

Piloting A Primary Measurement Model For Sociocultural Influences On Household Food Waste Behaviour In Oman

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Abstract:

Food consumption behaviour at households is one of the most significant drivers of food waste worldwide. The Sultanate of Oman is considered one of the countries with the highest rates of household food waste. This research article presents the results of a pilot survey of a convenience sample of 48 Omani households. The research aims to test the reliability and validity of a questionnaire developed to measure the impact of two important sociocultural factors on food waste that characterize Omani society as a Muslim community: religiosity and the Ramadan meal. Using structural equation modelling, the results of the internal consistency and validity assessment tests demonstrate the potential for integrating these two factors as sociocultural variables to understand household food waste behaviour. This highlights the importance of these factors in developing more accurate predictive measurement tools to understand food waste behaviour in societies where sociocultural influences are prominent in everyday life. This article opens up avenues for future research on food waste.

Keywords: Food Waste - Sociocultural Factors - Ramadan Meals - Religiosity - Measurement Items - Oman - Pilot Study.

1. INTRODUCTION

Food Waste (FW) has become one of the problems that hinders global sustainability, which is included in the United Nations Sustainability Development Goals (SDGs). Annually, the world rate of FW reaches 17% that equal to about one billion tons of food (Bolwig et al., 2021; Forbes et al., 2021; Forbes et al., 2024; Hensel K, 2022). Most of this quantity is household food waste (HFW). In 2022, global HFW was 61% (631 million tonnes) (Forbes et al., 2024). Like other Gulf Cooperation Council (GCC) countries, the Sultanate of Oman (Oman) is among the top food wasters in the world, especially in the month of Ramadan (Abiad & Meho, 2018; Al-Fawaz, 2015; Al-Khateeb et al., 2021; Al-Saidi et al., 2021; Al-Zahrani et al., 2019; Awadh I, 2020; Baig, Al-Zahrani, et al., 2019; El Bilali & Ben Hassen, 2020; ESCWA, 2017). According to the reports of the Food Waste Index (FWI), HFW in Oman was estimated at 451,415 tonnes in 2022, with an estimation of 95 kg per capita a year, which is above the global average of 74 kg (Forbes et al., 2021). Muscat Daily (2022) showed HFW of 460,000 tonnes. The per capita rate increased up to 99 kg in 2024 (Forbes et al., 2024). The municipality of Muscat reported that 18% of the solid waste of landfills was FW (Baawain et al., 2017; El Bilali & Ben Hassen, 2020). Around one-third of landfills in Oman are FW (Be'ah, 2020b), and HFW accounts for a third of all FW, especially in the month of Ramadan and Eid (Be'ah, 2020a, 2020b). In the first ten days of a month of Ramadan, about 13,000 tons of food were wasted, which could feed 374,135 people daily (Be'ah, 2020b; Kutty S, 2022).

2. Rational and Objective

Although Oman is a Muslim country and its local people are known as religious (Hossain & Rizvi, 2016), the high estimates of household food waste indicate a significant problem that requires a study of the relationship between sociocultural factors and food waste behaviour among Omani households, particularly religiosity and food waste behaviour during Ramadan. The data on FW in Oman is of low confidence (Forbes et al., 2021). Very few studies address HFW in Oman, as this topic in general is marginalized (Baig, Gorski, et al., 2019; Berjan et al., 2018; El Bilali & Ben Hassen, 2020). Therefore, this research article aimed to pilot and validate research instruments designed to assess the influence of religiosity and Ramadan meal as sociocultural factors (SCFs) on of household food waste behavior (HFWB) among a sample of Omani households.

