



Exploring Factors Driving Awareness of Food Waste Reduction Among Urban Households in Bangladesh: A SEM Analysis

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ABSTRACT

Amidst a stark reality where 36% of Bangladesh's population struggles with food insecurity, the staggering annual wastage of 82 kilograms of food per person stands as a profound moral and social crisis. That is why this study aimed to explore the key factors influencing urban households' in-home food waste awareness with a focus on understanding how health considerations, preservation knowledge, packaging awareness, and food management practices contribute to awareness levels. Data were collected from a household survey (n=349) of the three largest city corporations in Bangladesh. After that, structural equation modelling (SEM) was used to validate the proposed awareness model empirically. The results of the study revealed that among the four dimensions of the in-home awareness model, health importance and shelf-life knowledge of foods had a significant positive relation with the awareness. The other two factors (consciousness of packaging size with food quality and knowledge about food management) had an insignificant but negative relation with the awareness of food waste reduction. As Bangladesh is working towards sustainable development goals, this result would help notably in waste management and responsible consumerism, as well as developing consumer awareness campaigns.

1. Introduction

The detrimental effects of food waste on resource use and sustainability have made it a serious social and environmental concern globally. The FW Index Report 2024 indicates that although 5.5 billion metric tonnes (BMT) of food are available for consumption, consumers waste over 1.05 billion metric tonnes, or 19% of the available food supply. Out of these, 60 percent (equal to 631 million metric tonnes) originate from

homes, 12 percent from retail, and 28 percent from food services (UNDP, 2024). While around 800 million people are suffering from chronic undernourishment in contrast to the lost or squandered form of one-third of the globally produced food (Raj and Babu, 2021). Again, it is expected that there will be 9.8 billion people on the planet by 2050, so food production must rise by 70% to meet the needs of the global food supply (Amiri et al., 2023; Olowe, 2021). Since more than half of the world's arable land is already in use for agriculture, increasing

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the intensity of farming won't be able to address the current issue as increasing agricultural land will exacerbate the climate catastrophe and environmental destruction (Strzyżyńska, 2022). To ensure food security, an alternative solution can be the reduction of edible food waste.

Since the majority of garbage ends up in landfills in developing nations, the harmful methane (25 times more potent than carbon dioxide gas) and carbon dioxide gas are released during the breakdown of food waste in landfills (Spring et al., 2020; Van Biene et al., 2021). Furthermore, the production of wasted food consumes approximately 250 km³ of surface or groundwater (over 38 times the water used by all U.S. households) and occupies about 1.4 billion hectares of land, representing 28% of the world's agricultural land (FAO, 2013). Thus, food waste squanders important resources like energy, water, and land. Due to the resulting negative effects on the economy, environment, and society, food waste is becoming a growing concern in many countries.

In countries such as Bangladesh, India, and Pakistan, food waste is commonly disposed of along with general municipal solid waste, despite accounting for approximately 57–60% of the total waste stream (Roy et al., 2022). This lack of segregation hampers opportunities for resource recovery and hinders the development of sustainable waste management systems (Alam et al., 2015). Supporting this, a study conducted across six major Bangladeshi cities found that food waste made up a substantial 74% of municipal waste (Baul et al., 2021), highlighting the scale of the issue in densely populated urban areas. Compounding the problem is a widespread lack of public awareness about the consequences of food waste. Since households are the largest contributors, it is vital to direct research attention toward understanding behaviors at the household level.

Understanding food waste can aid in the creation of innovative methods to reduce waste (Silvennoinen et al., 2014). To define food waste, UNDP, which publishes the food waste index report, stated that food waste encompasses any food intended for human consumption that is discarded, lost, or left uneaten. This type of waste can occur at multiple points along the food supply chain, including during production, processing, distribution, and final consumption. There is a direct and indirect relationship between awareness regarding food waste and food waste reduction behavior. Consumers are more aware of the negative economic and financial effects of food waste (Ramli et al., 2022). However, there is a lack of studies on food waste in Bangladesh. Most of the waste reduction research was done on municipal solid waste and some was on restaurant waste. However, scarce research on in-home food waste reduction

behavior was portrayed. Based on these suppositions, this study investigates the factors influencing awareness of in-home food waste reduction, with a particular focus on household food literacy. Specifically, how health considerations, knowledge of shelf life or preservation, packaging awareness, and food management practices contribute to this awareness.

