# From Knowledge to Practice: Exploring the Impact of Awareness on Food Waste Management and Family Resources in Kuwait

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## Abstract

The aim of this study is to examine the correlations among community practices, awareness, knowledge, and perceptions of food waste, sustainability, and resource optimization in Kuwait. This research emphasizes the influence of demographic variables on sustainable food practices and underscores the crucial need of well-informed knowledge and encouraging changes in behavior aimed at decreasing food waste. The study employs a cross-sectional design using Partial least squares structural equation modeling (PLS-SEM) to analyze the responses obtained from households in Kuwait. Awareness and knowledge, social activities, and perceptions are fundamental constructs. The findings confirm 6 hypotheses, underscoring the importance of customized educational initiatives to close the divide between awareness and sustainable behaviors. The research findings indicate that increased consciousness is associated with the stronger propensity for adopting sustainable behaviors, even when considering cultural and self-reporting constraints. This study provides significant insights for the reduction of global food waste by means of community involvement and awareness initiatives.

**Keywords**: Awareness, Food Waste, Family Resource, Knowledge, Practice.

## Introduction

As the 21st century progresses, humanity is faced with significant environmental challenges that pose threats to our well-being and future prosperity. Among these challenges, food waste and food security stand out as critical issues that not only signify broader sustainability crises but also areas where targeted interventions can yield substantial positive impacts (Brennan & Browne, 2021). Food waste represents a significant obstacle to developing sustainable food systems, impacting environmental, economic, social, and health dimensions and thus proves

to be a burden on the planet for two reasons. Firstly, it causes greenhouse gas emission because of the landfill and lost production that contributes. Secondly, there is waste from the supply chain investments in the same (Diaz-Ruiz et al., 2019), exacerbating the challenges faced within Arab countries regarding supply chain inefficiencies and the implementation of quality management principles and practices (Soltani et al., 2011).

It is estimated that between 30-50% of all food produced worldwide goes to waste (Food and Agriculture Organization, 2009; Fox & Fimeche, 2013; Gunders et al., 2017). This wastage spans the entire food supply chain, from agricultural production, post-harvest handling, and storage to processing, distribution, and ultimately consumption (Food and Agriculture Organization, 2015). The largest food waste fraction is, however, at family levels where the final consumption of food happens (González-Santana et al., 2022). Studying the food waste at family level is also more important because the food reaching to a family became more value added through contributions from various phases at the value chain and therefore it remains a higher loss.

Largely, the global food system, characterized by inefficiencies from production to consumption, presents a paradox where significant amounts of food are wasted while global hunger and food insecurity persist (Conrad et al., 2018). This situation highlights the urgent need to reevaluate and align our food practices and policies with sustainability and equity principles. Such principles ought to be systematically integrated throughout the entire supply chain, given that all stakeholders therein partake in decision-making processes (Albuloushi & Algharaballi, 2014), thereby collectively influencing the phenomenon of food wastage which tends to peak at the household level (Göbel et al., 2015).

In tackling these challenges, the concepts of the circular economy and sustainable development emerge as innovative frameworks that offer pathways to a more resilient and sustainable future (Tsegaye et al., 2021). The circular economy, with its emphasis on resource reduction, reuse, and recycling, presents a compelling model for minimizing waste and optimizing resource utilization, particularly within the food sector (Falasconi et al., 2019). Sustainable development, as outlined in the United Nations Sustainable Development Goals (SDGs), provides a blueprint for harmonizing human development with planetary health, with Goal 2 specifically aiming to eradicate hunger and promote sustainable agriculture (Rossi et al., 2023).

In the context of Kuwait, the impact of awareness on food waste management and family resources becomes particularly significant as the same can increase the Kuwaiti customers trust and commitment to health and safety (Sultan & Alfulaij, 2022). Kuwait faces unique challenges

related to environmental sustainability and food security, exacerbated by its arid climate, high dependence on food imports, and substantial levels of food waste. This study extends the examination of food waste and sustainability by specifically investigating how increased awareness and knowledge within Kuwaiti families can influence food waste management practices and optimize family resources.

Highlighting the role of family units in sustainability efforts, the research emphasizes how familial habits and decisions around food purchasing, storage, and consumption directly impact waste levels and resource utilization. As this can be taken the family's concern for the future and promote a sustainable behaviour (Ritch & Brownlie, 2016). This focus underscores the potential for informed families to lead the charge in transforming food waste into an opportunity for enhancing food security, reducing environmental impacts, and fostering economic savings within the household, thereby contributing to the broader goals of sustainable development and a circular economy in Kuwait. This research aims to examining the intersections of Awareness and Knowledge, Social Practices, and Understanding of Practices related to food waste and sustainability. By exploring individuals' awareness of key sustainability concepts, their daily food-related practices, and the perceptions guiding these behaviors, the study seeks to uncover the underlying dynamics that either facilitate or hinder the adoption of sustainable food practices. This can help Kuwait to draw the urgently draw policies related to food waste in the context global climate change and growing concerns of food safety (Gelan & Atkinson, 2022). Further the study contributes to the overall green and sustainability envisioned by Kuwait for 2030 (Al-Fawaz, 2022).

**Theoretical framework**

The study framework concentrates on food waste management and sustainability in Kuwait. It revolves around investigating the dynamics of community practices, awareness, knowledge, and understanding of these practices. These components are essential for the development of sustainable food practices and the reduction of food waste, thus making a significant contribution to environmental sustainability and food security.