3. LITERATURE REVIEW

FW is food, including drinks, intended for human consumption, but removed from the human food supply chain (Forbes H. et al., 2024). As previously indicated, the household is the main driver of FW at the consumption stage (Pilone et al., 2023). A household is a single or group of persons who share a common meal at a housing unit for more than three months (Casimir & Tobi, 2011; OECD, 2007; Randall, 2018; UNEP, 2021; UNSD, 2022). HFW can be accrue inside and outside the home (Kaur et al., 2021). Food may be wasted due to behavioral or sociocultural factors (Aschemann-Witzel et al., 2017; Diaz-Ruiz, Costa-Font, López-i-Gelats, et al., 2018). Socio-cultural factors are considered major FW factors (Abiad & Meho, 2018; Chammas & Yehya, 2020; Diaz-Ruiz, Costa-Font, & Gil, 2018; Elshaer et al., 2021; Filimonau, Mika, et al., 2022; Karunasena et al., 2021; Schanes et al., 2018). However, these factors have not received sufficient research (Ananda et al., 2021; Baig, Al-Zahrani, et al., 2019; Elimelech et al., 2023; Lourenco et al., 2022; Secondi et al., 2015). Few studies address the religious influence on FWB in the context of the Islamic and Arab context (Elhoushy & Jang, 2021; Elshaer et al., 2021). Literature confirms gaps in understanding the relationship between HFW and SCFs (Diaz-Ruiz, Costa-Font, López-i-Gelats, et al., 2018). Food may be wasted due to behavioral or sociocultural factors (Aschemann-Witzel et al., 2017; Diaz-Ruiz, et al., 2018). The social and cultural factors often overlap, as most studies do not differentiate between cultural and social factors (Alsheyadi & Bathmanathan, 2025). Some studies consider The Ramadan meals under religious values (Alsheyadi & Bathmanathan, 2025). More research is necessary to understand religious and related social and cultural factors in the Arabic region (Abiad & Meho, 2018; El Bilali & Ben Hassen, 2020). There is a need for more empirical research that investigates the causes of FW (Alsawah et al., 2022; Alshabanat et al., 2021; Al-Zahrani K & Baig M, 2014; Baig, Al-Zahrani, et al., 2019; Baig et al., 2022; Baig, Gorski, et al., 2019). Quantitative research on FW is needed (Alsheyadi & Bathmanathan, 2025; Ben Hassen et al., 2022; El Bilali & Ben Hassen, 2020). Religiosity is a belief in the values and teachings of God that is reflected in the degree of commitment to good behaviours practised in practice. (Filimonau, Kadum, et al., 2022; Hassan et al., 2022; Singh et al., 2021). Religiosity is considered one of the most influential SCFs towards preventing FW (Elshaer et al., 2021; Graham-Rowe et al., 2015; Mak et al., 2020; Principato et al., 2021; Schanes et al., 2018). A study from Iraq by Filimonau et al. (2022) showed that religiosity has low effect on FWB. Therefore, the research proposed RE has a limit negative effect on FWB among Omani households. Ramadan, the holy month in the Islamic calendar, is a religious occasion that is supposed to be a time for fasting and practicing reducing food waste and sharing food with the poor as Islamic teachings encourage responsible food consumption. However, the reality proves otherwise, as extravagance in food preparation during Ramadan (Hornung et al., 2023; Jan Mohamed et al., 2013). For example, high rates of FW were recorded in most Islamic countries during Ramadan, such as the GCC countries (Aktas et al., 2018; Baig, Al-Zahrani, et al., 2019; Baig et al., 2022; Capone et al., 2016; Elimelech et al., 2023; Ismail et al., 2022; Secer et al., 2023; Sopian, 2022; Yildirim et al., 2016; Bolwig et al., 2021), Malaysia (Jan Mohamed et al., 2013), and Turkey (Secer et al., 2023). Therefore, the research hypothesized RM significantly influence FWB among Omani households.

4. MATERIALS AND METHODS

A convenient sample of Omani families was targeted for a pilot quantitative survey. The convenience sampling technique in quantitative research is acceptable and appropriate (Etikan, 2016; Golzar J et al., 2022). 48 responses were collected, which is more than the minimum recommended for a pilot survey (Brink, 1998; Hertzog, 2008). The pilot test aimed to evaluate the reliability of the measurements. The questionnaire was distributed via WhatsApp application, as a commonly used social media utilizing personal networks. The research used Google Forms, which is digital platform that enable the