2. Conceptual Model and Hypothesis for Research

In the context of household food waste, this study's research model was designed by using the knowledge, attitude, and practices (KAP) theory. It explores the influence of in-home food-related practices on the awareness of food waste reduction strategies among urban households in Bangladesh. To deepen theoretical insight, the study integrates perspectives from the Theory of Planned Behavior (TPB) and Health Belief Model (HBM) to explain how knowledge-related behaviors contribute to effective household-level food waste mitigation.

2.1 Awareness of Packaging and Food Quality

Packaging plays a critical yet often overlooked role in household food waste. Key issues include oversized or hard-to-empty packaging and waste from misunderstood "best before" dates (Williams et al., 2012; Toma et al., 2020). Producer and retailer decisions such as date labeling, storage instructions, and packaging design significantly influence consumer behavior (Aschemann-Witzel et al., 2015). Attractive packaging and promotions may also encourage unnecessary purchases, increasing spoilage risks. Moreover, confusion over date labels (e.g., expiration, sell by, best by) contributes to waste (Kavanaugh & Quinlan, 2020). Addressing these systemic issues through better portioning, clear labeling, and quality-preserving packaging can help reduce food waste (Brennan et al., 2021). So, we hypothesize it as:

H1: Awareness of packaging size and food quality is positively associated with food waste reduction awareness.

2.2 Health Awareness

The family food decision-maker's nutritional awareness is one of the major contributing causes of food waste (Min, Shi, Xiaobing Wang, and Xiaohua Yu., 2021). Dietary decisions of the households mostly depend on their income (Ren et al., 2019; Mohd Shariff et al., 2015). Research reveals that people with lower incomes tend to buy less fresh, high-value food than people with higher incomes, as they are less willing to take risks and waste food (French et al., 2019). Conversely, higher-

income families tend to throw away more food because they believe their family will eventually choose healthier options (Daniel, 2016). Again, the tendency to provide healthy foods to children also increases food waste. Parents strive to teach healthy eating habits to their children by serving fruit in a bowl rather than putting it in the fridge (Evans et al., 2013), as healthy foods (fruits) are sometimes not preserved ideally (Hoek et al., 2017). This type of practice also invites food waste. So, we hypothesize that

H2: There is a significant relation between increasing knowledge of health importance with awareness of decreasing food waste.

2.3 Knowledge of Food Management

Key household food waste drivers include poor product inspection, inadequate meal planning, overcooking, and leftover mismanagement (Romani et al., 2018). Younger consumers, in particular, often lack knowledge of shopping, storing, and using leftovers, leading to higher waste (Karunasena et al., 2021). Awareness of behaviors like stockpiling and improper storage can improve food literacy (Farr-Wharton et al., 2014b), while limited understanding of food safety and handling contributes to discard rates (Pearson et al., 2013; Graham-Rowe et al., 2014). Those with better food management knowledge tend to waste less (Bravi et al., 2019). These lead to the following hypothesis:

H3: Food management knowledge is significantly associated with food waste reduction awareness.

2.4 Food Preservation Knowledge

Knowledge of food preservation, particularly techniques to extend shelf life, plays a key role in reducing food waste (Amani & Gadde, 2015; Yu & Roe, 2023). Methods like freezing can significantly reduce spoilage (Holsteijn & Kemna, 2018), yet many lack proper storage knowledge, including optimal refrigerator practices (Porpino et al., 2015) and freezer temperature settings (Waitt & Phillips, 2016). Even small improvements in this knowledge can lead to notable reductions in household food waste (Toma et al., 2020).

H4: Food preservation knowledge is positively associated with food waste awareness.

3. Methodology

To investigate the factors influencing urban households' awareness of in-home food waste reduction behavior in

Bangladesh, a descriptive two-stage survey method (questionnaire survey and pilot research) was used in this study. After conducting pilot research among the target group and making some adjustments to the structured questionnaire, we moved forward with the final questionnaire survey. To ensure internal consistency and coherence for the application of analytical techniques, the data was gathered in a standardized manner.