The first hypothesis states that the practices followed by a community in terms of acquiring, storing, consuming, and managing food have a direct influence on the awareness and understanding of individuals and families regarding sustainability and the problem of food waste. Community practices encompass various sustainable initiatives such as communal composting programmes, local food sharing initiatives, educational campaigns on food preservation, and other community-driven efforts. The fundamental premise is that the level of community

involvement in sustainable practices directly correlates with the overall awareness and knowledge of its members.

Exploring the relationship between community practices (CP) and awareness and knowledge (AW) regarding sustainability and food waste is of utmost importance. Community practices, such as collective composting programmes, initiatives for sharing local food, and educational campaigns on food preservation, have a substantial impact on individuals' comprehension of sustainability and food waste (Martín-Ríos et al., 2018). These initiatives have a dual impact: they not only help decrease food waste, but also raise awareness among community members about the significance of sustainable practices in managing food (Derqui et al., 2016).

Research has indicated that there is a considerable quantity of food waste produced at different points in the food supply chain, with a noteworthy proportion occurring at the household level (Srivastava et al., 2022). This emphasises the significance of comprehending household behaviours and community-led initiatives in the management of food waste. Implementing sustainable practices for managing food waste at the household level, such as repurposing leftovers, segregating waste, and engaging in recycling, is crucial for advancing sustainability (Masdek et al., 2023).

- **Hypothesis 1:** *There is a significant relationship between community practices (CP) and awareness and knowledge (AW)*

The way communities acquire, store, consume, and manage food has a direct impact on individuals' and families' awareness and comprehension of sustainability and food waste problems. Community engagement is strengthened by sustainable practices such as communal composting, local food sharing, and educational campaigns. This, in turn, leads to increased levels of awareness within the community (Phooi et al., 2022). This is consistent with the concept that knowledge, attitude, and practices within a community are interrelated and mutually influence one another (Ghazi et al., 2020). Research on waste management and disease awareness indicates that knowledge and awareness are pivotal factors in influencing practices (Walter & Shenaar-Golan, 2019; Williams et al., 2013). Thus, by implementing sustainable initiatives, community practices can be improved, resulting in heightened awareness and knowledge, and promoting a culture of sustainability and waste reduction.

- **Hypothesis 2:** *There is a significant relationship between awareness and knowledge (AW) and understanding of practices (UP)*

The hypothesis that awareness and knowledge act as mediators in the relationship between community practices and understanding of practices is supported by the notion that community engagement in sustainable

practices is directly associated with the collective awareness and knowledge of its members (Barudin et al., 2021). Research has indicated that although individuals may possess knowledge about sustainable behaviours such as recycling, they do not consistently put this knowledge into action (Hasbi et al., 2022). This emphasises the significance of comprehending the factors that moderate the connection between community practices and individual comprehension and behaviour. Furthermore, studies on diverse health-related subjects have shown the importance of knowledge and awareness in shaping behaviours within communities. Research on cutaneous leishmaniasis and dengue fever has demonstrated that there is a connection between knowledge, awareness, and practices.

- **Hypothesis 3:** Awareness and *knowledge (AW) mediate the relationship between community practices (CP) and understanding of practices (UP)*

**Methods**

**Participants**

The study methodology encompassed a quantitative survey approach to evaluate the hypotheses and achieve the study's aims. Data was collected from Kuwaiti residents using self-administered questionnaires, which were divided into two main parts. The initial section captured demographic details of the respondents, such as gender, age, marital status, education level, occupation, and income. The subsequent section was dedicated to a structured survey focusing on crucial constructs, utilizing a five-point Likert scale for responses, ranging from strongly disagree to strongly agree.

In order to obtain a sample that accurately represents the Kuwaiti population, a stratified random sampling method was utilised. This approach entailed categorising the population into separate groups or strata based on specific demographic characteristics that were identified in the initial section of the questionnaire. To ensure the successful implementation of this sampling technique, the study involved the enlistment of data collectors. These individuals were carefully chosen and extensively trained to handle the intricacies of data collection in the Kuwaiti context.

After finishing their training, data collectors began the process of reaching out to households. In this phase, data collectors visited households that were randomly selected within each stratum. This approach not only increased the response rate but also guaranteed the thoroughness and dependability of the collected data. During these visits, data collectors offered a comprehensive explanation of the study's objective, ensured the confidentiality of the responses, and addressed any

questions from the participants, thus improving their comprehension and cooperation.

## Demographic characteristics

Table 1 presents the demographic characteristics of the study sample participants, including nationality, gender, age group, educational level, residence, household income, economic situation, marital status, and the number of children. The majority of the participants were Kuwaiti (96.9%), female (99.1%), and married (91.0%) with a considerable proportion falling in the age group of 30-40 years (36.4%). Participants were distributed among all six governorates, 16.8% from Ahmadi, 14.6% were from Al Farwaniyah, 15.9% were from Capital, 33.0% were from Hawally, 17.4% were from Mubarak the great, and 2.2% were from Jahra governorate. Regarding educational attainment, the majority of the participants had undergraduate/bachelor's degree, accounting for 58.6% of the total sample. Moreover, the most common household income range was 1000 to 2000 KD (47.7%). The majority of the participants belong to the medium category (48.0%) of economic situation. The majority of participants reported having 1 to 2 children (26.5%).