questionnaire to be distributed via social media networks (Aka & Buyukdag, 2021; Azazz & Elshaer, 2022). Google Forms is supported Excel sheet window and avoids input errors. The data were processed and analyzed through SPSS Statistics application (Version 29) and JASP software (version 0.18.3) for statistical analysis and reliability (Goss-Sampson, 2024a, 2024b; JASP Team, 2024; Love et al., 2019; Rogers, 2024). Structural Equation Modelling (SEM) in JASP allowed us to benefit from factor analysis. The design of the survey instrument items was based on questions tested in similar research on FW, which contributes primarily to the content validity (Cobern & Adams, 2020). **Table 1** shows the survey measurement items of sociocultural factors and their sources of adoption.

Table 1. The Survey Measurement Items of Sociocultural Factors

Variable	Item Code	Measurement Items	Source of adoption
Food Waste Behavior (FWB)	FWB1	My household understands that food waste is a problem.	(Osail et al., 2022)
	FWB2	Eating with our families and friends contributes to more food waste.	(Aktas et al., 2018; Stancu et al., 2016)
	FWB3	When we have guests, we cause more food waste.	(Aktas et al., 2018)
	FWB4	I intend to consume all purchased foods and waste no food at all.	(Aka & Buyukdag, 2021; Elshaer et al., 2021; Secer et al., 2023)
	FWB5	Producing only very little food waste is a normal matter.	(Aka & Buyukdag, 2021)
	FWB6	I keep telling friends and family to reduce food waste.	(Secer et al., 2023)
Religiosity	RE1	Religion encourages us not to waste food.	(Abdelradi, 2018; Elimelech et al., 2023)
	RE2	My religious believe influence me to avoid food waste.	(Azazz & Elshaer, 2022)
	RE4	We practically avoid food waste as a result of what our religion commands us to do.	(Azazz & Elshaer, 2022)
Ramadan Meals (RM)		During the month of Ramadan;	
	RM1	Food waste increases in my household	(Aktas et al., 2018)
	RM2	We cook more than usual.	(Aktas et al., 2018; Secer et al., 2023)
	RM3	Hosting guests causes more food waste	(Secer et al., 2023)
	RM4	We make unplanned meals which causes food waste.	(Aktas et al., 2018)
	RM5	Feeling hungry leads to more food being prepared, resulting in food waste.	(Odabasi & Argan, 2009)

5. RESULTS AND DISCUSSION

5.1 Sample Profile

Table 2 shows pilot demographic findings indicate that the sample represents 6 out of 11 Omani governorates. Most of the sample's responses were collected from Muscat and Al Batinah North (56% and 29%, respectively). 62.5% of that sample were Males and 37.5% were Females. 60.4% of the

respondents were Adults aged from 26 to 44 years, 37.5% were aged 45 years and above, while only 2% of respondents were young adults of 18 to 25 years old. All of these findings reflected clear acceptable frequencies.

Table 2. Demographic Characteristics of Pilot Sample

Variable	Frequency	%
location (Governorate)		
Ad Dakhiliyah	2	4.167
Ad Dhahirah	1	2.083
Al Batinah North	14	29.167
Al Batinah South	2	4.167
Ash Sharqiyah South	2	4.167
Muscat	27	56.25
Total	48	100
Respondent Gender		
Males	30	62.5
Females	18	37.5
Respondent age group		
Young adult (18-25 years	1	2.083
Adult (26-44 years)	29	60.417
Middle-aged (45-59), and above	18	37.5
Total	48	100