Preliminary research on a smaller scale called a feasibility study or pilot study, is carried out before the major study with 50 participants in April 2024 to assess feasibility or enhance the research design. Using Cronbach's alpha test, the accuracy of the responses for the pilot study was evaluated. The alpha values over 0.7 signify strong internal consistency of reliability (Apolonio, 2020). The computed alpha value for this pilot survey was 0.762, allowing us to move forward with the data-gathering stage and indicating that the questionnaire was dependable (Jalil et al., 2022a).

3.1 Study area

Considering Bangladesh's segmentation into eight divisions and twelve city corporations, conducting a statewide urban study proved logistically unfeasible. For this, a purposive sample technique was employed, concentrating on three principal city corporations: Rajshahi, Chattogram, and Dhaka North, to achieve a balance between practicality and relevance. Two wards from each group were randomly chosen to guarantee representativeness and methodological integrity.

3.2 Sample Size

To assess awareness of food waste reduction at the household level, this study includes only those participants who are responsible for at least 50% of grocery shopping and meal preparation within their households. Given that residential waste tends to be relatively homogeneous, with variations primarily influenced by income levels and source categories (Yousuf and Rahman, 2007), efforts were made to ensure diversity within the sample based on key socio-demographic variables such as age, gender, educational attainment, and income. A total of 349 urban households were surveyed for this study.

3.3 Measures

The assessment of awareness of the households on food waste reduction practices based on health importance, unconsciousness of packaging size and food quality, ignorance about food management, and shelf-life knowledge about food products are quite limited in social science research. As a result, our study attempted

to create items on these structures based on various literary sources, as Table 1 illustrates.

Table 1: The Overview of the Variables Indicating Awareness About Food Waste Reduction

| Research Variable | Definition Code | Statements | Reference |
|---|-----------------|---|--|
| Awareness of FWR | Awareness1 | Food waste harms the environment. | (Jalil et al., 2022b; Limon and Villarino, 2020; van Geffen et al., 2020a) |
| | Awareness2 | It will hamper the food supply | |
| | Awareness3 | It will increase poverty | |
| | Awareness4 | It will raise inequality in the food division | |
| | Awareness5 | I can contribute to a better world by throwing less food | |
| | Awareness6 | Throwing less food will improve the financial consequences for my family | |
| Awareness of Packaging and food quality | APFQ1 | I have purchased bigger packages of food than required. | (Bravi et al., 2019) |
| | APFQ2 | I tried new foods seeing the packaging but didn't like | |
| | APFQ3 | I did not look at the expiry date | |
| | APFQ4 | The attractive packaging influenced me to buy more. | |
| | APFQ5 | I frequently throw out food for bad quality | |
| Health Awareness | HA1 | I prefer to eat only healthy foods | (Ahmed et al., 2021); (Teng et al., 2020) |
| | HA2 | I prefer to eat fresh fruits only | |
| | HA3 | I try to cook healthy foods for my family | |
| Knowledge of food-related practice & management | FP1 | I don't know exactly what food and ingredients are left at home. | (Van Geffen et al., 2017) |
| | FP2 | I find it difficult to estimate the amount of food the whole family needs to eat each week. | |
| | FP3 | I habitually throw away the skin or | |

| | | | |
|-----------------------------|------|--|---------------------------|
| Food preservation knowledge | | vegetable leaves of edible food. | (Van Geffen et al., 2017) |
| | FPK1 | I know how to preserve fruit and vegetables for as long as possible. | |
| | FPK2 | I know how to preserve meat and fish for as long as possible. | |
| | FPK3 | I am aware of the ideal temperature for maintaining the freshness of my food in the refrigerator | |
| | FPK4 | I am aware of techniques for maintaining product freshness. | |

Five items (including awareness) use a 5-point Likert scale ranging as never, rarely, sometimes, very often, and always.

3.4 Analysis of Data

Exploratory Factor Analysis (EFA) and Descriptive statistics were performed using Statistical Package for Social Science (SPSS) 26.0 software. The valid items for awareness were extracted using EFA. After that, Analysis of Moment Structures (AMOS) was used to conduct Confirmatory Factor Analysis (CFA). Using AMOS version 24, the awareness of food waste model was performed using the structural equation model (SEM).