**Table 1** *Demographic Characteristics*

| Variables | Overall (N=321) |
|---|---|
| **Nationality** | |
| Kuwaiti | 311 (96.9%) |
| other nationalities | 10 (3.1%) |
| **Gender** | |
| female | 318 (99.1%) |
| male | 3 (0.9%) |
| **Age group** | |
| 60 years and over | 18 (5.6%) |
| From 20 to less than 30 | 58 (18.1%) |
| From 30 to less than 40 | 117 (36.4%) |
| From 40 to less than 50 | 75 (23.4%) |
| From 50 to less than 60 | 53 (16.5%) |
| **Educational level** | |
| Diploma (two academic years post-secondary) | 65 (20.2%) |
| High school or equivalent | 32 (10.0%) |
| Postgraduate studies (Masters/PhD) | 25 (7.8%) |

| Variables | Overall (N=321) |
|---|---|
| Undergraduate/Bachelor's degree | 188 (58.6%) |
| without secondary | 11 (3.4%) |
| **Residence in the province** | |
| Ahmadi | 54 (16.8%) |
| Al Farwaniyah | 47 (14.6%) |
| Capital | 51 (15.9%) |
| Hawali | 106 (33.0%) |
| Jahra | 7 (2.2%) |
| Mubarak the Great | 56 (17.4%) |
| **Household income** | |
| From 1000 to less than 2000 KD | 153 (47.7%) |
| From 2000 to less than 3000 KD | 67 (20.9%) |
| From 3000 to less than 4000 KD | 41 (12.8%) |
| From 4000 to less than 5000 KD | 15 (4.7%) |
| Less than 1000 KD | 44 (13.7%) |
| More than 5000 KD | 1 (0.3%) |
| **Economic situation** | |
| Excellent and covered all my needs | 145 (45.2%) |
| Medium and covered some of my needs | 154 (48.0%) |
| Non-existent and did not cover my needs | 1 (0.3%) |
| Weak and barely covered my needs | 21 (6.5%) |
| **Marital status** | |
| Divorced/divorced | 20 (6.2%) |
| Married | 292 (91.0%) |
| widow/widow | 9 (2.8%) |
| **Number of children** | |
| From 1 to 2 | 85 (26.5%) |
| From 3 to 4 | 94 (29.3%) |
| From 4 to 5 | 65 (20.2%) |

| Variables | Overall (N=321) |
|-----------|-----------------|
| More than 5 children | 77 (24.0%) |

The participants were selected as heads of family members and therefore the criteria were used if they formed a family unit to explore the same as unit of analysis. Single individuals are excluded from the study, whereas those who were married, divorced or were widow are included. Similarly, the participants must have at least one child to assess a familywise measurement of the variables. The constructs of awareness and knowledge, social practices, and perceptions were assessed through several indicators specified in Table 2.

**Table 2** *Study Constructs with Items and Their Definitions.*

| Constructs | Items | Items Definition |
|------------|-------|------------------|
| Awareness and Knowledge | AW1 | I am aware of the term "circular economy." |
| | AW2 | I am aware of the term "sustainable development." |
| | AW3 | I have sufficient awareness of the environmental damage caused by excess food. |
| | AW4 | I have sufficient awareness of the process of disposing of food in the trash and its impact on the environment. |
| | AW5 | I have sufficient awareness of the global shortage of food sources and natural resources. |
| | AW6 | I am aware that the world may face food security crises in the future. |
| Community Practices | SP1 | I make sure to prepare meals suitable for the number of family members to reduce excess food. |
| | SP2 | I make sure to use available food and ingredients in my kitchen to prepare family meals. |
| | SP3 | I make sure to keep track of the expiration dates of food ingredients in my kitchen and use them before they expire. |
| | SP4 | I throw away excess food in the trash can. |
| | SP5 | I distribute excess food to neighbors. |
| | SP6 | I distribute excess food to those in need. |
| | SP7 | I distribute excess canned and unused food to those in need and charitable organizations. |
| | SP8 | I keep excess food to eat the next day. |
| | SP9 | I keep excess food to make a new dish the next day. |
| Understanding of | UP1 | I feel responsible for excess food. |

| Constructs | Items | Items Definition |
|---|---|---|
| Practices | UP2 | I do not throw away excess food to preserve the environment. |
| | UP3 | I do not throw away excess food because it is a blessing from God and should be preserved. |
| | UP4 | I do not throw away excess food because I was raised to conserve blessings. |
| | UP5 | I throw away excess food in the trash because family members prefer not to eat food if it is left for the next day. |
| | UP6 | Distributing excess food contributes to conserving blessings. |
| | UP7 | Distributing excess food contributes to achieving sustainable development. |
| | UP8 | Distributing excess food helps make the needy happy. |
| | UP9 | Distributing excess food makes me happy. |

## Measure and Reliability Analysis

Reliability assessment was done to examine the questionnaire reliability. Table 3 shows the value of item rest correlation and Cronbach's alpha for each item if the item is dropped from the scale along with the value of overall Cronbach's alpha for constructs AW, CP and UP respectively. The item rest correlation is a measure of how strongly each item is correlated with the total scale score. Cronbach's alpha is a measure of internal consistency. As shown in results, the Cronbach's alpha values for the research items exceed the 0.70 threshold Hair *et al.* (2006), confirming the questionnaire's reliability. Furthermore, none of the items exhibit an Item-Total Correlation below 0.20, underscoring the importance of considering all items in the study (Al-Gouhari et al., 2023; Streiner & Norman, 2003).