5.2 Internal Consistency

Internal consistency or Cronbach's Alpha reliability of the constructs is the variance in test scores explained by the constructs, scaled by the coefficient omega (Cronbach's alpha) as recommended in recent reseach (Alharbi et al., 2019; Dijkstra & Henseler, 2015; George & Mallery, 2020; J. F. Hair et al., 2024; JASP Team, 2024; Sarstedt et al., 2021; Taherdoost, 2016). According to Kennedy (2022), the sample size using Cronbach's alpha statistics should be at least 40, which is applicable for this research. Alpha ranges between 0 and 1 (George & Mallery, 2020). As shown in **Table 3**, the estimated Cronbach's alpha for the pilot survey indicates acceptable internal consistency (Alharbi et al., 2019; J. F. Hair et al., 2024; Phong & Minh, 2022; Ponis et al., 2017; Rasool et al., 2021; Sarstedt et al., 2021; Sharma, 2016). Cronbach's alpha values of 0.60 to 0.70 are acceptable to pilot as exploratory research (Alharbi et al., 2019; Fan & Le, 2011; Rasool et al., 2021; Saeed & Kassim, 2017; Tewodros, 2017). Although the alpha point estimate of all constructs predicts reliability at a good degree, some items measuring religiosity (RE2 and RE3) are still under the recommended threshold of 0.60 (J. F. Hair et al., 2024; Sarstedt et al., 2021; Sharma, 2016). Internal consistency also can be assessed through the average item-rest correlation (IBM, 2019). The item-rest correlation is the correlation between the items of a construct (Zijlmans et al., 2018). The minimally required values of item-rest correlations are 0.20 (Momani, 2015; Zijlmans et al., 2018). As shown in **Table 3**, all items were at acceptable levels of correlation range between 0.364 and 0.770, reflecting good internal consistency.

Table 3. Research measurement items reliability

Construct	Item	Cronbach's α (If item dropped)	Cronbach's α	Item-rest correlation
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				(Point estimate	
Food Behavior (FWB)	Waste	FWB1	0.703	0.791	0.642
		FWB4	0.661		0.681
		FWB6	0.780		0.572
Ramadan (RM)	Meal	RM1	0.856	0.877	0.686
		RM2	0.837		0.770
		RM3	0.852		0.702
		RM4	0.842		0.743
		RM5	0.868		0.637
Religiosity (RE)		RE1	0.763	0.689	0.364
		RE2	0.586		0.471
		RE3	0.391		0.630

5.3 Structural Equation Modeling (SEM) Assessment

There are two types of reliability measures derived from confirmatory factor analysis: the composite reliability (CR) and the average variance extracted (AVE) (Hair J et al., 2014).

5.3.1 Composite Reliability

CR is a SEM-based assessment (Cheung et al., 2024; Taherdoost, 2016). CR is known as McDonald's omega and construct reliability (Cheung et al., 2024). In **Table 4**, CR values show that sociocultural factors have high composite reliability. CR for RM and RE were 0.879 and .602 respectively above the acceptable threshold of 0.60 (Bell & Ulhas, 2020; Rasool et al., 2021). These values were close to the Cronbach values.

5.3.2 Average Variance Extracted

VE is an average percentage of items that represents a variance of measurement error captured by a construct forming a latent construct (Cheung et al., 2024; J. Hair et al., 2010; JASP Team, 2024). AVE should not be less than 0.5 for adequate convergent validity (Bell & Ulhas, 2020; Cheung et al., 2024; Fornell & Larcker, 1981; J. Hair et al., 2010; Mondéjar-Jiménez et al., 2016; Rasool et al., 2021; Sarstedt et al., 2021). **Table 4** shows that RM (0.589) had acceptable validity, while RE (0.382) indicated potential validity issues. However, the AVE is merely a complementary procedure to determine validity (Fornell & Larcker, 1981).

5.3.3 Convergent Validity

Convergent validity is the extent to which items of measurement are strongly linked (Taherdoost, 2016). Convergent validity is evaluated by average variance extracted (AVE) and the composite reliability (CR) (Bell & Ulhas, 2020; Cheung et al., 2024; Rasool et al., 2021), and standardized factor loadings (Cheung et al., 2024). Factor analysis is a multivariate statistical evaluation to refine and simplify a research measurement model for better validity (Hinkin, 1998; Pallant, 2020; Phong & Minh, 2022; Williams et al., 2010). There are two ways for factor analysis; either by Exploratory Factor Analysis (EFA), or Confirmatory Factor Analysis (CFA) (Pallant, 2020; Williams et al., 2010). According to Taherdoost (2016), construct convergent validity is a must in CFA. Therefore, CFA was used to verify construct convergent validity (J. F. Hair et al., 2020) and average variance extracted (AVE) (Fornell & Larcker, 1981).