An SEM consists of two parts: a structural part that connects the constructs (typically, this part expresses the endogenous or dependent constructs as linear functions of the independent or exogenous constructs), and a measurement part that connects the constructs to observed measurements. The second section resembles a model from confirmatory factor analysis (Toma et al., 2009). However, two statistical techniques used for SEM are Path analysis and confirmatory factor analysis (CFA) (Fan et al., 2016). Though initially SEM was used to measure the individual and combined impact of influencing factors on a target variable, it has recently been used in research about sustainability and other forms of food waste (Baser et al., 2017; Goh et al., 2022). The covariance-based (CB) SEM and variance-based partial least square (PLS) methods of SEM modeling are both often utilized (Szakos et al., 2021). In this study, we have used covariance-based SEM. By removing indications with high error terms and/or low loadings, CB-SEM enhances the quality of the latent constructs modeled (Hair, Gabriel, et al., 2014). In this model,

constructs are classified as exogenous or endogenous. Exogenous variables are first-order predictors unaffected by others, while endogenous variables depend on other predictors and may be second-order or higher (Bulhões et al., 2023).

4. Result and Analysis

4.1 Exploratory Factor Analysis

The Exploratory Factor Analysis (EFA) results reveal five key latent variables related to consumer awareness and food-related knowledge: Awareness, Awareness of Packaging Size and Food Quality (APFQ), Health Awareness (HA), Knowledge of Food related Practice & Management (FP), and Food Preservation Knowledge (FPK). Each factor consists of multiple observed variables (items) with factor loadings mostly above 0.7, indicating strong associations between the items and their respective constructs. The variance explained by each factor ranges from 52.212% (FP) to 74.165% (FPK), with higher percentages suggesting a stronger ability to capture underlying patterns in the data.

Table 2: An Overview of the Findings from the Exploratory Factor Analysis (EFA)

| | Factor Constructs | Factor loadings | Variance explained | Reliability |
|-----------|----------------------|--------------------|-----------------------|-------------|
| Awareness | Awareness3 | .816 | 59.596% | .859 |
| | Awareness4 | .816 | | |
| | Awareness2 | .808 | | |
| | Awareness6 | .669 | | |
| | Awareness5 | .614 | | |
| | Awareness1 | .514 | | |
| APFQ | APFQ2 | .704 | 64.812% | .727 |
| | APFQ1 | .696 | | |
| | APFQ5 | .647 | | |
| HA | HA3 | .766 | 71.315% | .792 |
| | HA2 | .764 | | |
| | HA1 | .564 | | |
| FP | FP2 | .834 | 52.212% | .714 |
| | FP1 | .762 | | |
| | FP3 | .510 | | |
| FPK | FPK2 | .868 | 74.165% | 0.882 |
| | FPK4 | .826 | | |
| | FPK1 | .788 | | |
| | FPK3 | .757 | | |

Reliability (Cronbach’s Alpha) is highest for FPK (0.882) and Awareness (0.859), showing strong internal consistency, while APFQ (0.727) has the lowest reliability but remains acceptable. The results indicate that these factors effectively measure different dimensions of food-related awareness and knowledge.

4.2 Confirmatory Factor Analysis

4.2.1 Measurement Model

To confirm the relationship between five subdimensions of knowledge about reducing household food waste (awareness about the negative impact of food waste, health awareness, packaging and food quality awareness, food management knowledge, and food preservation knowledge) and their observed indicators, a first-order CFA model for household knowledge was developed (Table 4). There were 19 observed variables in the urban household’s food waste knowledge model. The observed variances and covariances were 24 and 12, respectively. The number of estimated parameters was 69. This measurement model for household food waste reduction knowledge was identified and tested with 140 degrees of freedom (209 – 69). A chi-square score of 318.468 (df = 140 and p = 0.000) indicates a strong fit for the model.