**Table 3** *Item Reliability Statistics for awareness and knowledge (AW), community practices (CP), and understanding of practices (UP)*

| Construct | Item | Mean | SD | Item-rest correlation | Cronbach's α: If item dropped | Cronbach's α |
|---|---|---|---|---|---|---|
| awareness and knowledge (AW) | AW1 | 2.92 | 1.148 | 0.499 | 0.749 | 0.775 |
| | AW2 | 3.32 | 1.103 | 0.523 | 0.742 | |
| | AW3 | 4.06 | 0.929 | 0.56 | 0.734 | |
| | AW4 | 3.6 | 1.137 | 0.571 | 0.729 | |
| | AW5 | 3.94 | 0.98 | 0.597 | 0.724 | |

| Construct | Item | Mean | SD | Item-rest correlation | Cronbach's α: If item dropped | Cronbach's α |
|-----------|------|------|-----|----------------------|------------------------------|--------------|
| | AW6 | 4.15 | 0.897 | 0.391 | 0.771 | |
| community practices (CP) | CP1 | 4.34 | 0.773 | 0.494 | 0.756 | 0.778 |
| | CP2 | 4.32 | 0.794 | 0.459 | 0.76 | |
| | CP3 | 3.77 | 1.082 | 0.382 | 0.769 | |
| | CP4 | 4.29 | 0.827 | 0.569 | 0.746 | |
| | CP5 | 3.9 | 1.087 | 0.561 | 0.742 | |
| | CP6 | 3.97 | 0.996 | 0.425 | 0.762 | |
| | CP7 | 3.6 | 1.16 | 0.473 | 0.756 | |
| | CP8 | 3.73 | 1.209 | 0.5 | 0.752 | |
| | CP9 | 2.66 | 1.212 | 0.388 | 0.771 | |
| Understanding of practices (UP) | UP1 | 4.54 | 0.689 | 0.538 | 0.753 | 0.781 |
| | UP2 | 3.92 | 1.041 | 0.443 | 0.768 | |
| | UP3 | 4.65 | 0.697 | 0.609 | 0.744 | |
| | UP4 | 4.55 | 0.729 | 0.613 | 0.742 | |
| | UP5 | 3.91 | 1.174 | 0.232 | 0.814 | |
| | UP6 | 4.67 | 0.57 | 0.627 | 0.748 | |
| | UP7 | 4.41 | 0.798 | 0.474 | 0.759 | |
| | UP8 | 4.68 | 0.549 | 0.645 | 0.748 | |
| | UP9 | 4.18 | 0.913 | 0.406 | 0.771 | |

## Statistical Analysis

A two-step process was employed for the data analysis. Firstly, the data were imported into SPSS version 28 to conduct an initial data analysis, which included data cleaning and the generation of descriptive statistics. In the second phase, the suggested model underwent assessment through the application of PLS-SEM using the SmartPLS 4 software package (Ringle et al., 2015).

Partial Least Squares Structural Equation Modeling (PLS-SEM) is an extension of conventional multivariate analysis methods like regression, factor analysis, and discriminant analysis. It allows for the simultaneous examination of several relationship between independent and dependent variables. SmartPLS 4 was utilized to analyze the survey data via PLS-SEM, which constructs a path model illustrating

relationships among variables. This structural equation model facilitates the investigation of connections between measurable variables and latent constructs.

At the first step of analysis, descriptive statistics, and correlation analysis was carried out. Analysis of Variance was employed to examine the mean difference in the study constructs for the demographics of the participants. Subsequently, SEM analysis was conducted, consisting of two phases: the evaluation of the measurement model and the assessment of the structural model. In the measurement model assessment, reliability and validity were examined using various statistical measures such as Cronbach's alpha, composite reliability, cross-loadings, etc. available within the SmartPLS software. Following this, the proposed hypotheses were examined within the structural model assessment phase.

## Results

Table 4 demonstrates the correlation between the study constructs that explain the relationships between awareness and knowledge (AW), community practices (CP), and understanding of practices (UP). The correlations are denoted with significance levels, where *** indicates a statistically significant relationship (p-value < .001). The matrix reveals a moderate positive correlation between AW and CP (r = 0.427, ***), and AW and UP (r = 0.383, ***), indicating that as awareness and knowledge increase, so do community practices and understanding of these practices, respectively. A strong positive correlation is observed between CP and UP (r = 0.661, ***), suggesting that a deeper engagement with community practices is associated with a greater understanding of these practices.