5.3.4 CFA-Factor Loadings

Two CFA analyses were conducted to estimate the correlations among the constructs. As shown in **Table 4**, the initial factor loading found all items of sociocultural variables had high loadings above the threshold of 0.40, which is an acceptable level for convergent validity (Cheung et al., 2024; Rasool et al., 2021).

Table 4. CFA- Convergent Validity

Construct	Items	Standardized Factor Loading estimate (λ)		AVE	Coefficient ω CR
		Initial	Final		
	FWB1	0.815	0.815		
	FWB2	0.098	Dropped		

FWB	FWB3	0.366	Dropped	0.559	0.796
	FWB4	0.809	0.818		
	FWB5	0.405	(0.391) Dropped		
	FWB6	0.816	0.816		
RM	RM1	1.037	1.031	0.589	0.879
	RM2	1.095	1.096		
	RM3	0.959	0.955		
	RM4	0.992	0.989		
	RM5	1.037	1.048		
RE	RE1	0.470	0.463	0.382	0.602
	RE2	0.807	0.812		
	RE3	0.912	0.906		

5.3.5 Exploratory Factor Analysis

EFA is used to detect underlying constructs (Sarstedt et al., 2021). For factorability, EFA has to display a correlation matrix beyond 0.30 as the minimum accepted loading (Howard, 2016; Williams et al., 2010; Yong & Pearce, 2013), with at least 3 variables per facto (Costello & Osborne, 2005; Yong & Pearce, 2013). **Table 5** shows the EFA analysis applied Promax as rotation method. It found that most of the items loaded on the first factor are items of RM whereas RE items were loaded at the second factor. Although most of the items were loaded on the underlying factors, only the item 'RE1' has high uniqueness, which need to be considered a problematic matter. The uniqueness value is the variance ratios which not explained by the factor (JASP Team, 2024). The path diagram as shown in **Figure 1** represents a statistical model from the SEM analysis, displaying the observed associations between the latent variables and the effectiveness of items in predicting their structures. The diagram reflects the complexity of the model of the influence of sociocultural factors on FWB, and confirms the need for developing strong items to understand the relationship between RE and HFWB.