4.2.2 Model Fit

The model showed an initial good fit with chi-square values of 387.689 (df = 142 and p = 0.000), TLI = 0.896, CMIN/DF = 2.730, and RMSEA = 0.071. According to MI’s suggestion, higher RMSEA and TLI could lead to an improvement in the measurement model. Therefore, we correlated the error term e16 with e17 and e5 with e6. Consequently,

Table 3: Measures for Model Fitness

| Indicator | Estimate | Criteria | Result |
|-----------|----------|-----------------|------------|
| CMIN/DF | 2.275 | Between 1 and 3 | Excellent |
| CFI | 0.937 | >0.95 | Acceptable |
| TLI | 0.923 | >0.95 | Acceptable |
| NFI | 0.894 | >0.90 | Acceptable |
| SRMR | 0.066 | <0.08 | Excellent |
| RMSEA | 0.061 | <0.06 | Acceptable |
| PClose | 0.025 | >0.05 | Acceptable |

The model was improved where the chi-square test value was 2.275 which indicates an excellent fit of the model. Besides, the CFI value was greater than 0.9 but less than 0.95 which means it's satisfactory for the model. Again, the TLI (0.923) and NFI (0.894) test values are also satisfactory. The value of RMSEA is 0.06 which is also satisfied the threshold for model fit indices (Hooper et al., 2008; Shek and Yu, 2014; Gaskin and Lim, 2016). All these results are shown in Table 3.

4.2.3 Convergent and Discriminant Validity

Convergent validity was assessed by comparing the model's outputs to established thresholds using composite reliability (CR) and average variance extracted (AVE), as presented in Table 6. CR, considered a more reliable metric for SEM-based studies, should exceed 0.70 to indicate strong internal consistency (Raykov et al., 2018). All constructs met this criterion, with CR values ranging from 0.728 to 0.885. AVE values ranged from 0.472 to 0.658, with only one construct (APFQ) falling slightly below the 0.50 threshold. However, an AVE below 0.50 is acceptable when CR exceeds 0.60 (Hair et al., 2014; Fornell & Larcker, 1981), thus supporting convergent validity across the five-dimensional construct.

Discriminant validity was examined using both the Fornell–Larcker criterion and the Heterotrait–Monotrait (HTMT) ratio. According to the Fornell–Larcker approach, AVE should exceed the maximum shared variance (MSV) or average shared squared variance (ASV) (Almén et al., 2018). Four constructs (HA, APFQ, FP, and FPK) met this condition, but Awareness did not. Given the limitations of the Fornell–Larcker method, the HTMT ratio was also applied. As all HTMT values (Table 7) were below the conservative threshold of 0.85, discriminant validity was confirmed.

Table 4: Convergent and Discriminant Validity Measures

| | CR | AVE | MSV | Aware | HA | APFQ | KFM | FPK |
|-------|-------|-------|-------|--------------|--------------|--------------|--------------|--------------|
| Aware | 0.860 | 0.515 | 0.087 | 0.718 | | | | |
| HA | 0.803 | 0.578 | 0.283 | 0.296*** | 0.760 | | | |
| APFQ | 0.728 | 0.472 | 0.101 | -0.008 | 0.195** | 0.687 | | |
| FP | 0.755 | 0.524 | 0.101 | -0.072 | -0.095 | 0.317*** | 0.724 | |
| FPK | 0.885 | 0.658 | 0.283 | 0.267 | 0.532 | 0.141 | 0.152* | 0.811 |

Notes: CR = Composite Reliability; AVE = Average Variance Extracted; MSV = Maximum Shared squared variance; * The bolded numbers are the square root of a given factor's AVE

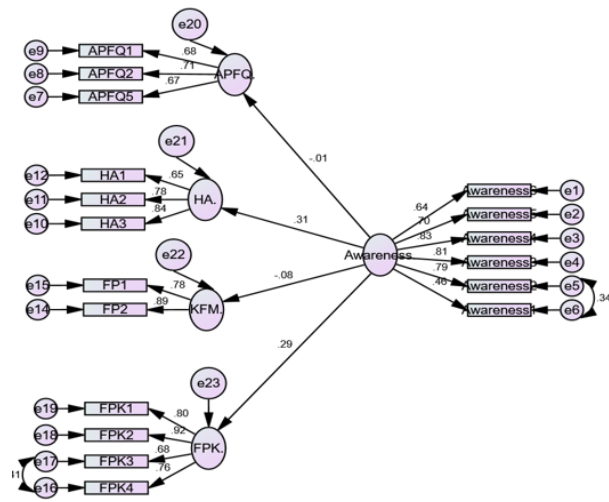
Table 5: HTMT Analysis

| | awareness | HA | APFQ | KFM | FPK |
|------------|-----------|-------|-------|-------|-----|
| awareness. | | | | | |
| HA | 0.306 | | | | |
| APFQ | 0.034 | 0.205 | | | |
| KFM. | 0.105 | 0.019 | 0.466 | | |
| FPK | 0.292 | 0.549 | 0.139 | 0.140 | |