**Table 4**

*Correlation Matrix of Awareness and Knowledge (AW), Community Practices (CP), and Understanding of Practices (UP), showing significant positive relationships.*

|     | AW    |     | CP    |     | UP  |
| --- | ----- | --- | ----- | --- | --- |
| AW  | —     |     |       |     |     |
| CP  | 0.427 | *** | —     |     |     |
| UP  | 0.383 | *** | 0.661 | *** | —   |

Note. * p < .05, ** p < .01, *** p < .001

Results of Analysis of variance (ANOVA) that was conducted to compare the mean value of the study constructs for age-group, education level and the number of children is shown in Table 5, Table 6 and Table 7, respectively. The finding of the study shows significant difference in the mean score of the study constructs AW, CP and UP for age-group

($p<0.05$) and number of children ($p<0.05$). The mean score of AW, CP and UP was found to be high for participants with age-group 60 years and over as compared to the participants with another age-group. Moreover, for number of children, the mean value of AW was high for participants having 4 to 5 children, mean CP value was high for participants having 4 to 5 children or more than 5 children, while mean UP was high for participants having more than 5 children. Moreover, mean CP score also differ for different education level, with participants having high school or equivalent shows higher CP mean score.

**Table 5** *Cross Table: Study constructs with age-group category*

| | 60 years and over (N=18) | From 20 to less than 30 (N=58) | From 30 to less than 40 (N=117) | From 40 to less than 50 (N=75) | From 50 to less than 60 (N=53) | Total (N=321) | p value |
|---|---|---|---|---|---|---|---|
| **AW** | | | | | | | $< 0.001^1$ |
| Mean (SD) | 4.1 (0.7) | 3.4 (0.7) | 3.7 (0.7) | 3.8 (0.7) | 3.5 (0.7) | 3.7 (0.7) | |
| Range | 2.8 - 5.0 | 1.0 - 5.0 | 1.8 - 5.0 | 2.2 - 5.0 | 1.5 - 4.7 | 1.0 - 5.0 | |
| **CP** | | | | | | | $0.002^1$ |
| Mean (SD) | 4.2 (0.5) | 3.7 (0.6) | 3.9 (0.6) | 4.1 (0.6) | 4.1 (0.5) | 3.9 (0.6) | |
| Range | 3.6 - 5.0 | 2.2 - 4.9 | 1.6 - 4.9 | 2.6 - 5.0 | 2.6 - 5.0 | 1.6 - 5.0 | |
| **UP** | | | | | | | $< 0.001^1$ |
| Mean (SD) | 4.6 (0.4) | 4.2 (0.6) | 4.4 (0.4) | 4.6 (0.4) | 4.5 (0.4) | 4.5 (0.5) | |
| Range | 3.7 - 5.0 | 2.7 - 5.0 | 3.2 - 5.0 | 3.9 - 5.0 | 3.4 - 5.0 | 2.7 - 5.0 | |

1.  Linear Model ANOVA

**Table 6** *Cross Table: Study constructs with education level*

| | Diploma (two academic years post-secondary) (N=65) | High school or equivalent (N=32) | Postgraduate studies (Masters/PhD) (N=25) | Undergraduate/Bachelor's degree (N=188) | without secondary (N=11) | Total (N=321) | p value |
|---|---|---|---|---|---|---|---|
| **AW** | | | | | | | $0.902^1$ |
| Mean(SD) | 3.7 (0.7) | 3.7 (0.6) | 3.8 (0.7) | 3.6 (0.7) | 3.7 (0.6) | 3.7 (0.7) | |
| Range | 1.5 - 4.8 | 2.3 - 4.8 | 2.3 - 4.8 | 1.0 - 5.0 | 2.7 - 4.7 | 1.0 - 5.0 | |
| **CP** | | | | | | | $0.002^1$ |
| Mean (SD) | 4.0 (0.6) | 4.3 (0.4) | 3.7 (0.6) | 3.9 (0.6) | 4.1 (0.7) | 3.9 (0.6) | |

| | Diploma (two academic years post-secondary) (N=65) | High school or equivalent (N=32) | Postgraduate studies (Masters/PhD) (N=25) | Undergraduate/Bachelor's degree (N=188) | without secondary (N=11) | Total (N=321) | p value |
|---|---|---|---|---|---|---|---|
| Range | 2.6 - 5.0 | 3.2 - 5.0 | 2.4 - 4.7 | 1.6 - 5.0 | 2.6 - 4.8 | 1.6 - 5.0 | |
| **UP** | | | | | | | 0.157[1] |
| Mean (SD) | 4.6 (0.4) | 4.6 (0.3) | 4.4 (0.4) | 4.4 (0.5) | 4.4 (0.3) | 4.5 (0.5) | |
| Range | 3.7 - 5.0 | 3.9 - 5.0 | 3.7 - 5.0 | 2.7 - 5.0 | 4.0 - 4.9 | 2.7 - 5.0 | |

1. Linear Model ANOVA

**Table 7** *Cross Table: Study constructs with number of children*

| | From 1 to 2 (N=85) | From 3 to 4 (N=94) | From 4 to 5 (N=65) | More than 5 children (N=77) | Total (N=321) | p value |
|---|---|---|---|---|---|---|
| **AW** | | | | | | 0.015[1] |
| Mean (SD) | 3.5 (0.8) | 3.7 (0.6) | 3.8 (0.6) | 3.7 (0.7) | 3.7 (0.7) | |
| Range | 1.0 - 5.0 | 1.8 - 5.0 | 2.3 - 5.0 | 2.0 - 4.8 | 1.0 - 5.0 | |
| **CP** | | | | | | < 0.001[1] |
| Mean (SD) | 3.7 (0.6) | 3.9 (0.6) | 4.1 (0.6) | 4.1 (0.5) | 3.9 (0.6) | |
| Range | 2.2 - 4.9 | 1.6 - 5.0 | 2.6 - 5.0 | 2.6 - 5.0 | 1.6 - 5.0 | |
| **UP** | | | | | | 0.028[1] |
| Mean (SD) | 4.4 (0.5) | 4.4 (0.5) | 4.5 (0.4) | 4.6 (0.4) | 4.5 (0.5) | |
| Range | 2.7 - 5.0 | 3.0 - 5.0 | 3.6 - 5.0 | 3.7 - 5.0 | 2.7 - 5.0 | |

