects FWI (β= + 0.339, p < 0.001), the A toward behavior significantly and positively impacts FWI (β= + 0.559, p < 0.001), the SN significantly and positively influences FWI (β= + 0.45, p < 0.02) and we also found that the PBC significantly and positively impact FWI (β= + 0.47, p <0.01).

To assess the robustness of the structural model, we calculated the R^2. The coefficient indicates a significant and substantial value of 0.785, which represents in this study the ratio of the FWI justified by the seven independent variables. Therefore, using them, we can explain approximately 78.5% of the variance in FWI in the regression model

5. DISCUSSIONS AND IMPLICATIONS

Both food security and environmental sustainability are pushing policy makers, scholars and ad-ministrators of food-related organizations to address the issue of FW since it has a substantial effect on society, economy and environment. The current research addresses this global issue in one of

the prominent nations in FW, i.e. SA. The research attempts to understand the roots of household FW by exploring the factors that influence people's intention to waste food in SA to delve into this issue to deal with such var-iables properly and provide implications to control this phenomenon.

The results showed that the consumption culture, as part of national culture, encourages households to buy large portions of food more than needed, especially for their guests to express hospitality, encour-aged them to positively waste food. This supports the results of Elshaer et al., (2021) that the culture of generosity and hospitality made Saudi offer food more than needed and waste unused food. The Saudi culture is collective; hence, Saudi gather with their family members and peers almost on daily basis. Of-fering extra food and drinks for guests is an expression of hospitality to guests, albeit it leads to a high rate of FW at households. The results confirmed that this culture is the prominent factor that significantly leads to FW in the household. This culture was supplemented with the high income of households in SA (Sobaih 2023) making excessive buying more apparent and leading to more FW.

The second prominent variable that significantly and positively influences FW in Saudi households is favorable attitude towards wasting food. It was surprising that households do not see wasting food as a bad thing nor its reduction as beneficial; therefore, this shaped their intention of FW. This supports the notion of TBP and the results of previous research (e.g. Elshaer et al., 2021; Elhoushy & Jang, 2021) that favorable attitude towards behaviours significantly affect their behavioural intention. The third variables that sig-nificantly and positively influences FW in Saudi households is absence of shopping plan. This reflects that Saudi households they do not develop proper shopping plan as they do not check what they have at home before shopping and do not develop proper list of items to buy as they need. This results in buying more food than needed and buying some items that they already have at home leading to FW. This supports previous research (Evan, 2014; Pearson & Perera, 2018) that absence of shopping plan leads to buying unneeded food items resulting in wasting some of these items.

The results showed that Saudi households are influenced by other households, which significantly and positively affect their intention of FW. They found themselves unmotivated by their friends and family members to reduce food waste as they believe it is unnecessary action. They are not encouraged by their friends, family and other households to save FW for protecting environment, hence, they develop FW in-tention. This result is in line with TBP and the work of Elshaer et al. [16] who also confirmed a positive significant influence of subjective norms on FW intention. Similarly, PBC was found to significantly and positively influences FW intention of Saudi households. The results showed that Saudi households do not want to produce less food waste. They found it easy to waste and difficult to save it. Simply, they cannot easily control their action; hence, developing positive behavioral intention of FW. This supports earlier studies (Russell et al., 2017; Elshaer et al., 2021; Elhoushy & Jang, 2021), which also found significant relationship between PBC and FW intention. Furthermore, social media was found to positively and sig-nificantly affect FW of Saudi households. The results confirm that households' regular use of social posi-tively developed their FW intention, which supports the work of Azazz and Elshaer (2022), who found that social media usage stimulates unnecessary purchasing, subsequently it has a greater intention toward FW.

The results, however, showed that religiosity was a prominent variable that significantly, but nega-tively, affected FW in households. This contradicts the Elshaer et al., (2021) and Sobaih (2023), who found insignificant impact of religiosity on FW in SA, especially in Saudi restaurants. This result means that the Saudis realize that their religious beliefs direct their intention, in this case, is the FW intention. Saudi are categorised as religious, Islamic, society and their faith and beliefs strongly encourage to take care of re-sources, e.g. food and save the environment; hence, this negatively affect their intention to FW. Notwith-standing this, religiosity alone was not enough to prevent or reduce FW in Saudi households as still ap-parent. The results showed that all other factors have collectively more positive influence on FW than the negative influence of religiosity, which may justify the continuity of FW in Saudi households.