4.3.4 Second-Order CFA: Structural Model

We test the relationships of four dimensions (awareness of packaging and food quality, health awareness, knowledge of food-related practice and management, and food preservation knowledge) with awareness or knowledge about food waste in second-order CFA.

Fig 1: Second-order confirmatory factor analysis model for urban households' food waste knowledge



Initially, the model was identified but the value of the model fit was not significant (CMIN/DF = 3.320, CFI = 0.879, TLI = 0.861, RMSEA = 0.082). According to the MI suggestions, we excluded the lowest factor loading construct (FM and EA3) and then ran the model. The model fit indices demonstrated satisfactory results, meeting all required criteria with a chi-square value of

323.295 (df = 129 and p = 0.000), CMIN/DF of 2.506, CFI of 0.928, and RMSEA of 0.066.

The second-order CFA model’s result has been shown in Table 6.

Table 6: Summary of Structural Model of Awareness About Food Waste Among Urban Households.

| Items | loadings | S.E. | C.R. | P | AVE | CR |
|------------|----------|------|--------|------|-------|-------|
| Awareness6 | .637 | | | | | |
| Awareness5 | .702 | .093 | 10.939 | *** | | |
| Awareness4 | .831 | .099 | 12.355 | *** | 0.524 | 0.866 |
| Awareness3 | .810 | .088 | 12.147 | *** | | |
| Awareness2 | .791 | .086 | 11.952 | *** | | |
| Awareness1 | .465 | .077 | 7.634 | *** | | |
| APFQ5 | .667 | | | | | |
| APFQ2 | .714 | .114 | 8.543 | *** | 0.472 | 0.728 |
| APFQ1 | .681 | .112 | 8.588 | *** | | |
| HA3 | .836 | | | | | |
| HA2 | .777 | .078 | 12.125 | *** | 0.578 | 0.803 |
| HA1 | .654 | .083 | 11.094 | *** | | |
| FP2 | .887 | | | | | |
| FP1 | .784 | .579 | 1.509 | .131 | 0.696 | 0.821 |
| FPK4 | .758 | | | | | |
| FPK3 | .681 | .061 | 16.382 | *** | | |
| FPK2 | .921 | .075 | 16.009 | *** | 0.658 | 0.885 |
| FPK1 | .801 | .071 | 15.120 | *** | | |

5. Discussion

The study aimed to analyze the factors influencing households’ knowledge about food waste and the influence of these factors on food waste reduction practices. The measurement model results for household food waste knowledge supported hypotheses H1, H2, H3, and H4 and confirmed that among the four dimensions of

knowledge, two (health awareness and food preservation knowledge) had significant positive relationships, and the other two factors (awareness of Packaging & food quality and knowledge about food management) had negative but insignificant relation with awareness. This research shows that households typically utilize the four aspects of household food consumption to assess their level of awareness of food waste reduction.

According to the findings of this study's empirical investigation, the health-importance knowledge

subdimension is the most relevant indication in quantifying a household's food waste knowledge.

Whereas eating healthy foods helps to reduce food waste. This finding contradicts prior research (Brennan & Browne, 2021; Lisciani et al., 2024; Graham-Rowe et al., 2014; Savelli et al., 2019) which argued that healthy eating may lead to increased waste due to heightened selectivity or rejection of "imperfect" food.