1.Linear Model ANOVA

**SEM for the conceptual proposed framework**

Structure Equation Modeling (SEM) investigates numerous relationships simultaneously. PLS is a two-step procedure that commences by assessing the outer measurement model and concludes by evaluating the inner model, which is also referred to as the structural model (J. and H. Henseler G. and Ray, P. A., 2016; J. and R. Henseler C. M. and Sinkovics, R. R., 2009). Figure 1 shows the node diagram for the PLS-PM model after removing items having low loading (loading less than 0.6).

**Figure 1** *Node diagram for the PLS-PM model after removing items having low loading*
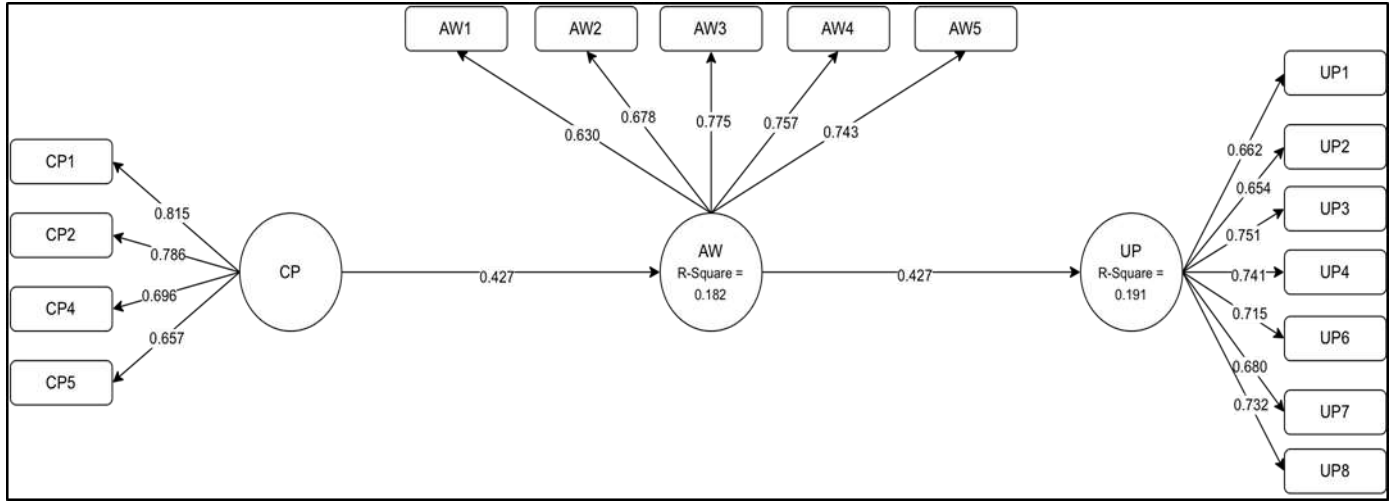
## Measurement Model assessment

Measurement models, also known as outer models, elucidate the connections between constructs and the indicators used to represent them. In an alternative perspective, measurement models outline how constructs are assessed or quantified through their respective indicators (J. and H. Hair C. L. and Randolph, A. B. and Chong, A. Y. L., 2017). To enhance the accuracy of the measure, researchers are required to ascertain the reliability and validity of the indicators employed in multivariate analysis.

The measurement assessment was done by the guidelines provided by Hair *et al.* (2017). These guidelines involved assessing the reliability of constructs, their convergent validity, and their discriminant validity. Table 10 presents the results of the measurement model assessment. The results encompass assessments of validity (specifically, convergent validity), reliability (measured through Cronbach's alpha and composite reliability), as well as factor loadings and VIF (Variance Inflation Factor) values for each individual item (J. F. Hair Jr et al., 2021).

It is important to note that all VIF values are below 3. This indicates that collinearity within the model is not a concern. As Hair *et al.* (2021) have pointed out, VIF values indicative of collinearity issues typically exceed 5.

Moreover, convergent validity was assessed using the average variance extracted (AVE) values, which should be more than the threshold value of 0.5 to signify sufficient convergent validity (Al-Shamali et al., 2022; Ramayah et al., 2017). All constructs in the research surpassed this threshold, implying that the measures were valid and accurately represented by their respective items. In Addition to AVE, the item factor loadings are reported, which should ideally be greater than 0.6 for good convergent validity (Mashal & Shuhaiber, 2018). The items with loadings of less than 0.6 were eliminated from the model due to lower factor loadings (Figure 2). All of the remaining items had factor loadings

greater than 0.60, further demonstrating the convergent validity of the measures.

Further, to examine the construct reliability, Cronbach's alpha and composite reliability was assessed, which should typically exceed 0.7 to indicate adequate reliability (AlKandari et al., 2023; J. and H. Henseler G. and Ray, P. A., 2016; Sharif et al., 2021). All the study constructs met this criterion, thus confirms the construct reliability. Overall, it can be concluded that constructs used in this study had good convergent validity and reliability (see table 8).