The results add to understanding households' FW in nations, where this problem is prominent. The research identified the factors that shaped the FW intention of households in SA. The research extends the TBP (Ajzen, 1991) by confirming the impact of its dimensions: "SN", "PBC" and "A" on FW intention and adding new variables that influence FW intention, which are food consumption culture, social media, shopping plan and religiosity. The research provides an intensive model that enables scholars to understand the problem of household FW in SA.

The results offer some implications for policy makers and any organisation interested in managing

FW among Saudi household. The results showed a need for media campaign to raise the awareness of Saudi households about the negative consequences of FW on environment, society and economy. This media campaign showed show best practices of green consumption culture that households could adopt to manage FW. Best practices could include raising consumers' awareness about the positive outcomes of reducing FW and developing proper shopping plans. Media campaigns should build religiosity and use religious leaders to raise awareness of households since religiosity was able to negatively significantly affect FW intentions of households. The integration of social media in this campaign is crucial since it drives the consumers' FW intention. Raising the awareness and knowledge of households about FW would encourage them to develop negative attitude towards FW. It would also enable households' members to control their practices which would affect their intention of FW.

6. CONCLUSION

This study explores the problem of FW among Saudi household using an intensive model that integrates TBP framework with other variables, e.g. consumption culture, social media, shopping plan and religiosity. The results of AMOS-SEM confirmed the framework of TBP in the Saudi household FW. More specifically, the results confirmed that the favorable attitude of households toward wasting food, subjective norms and their perceived behavioral control have positive significant effects on their FW intention. Ad-ditionally, the results showed that consumption culture, social media and absence of proper shopping plan positively and significantly affects households FW intention. On the other side, religiosity was a prominent variable that significantly, but negatively, affected the Saudi household FW. Despite this finding, the FW rate is still high due to the collective influence of other factors. Based on these findings, the study provided some implications for researchers, policy makers and organizations interested in FW management.

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Appendix 1: The research scale

Abbrevation	Item
Food Consumption Culture (Aktas et al., 2018)	
FCC1	It is my culture to serve much food to show my hospitality
FCC2	I tend to buy a few more food products than I need
FCC3	I serve more food than can be eaten to show my hospitality
Shopping Plan (Li et al., 2020)	
SP4	I check what I have at home before shopping
SP5	I plan for a meal before I go shopping
SP6	I make a shopping list before going to shopping
SP7	I estimate how much of each item I would need before I shopping
SP8	I buy only items on my shopping list
SP9	I avoid buying items that I didn't originally plan to buy
Religiosity (Bhuian et al., 2018)	
R10	My faith involves all of my life
R11	In my life, I experience the presence of God
R12	I am a religious person and I let religious considerations influence my everyday affairs
R13	Nothing is as important to me as serving God as best as I know how
R14	My religious beliefs are what really lie behind my whole approach to life
R15	I try hard to carry my religion over into all my other dealings in life
R16	One should seek God's guidance when making every important decision
Social media (Xu et al., 2012)	
SM17	I frequently upload something on social media.
SM18	I frequently view something on social media.
SM19	I frequently share something on social media
SM20	I frequently reply to something on social media
Attitude (Halder et al., 2016)	
A21	I would like to produce less food waste at home
A22	In my opinion, food is worthwhile, so wasting it is a bad thing
A23	For me, the reduction in food waste at home is beneficial.
A24	It is necessary to promote the prevention of food waste production.
Subjective Norms Aktas et al., 2018)	
SN25	My friends think my efforts toward reducing food waste are necessary
SN26	My family thinks my efforts toward reducing food waste are necessary
SN27	My friends think my efforts towards preparing food from leftovers are necessary
SN28	My family thinks my efforts towards preparing food from leftovers are necessary
SN29	The people who important for me expect me to be environmentally friendly.

SN30	The people who are important to me suggest that I have to take into account environmental protection activities
SN31	Families, friends, and society are expecting to work for food waste reduction at home
Perceived Behavioral Control (Buchner et al., 2012)	
PBC32	If I want, I can produce less food waste.
PBC33	Not producing food waste at home is not easy for me.
PBC34	Less food waste production will depend only on myself
PBC35	I produce less food waste, regardless of whether or not there are incentives in the community
Food Waste Intention (Aktas et al., 2018)	
FWI36	I have no intention to eat leftover food
FWI37	I throw away trimmings' food
FWI38	I do not generate as little food waste as possible
FWI39	I have no intention to find a use for food trimmings