Table 7: Result of Hypothesis Testing

| Hypothesis | Estimate | P value | Result |
|---|------------|---------|--------------|
| There is a significant relationship between unconsciousness about packaging size and food quality with awareness of food waste. | H1 - 0.009 | 0.924 | Not accepted |
| There is a significant relationship between health awareness and food waste reduction knowledge. | H2 0.473 | *** | Accepted |
| There is a negative relationship between knowledge about food management and food waste knowledge. | H3 -0.159 | 0.205 | Not accepted |
| There is a positive relationship between increasing preservation knowledge of food and food waste awareness. | H4 0.375 | *** | Accepted |

However, in our study, households that emphasized healthy eating appeared more likely to reduce waste, likely because health-conscious consumers may plan meals more carefully, store food properly, and value food as part of their wellbeing. This aligns with research by Stancu et al. (2016), who found that individuals with stronger health motivations were more likely to engage in sustainable consumption behaviors, including food waste prevention. These findings suggest that linking healthy eating campaigns with food waste reduction messaging could be a promising public policy strategy.

Secondly, the shelf-life or preservation knowledge is the second significant indicator in measuring household's food waste knowledge. This finding of this model confirmed that awareness or knowledge of household food waste has a significant positive connection with the shelf-life knowledge subdimension. This result supports the findings of van Geffen et al. (2017), who emphasized that preservation knowledge, such as optimal storage conditions or freezing practices, plays a vital role in household food management and waste reduction. Similar results also found by (Chinie et al., 2021) and (Kolawole et al., 2024) indicating that sufficient knowledge of food preservation could reduce waste. Though this result contrasts with a study based on a comprehensive literature review that increased demand for so-called "fresh products," which may contribute to the illusion that products with a longer shelf life are less fresh. So, the link between shelf-life extension and food

waste reduction does not appear to be obvious (Amani & Gadde, 2015). This disparity underlines the need for more targeted education on interpreting expiry labels and understanding actual food spoilage indicators.

Besides, food management and awareness of packaging and food quality are the other two determinants of measuring knowledge of food waste among urban households. We have found an insignificant but negative relationship between these two factors with awareness or knowledge. Although the FAO (2019) found either inadequate or excessive packing as the main causes of food loss in underdeveloped areas, consumer opinions sometimes minimize the importance of packaging in extending shelf life or avoiding damage. While big packaging might lead to waste because of over-purchasing or rotting, Wohner et al. (2019) contended that smart packaging technologies can improve preservation and offer helpful consumption advice.

The research findings may be explained by the growing impact of Agenda 2030 and Sustainable Development Goals (SDGs) on public opinion. As food appears to have been a cross-cutting issue in this expansive program, connecting most of the goals; in fact, Agenda 2030 cannot be effectively executed without eradicating hunger, guaranteeing food and nutrition security, and enhancing the health of the world's people (Rasool et al., 2021). As a result, people are becoming more conscious of issues related to food consumption.

6. Conclusion

This study explored the factors influencing household knowledge of food waste and their impact on waste reduction practices among urban households in Bangladesh. The results revealed that health awareness and food preservation knowledge significantly and positively influence food waste awareness, while knowledge of food management and packaging awareness showed negative but statistically insignificant relationships. These findings indicate that there must be targeted interventions to enhance household understanding of food waste reduction. Based on the results, it is recommended that policymakers integrate food waste education into health and nutrition campaigns, promote public awareness of food preservation techniques, encourage packaging innovations for smaller portions, and raise the quality of preservation techniques. Aligning these actions with the Sustainable Development Goals can strengthen national efforts to reduce urban food waste and promote sustainable consumption behavior.

7. Significance of this study

This study makes key theoretical and practical contributions by conceptualizing food waste knowledge as a multi-dimensional construct, taking food management, health importance, packaging and quality, and preservation as the mediating variables. It deepens understanding of food waste awareness by emphasizing the "knowledge" component within the KAP framework and integrating elements from the Theory of Planned Behavior and Health Belief Model. Finally, the findings inform targeted education and community interventions and support the development of food waste reduction policies in Bangladesh that are in line with international practices.

8. Limitations and Scope for Further Research

This study focused solely on in-home food waste reduction awareness, as no training programs or educational campaigns on this issue were observed in Bangladesh. However, food waste generated outside the home, particularly at marriage ceremonies and various events held in community centers and restaurants, is significantly high. Additionally, both urban and rural areas should be examined for a comprehensive understanding, but this study was limited to the urban areas of Bangladesh. Future research could explore attitudes toward food waste reduction, opportunities for minimizing waste, and recycling practices.

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