**Table 8** *Outer Model Summary Table for the PLS-SEM Model.*

| Construct | Items | loading | VIF | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
|-----------|-------|---------|-------|----------|----------|----------|----------|
| AW | AW1 | 0.630 | 1.615 | 0.770 | 0.788 | 0.841 | 0.516 |
|    | AW2 | 0.678 | 1.621 | | | | |
|    | AW3 | 0.775 | 1.496 | | | | |
|    | AW4 | 0.757 | 1.625 | | | | |
|    | AW5 | 0.743 | 1.470 | | | | |
| CP | CP1 | 0.815 | 1.690 | 0.731 | 0.752 | 0.829 | 0.550 |
|    | CP2 | 0.786 | 1.716 | | | | |
|    | CP4 | 0.696 | 1.647 | | | | |
|    | CP5 | 0.657 | 1.540 | | | | |
| UP | UP1 | 0.662 | 1.485 | 0.835 | 0.838 | 0.874 | 0.499 |
|    | UP2 | 0.654 | 1.295 | | | | |
|    | UP3 | 0.751 | 2.396 | | | | |
|    | UP4 | 0.741 | 2.311 | | | | |
|    | UP6 | 0.716 | 2.215 | | | | |
|    | UP7 | 0.680 | 1.746 | | | | |
|    | UP8 | 0.732 | 2.356 | | | | |

Discriminant validity evaluates the extent to which a construct within a model can be effectively distinguished from other constructs. This is achieved when a construct exhibits stronger correlations with its own indicators compared to the indicators of other constructs. Researchers often rely on three established criteria to assess discriminant validity: the Fornell-Larcker criterion, cross-loadings, and the Heterotrait-Monotrait ratio (HTMT) (J. and H. Hair C. L. and Randolph, A. B. and Chong, A. Y. L., 2017; J. and H. Henseler G. and Ray, P. A., 2016).

Fornell and Larcker (1981) proposed other criteria to examine the discriminant validity. According to this criterion, the square root of AVE (diagonal) for each construct should exceeds the bivariate correlations between that construct and all other constructs. Table 9 demonstrates the results of Fornell-Larcker Criterion. It is evident that the square root of each construct's Average Variance Extracted (AVE) is greater than the correlations with other constructs, thus confirms that the criteria for discriminant validity have been met (Fornell, 1981).

**Table 9** *Fornell-Larcker Criterion Results*

|  | AW | CP | UP |
|---|---|---|---|
| AW | **0.719** | | |
| CP | 0.427 | **0.741** | |
| UP | 0.427 | 0.651 | **0.706** |

The Heterotrait–Monotrait (HTMT) ratio is another measure of assessing discriminant validity. In accordance with the guidelines established by Henseler *et al.* (2015), it is recommended that the HTMT ratio should be less than 0.90 to ensure satisfactory discriminant validity (J. and R. Henseler C. M. and Sarstedt, M., 2015). On examining the HTMT values presented in Table 10, it is evident that all the ratios fall below the specified threshold of 0.90, thus signifies compelling evidence of discriminant validity among the constructs incorporated within the model.

**Table 10** *HTMT Ration Results*

|  | AW | CP | UP |
|---|---|---|---|
| AW | | | |
| CP | 0.540 | | |
| UP | 0.472 | 0.818 | |

**Structural Model Assessment**

Once the measurement model has been validated, the subsequent stage involves assessing the structural model, which is also known as the inner model. This step entails analyzing the connections between the

constructs within the model. The assessment of the structural model involves estimating path coefficients through a bootstrapping procedure (J. and H. Hair C. L. and Randolph, A. B. and Chong, A. Y. L., 2017). The outcomes of the path analysis are presented in Table 11. The results revealed that there is a significant direct effect of AW on UP ($\beta = 0.427$, t = 9.127, p <0.001). Moreover, the effect of CP on AW was also statistically significant ($\beta = 0.427$, t = 9.270, p <0.001).

**Table 11** *Bootstrap Results for the Inner Model Regression Paths*

| Path | Original sample (O) | Standard deviation (STDEV) | T statistics (\|O/STDEV\|) | P values | Decision |
|------|---------------------|----------------------------|----------------------------|----------|----------|
| AW -> UP | 0.427 | 0.047 | 9.127 | 0.000 | Supported |
| CP -> AW | 0.427 | 0.046 | 9.270 | 0.000 | Supported |

A mediation analysis was conducted to assess the significance of the mediating variable AW in explaining the relationship between the independent (CP) and dependent (UP) variable. The results of this mediation analysis are summarized in Table 12. The mediating effect of AW on CP and UP ($\beta = 0.182$; t = 5.130; p <0.001) was found to be statistically significant.