Table 5 JASP-EFA Factor Loadings

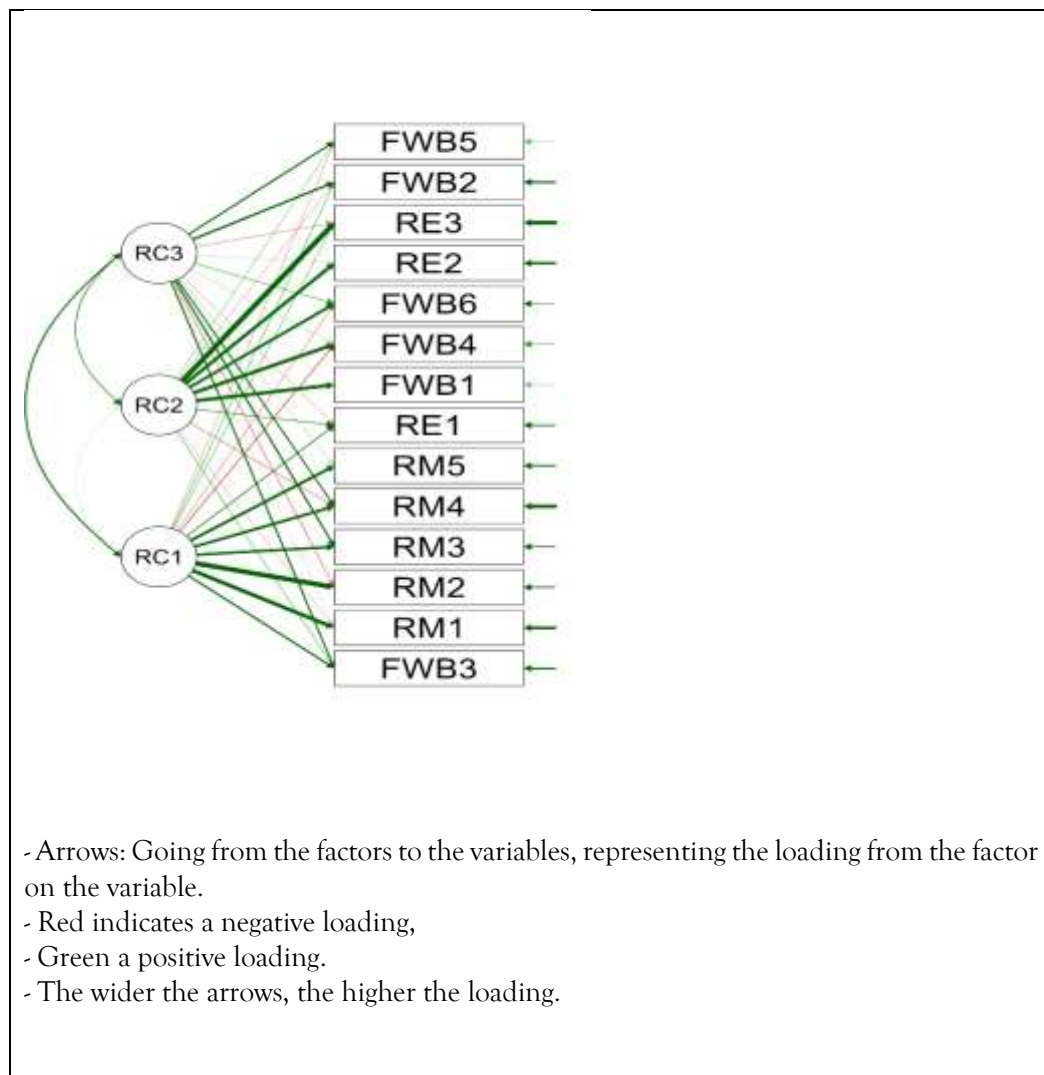
	Factor 1	Factor 2	Factor 3	Uniqueness
FWB1		0.730		0.475
FWB2			0.516	0.632
FWB3	0.458		0.410	0.383
FWB4		0.726		0.378
FWB5			0.442	0.767
FWB6		0.611		0.465
RM1	0.780			0.407
RM2	0.967			0.155
RM3	0.604		0.433	0.277
RM4	0.623		0.394	0.302
RM5	0.618			0.574
RE1	0.337	0.308		0.813

Table 5 JASP-EFA Factor Loadings

	Factor 1	Factor 2	Factor 3	Uniqueness
RE2		0.672		0.510
RE3		0.920		0.177

Note. Applied rotation method is Promax.

Figure 1. Path diagram of Residual Correlation matrix based on Explanatory Factor Analysis



Research Importance

This article addresses a neglected research topic in a country with high levels of FW at the household consumption stage, thus enriching relevant knowledge. This pilot research, to some extent, confirmed the effectiveness of the research measurement tool and its potential for developing a solid questionnaire for understanding food waste behaviour, which is a step forward for future investigation.

Limitation And Future Research

This article presents part of the results of a pilot survey of only two variables within a set of sociocultural variables, reflecting the extent to which both RE and the RM influence HFWB within an integrated research model of a set of sociocultural factors. Therefore, the results can

only be compared with similar models, and it is difficult to generalize the findings due to the convenience and small size of the sample. This research was quantitative with closed-ended questions. Future research could address the same questions in qualitative surveys to further validate the predictive accuracy of the measurement tools and test the extent to which their factors influence FWB. Alternatively, mixed approaches could be combined in the survey to derive further insights and develop more consistent tools that can provide more effective research tools to bridge the knowledge gap in understanding FWB driven by sociocultural influences.

CONCLUSIONS

HF WB is a major FW cause in Oman, a country characterised by cultural and religious norms that influence daily life. This research article focused on testing predictive measures that contribute to understanding the relationship between the RM and RE as independent variables in HF WB. This will provide results based on an empirical study that relied on a quantitative survey using measurement tools that considered the geographical contexts in understanding FW factors. This pilot survey provided some further steps in understanding HF WB.

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