**Table 12** *Bootstrap Results for the Inner Model Regression Paths (Mediation Analysis)*

| | Original sample (O) | Standard deviation (STDEV) | T statistics (\|O/STDEV\|) | P values | Decision |
|------|---------------------|----------------------------|----------------------------|----------|----------|
| CP -> AW -> UP | 0.182 | 0.036 | 5.130 | 0.000 | Supported |

## Discussion

The impact of knowledge on food waste management and familiar resources is significant, particularly when considered in the context of sustainability and resource optimization. Families possessing more understanding of the environmental, economic, and social ramifications of food waste are more inclined to implement solutions that facilitate waste reduction and resecure conservation. These tactics encompass meal planning according to family size, recognizing the significance of creatively utilizing leftovers, and the deliberate procurement off food to reduce waste. These findings correspond with the extensive research indicating that familial attributes and educational backgrounds significantly influence food waste reduction, with similar behaviors potentially enduring over generations (Abeliotis et al., 2016).

Albeeshi et al. (2020) present an alternative viewpoint by concentrating on extensive food waste management options highlighting the necessity for infrastructural solutions like composting and incineration to address Kuwait's increasing municipal food waste. The

research emphasizes that Kuwait's food waste it's predominantly handled by land fully, resulting in considerable environmental issues. Although Albeeshi et al. Concentrate on technical solutions for waste management, our study illustrates that mitigating food waste at the source by increased awareness and behavioral modification is of similar significance. Both methodologies technical and behavioral are essential for effective waste management.

This study elucidates the essential connections among community activities, individual views, and awareness of food waste and sustainability. The statistics indicate a sophisticated comprehension among participants of the ideas of circular economy and sustainable development, which directly effects their food related behaviors. Individuals with elevated awareness had heightened inclination to partake in sustainable actions, including the redistribution of surplus food and the reduction of waste. This correlation highlights the possibility for focused educational and legislative measurements to improve community involvement in port sustainability matters. Albeeshi et al. (2020) similarly underscored the significance of public engagement, especially with the adoption of technologies such as composting however their emphasis is on large scale infrastructure rather than grassroots behavioral transformation.

The diversity and societal practices and beliefs highlights the influence of cultural and socioeconomic factors and food waste management strategies. The readiness to recycle redistribute food signifies overarching principles concerning resource conservation and communal assistance. research indicates that values such as thankfulness, when ingrained in family's foster widespread awareness of food waste at the consumption stage (Mourad, 2016; Porpino, 2016). Albeeshi et al. (2020) recognize the significance of socioeconomic conditions but emphasized technical aspects such as the cost effectiveness of composting and incineration technologies, thereby allowing for additional investigation into the impact of cultural barriers on household waste reduction.

The results indicate that individuals possessing greater awareness and knowledge regarding food sustainability are more inclined to implement practices that mitigate food waste, underscoring the significant influence of educational and awareness initiatives on fostering sustainable behavioral change (Faisal et al., 2024; Farr-Wharton et al., 2014). The research examines the impact of demographic characteristics, including age and family size, on the adoption of sustainable eating practices. Older participants and individuals with the greater number of children exhibited increased involvement in community activities, as well as enhanced

awareness and comprehension of sustainable practices. the results indicate that life experiences and familial dynamics influence sustainable behaviors. Albeeshi et al. (2020) emphasize logistics and economics of food waste management technologies over demographic factors, yet both viewpoints the necessity for targeted interventions that account for differing levels of awareness and resource availability among various population segments (Evans, 2012).

The research emphasizes the intermediary function of consciousness and knowledge in the relationship between community practices and the comprehension of sustainable behaviors. It emphasizes the importance of extensive educational initiatives that not only increase awareness of the detrimental effects of food waste but also equip individuals with the necessary knowledge and skills to embrace environmentally sustainable practices .this strategy seeks to connect awareness and action at both personal and communal (Smith & Jehlička, 2013) research indicates that mass media campaigns can engage mainstream media, so facilitating a broader initiatives to mitigate food waste through extensive education (Soma et al., 2020). Albeeshi et al. (2020) emphasized technological interventions while recognizing that public engagement, enabled by education, is essential for the efficacy of their proposed solutions.

Moreover, the study examines the impact of cultural and socioeconomic factors in food waste management solutions. It indicates that social beliefs considering resource conservation at communal solidarity influence individuals 'propensity to participate in sustainable behaviors. Despite awareness of sustainability, the ongoing issues of food loss highlights the difficulty of converting knowledge into action. The research highlights the necessity for culturally attuned treatments and additional investigation to address obstacles to the adoption of sustainable behaviors (AlMutairi & Yen, 2022; Pelletier et al., 2013). Consequently, food waste must be addressed as a collective concern, and people and families should recognize their responsibility in fostering a social impact that integrates sustainable behaviors and practices regarding food consumption.

## Conclusions

The findings of the present research underscore the critical role of awareness and knowledge in facilitating sustainable food practices among individuals. The significant relationship between community practices, awareness, knowledge, and understanding of practices highlights the transformative potential of educating communities on the importance of food sustainability. As the world faces escalating challenges related to food waste and insecurity, this study illuminates the path towards a more sustainable future by emphasizing the need for comprehensive

educational initiatives. By fostering a deeper understanding of the impacts of food waste and equipping individuals with the necessary knowledge to make informed decisions, we can collectively contribute to the reduction of food wastage.

In light of these findings, it is imperative for policymakers, educators, and community leaders to collaboratively develop targeted interventions that address the gaps in public awareness and knowledge regarding food sustainability. Tailored programs that cater to the specific needs and cultural contexts of diverse communities can significantly enhance the adoption of sustainable food practices. Furthermore, the study's insights into the demographic factors influencing sustainability behaviors offer valuable guidance for designing effective educational and policy measures.

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