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Assessing food waste and environment-related factors: Evidence from urban households in Southwestern Nigeria

Aminu, Folasade Oluremi[1+]
Olulaye, David Oluwatimilehin[2]

[1,2]*Department of Agricultural Extension and Management, School of Agricultural Technology, Yaba College of Technology, Epe Campus, Yaba, Lagos State, Nigeria.*
[1]*Email: folaafe02@gmail.com*
[2]*Email: Olulayedavid@gmail.com*


(+ Corresponding author)

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ABSTRACT

This study assessed food waste and environment-related factors among urban households in Southwestern Nigeria. The objectives were to identify commonly wasted food types, examine household practices and attitudes toward food storage, consumption, and waste disposal, and analyze the socio-economic, cultural, and environmental determinants of food waste. A multistage sampling technique was used to select 240 respondents, and data were collected using structured questionnaires. Descriptive statistics and multiple regression analysis were employed to analyze the data. Results revealed that commonly wasted foods include legumes, noodles, bread, and cereals, largely due to over-purchasing, convenience preferences, and short shelf life. Perception analysis showed general awareness of food waste, although some households still engage in wasteful practices. Environmental factors such as inadequate municipal waste collection and irregular electricity supply significantly contribute to household food spoilage. Regression analysis indicated that variables including household income, the presence of children under 10 years old, access to refrigerators, frequency of food purchases, and environmental awareness substantially influence the level of food waste. The study concluded that food waste in urban households is a complex issue shaped by socio-economic, behavioral, and environmental factors. It recommended implementing awareness campaigns, improving infrastructure for food preservation, and developing targeted policy interventions to promote sustainable household food management and mitigate the negative environmental impacts of food waste.

Contribution/Originality: The study contributes to the existing literature by exploring the socio-economic and environmental determinants of food waste among urban households in Nigeria. It offers new insights into how household characteristics, consumption behaviors, and infrastructural constraints influence food waste, thereby enhancing understanding of sustainable food management and supporting the development of a circular economy in developing contexts.

1. INTRODUCTION

Food is a fundamental requirement for human survival, providing the necessary nutrients and energy for optimal bodily function. Sourced from plants, animals, or fungi, food contains essential elements such as carbohydrates, proteins, fats, vitamins, and minerals (Sunday et al., 2022). Despite its vital role, a considerable proportion of food produced is wasted, particularly at the household level. Food waste (FW) refers to the avoidable loss or disposal of food that is otherwise suitable for human consumption, often occurring at the retail and consumer stages of the supply chain. This includes discarded leftovers, food spoiled due to poor storage, or items not consumed before their

expiration date (Soomro et al., 2021). Globally, food waste has emerged as a critical issue with substantial implications for food security, environmental sustainability, and economic development (Zielińska, Dąbrowska, Vovk, & Drozda, 2023). In Nigeria, approximately 40% of all food produced is either lost or wasted, with urban households accounting for a significant share of this waste (Kolawole et al., 2024). This trend is particularly concerning in light of the country's growing food insecurity, rapid urban expansion, and increasing environmental degradation.

Although much of the academic and policy focus has been on post-harvest losses in agricultural production, food waste at the household level, especially in urban settings, remains under-researched. Nevertheless, it contributes significantly to national food loss statistics (Kolawole & Owoigbe, 2025). For instance, a representative study by Sunday et al. (2022) in Kogi State found that urban households wasted an average of 13.1% of their monthly food expenditure, compared to 7.2% in rural areas. Contributing factors include leftover disposal, poor storage facilities, irregular power supply, higher income levels, evolving food preferences, and cultural norms that encourage overcooking (Adedayo, Adeaga, & Akomolafe, 2020; Kolawole & Owoigbe, 2025). Additionally, limited environmental awareness and weak waste management infrastructure further compound the problem. The fast-paced urban lifestyle and the growing reliance on convenience foods are also key drivers of food waste in cities (Kolawole & Owoigbe, 2025; Sunday et al., 2022).

Environmentally, household food waste contributes significantly to greenhouse gas emissions, particularly methane, when discarded in landfills. It also leads to water and soil pollution and represents a loss of the resources used in food production, such as land, energy, and water (United Nations Environment Program, 2021). These impacts undermine progress toward global sustainability goals, particularly SDG 12 (Responsible Consumption and Production) and SDG 11 (Sustainable Cities and Communities). Therefore, reducing food waste at the household level is imperative for achieving sustainable urban development and mitigating climate change.

South Western Nigeria is predominantly agrarian but is undergoing steady urbanization, which is influencing dietary habits, food acquisition practices, and waste disposal behaviors. Despite these changes, there remains a dearth of empirical research exploring household food waste and its environmental dimensions in the state's urban areas. This study, therefore, seeks to assess the extent of household food waste and examine the socio-economic, cultural, and environmental factors influencing food waste behavior among urban households. The findings are expected to inform targeted policies and interventions aimed at enhancing food security, protecting the environment, and promoting sustainable living in Nigerian cities.

2. LITERATURE REVIEW

2.1. Concept of Food Waste

Food loss and waste (FLW) have become major global concerns due to their implications for food security, resource efficiency, and environmental sustainability. Current estimates indicate that nearly one-third of the food produced for human consumption is either lost or wasted at various points along the supply chain, with households contributing significantly to the total consumer-level waste (Gustavsson, Cederberg, Sonesson, van Otterdijk, & Meybeck, 2011; United Nations Environment Program, 2021). Food waste specifically refers to situations where food that is safe and suitable for human consumption is discarded or diverted to non-food uses at any stage from production to final household consumption (Bellù, 2018).

Throughout the retail and distribution segments, waste often arises from poor handling practices, excess procurement, and rigid cosmetic standards for fresh produce. Items may be rejected because they deviate from required size, color, or shape specifications, even when they remain fit for consumption (Parfitt, Barthel, & Macnaughton, 2010).

Within households, food waste is typically driven by inappropriate purchasing behavior, inadequate storage, and cooking or serving practices that generate excess leftovers. Many consumers purchase more food than they can realistically use before spoilage occurs, or they dispose of edible leftovers and food scraps that could otherwise be

repurposed. Evidence suggests that income level plays a significant role in household wastage patterns, with food waste tending to increase as household income rises (Secondi, Principato, & Laureti, 2015). In urban settings, waste is further exacerbated by limited meal planning, misinterpretation of date labels, and busy lifestyles. This differs from rural households, where food is often treated more carefully due to its scarcity and the labor invested in production (Okoruwa & Olusanya, 2019). Household routines, such as frequent dining out or irregular eating schedules, can also contribute to spoilage when stored food is left unused (Parizeau, Von Massow, & Martin, 2015).

With rapid urbanization and changing dietary behaviors in Nigeria, household food waste has become an increasingly important issue in major Southwestern cities. Beyond the financial losses incurred, the disposal of food waste generates significant environmental consequences, including greenhouse gas emissions, inefficient use of water and land resources, and pollution linked to poor waste management practices (Food and Agriculture Organization, 2014; United Nations Environment Programme (UNEP), 2024).

2.2. Food Waste Generation and its Environmental Impacts

Food waste has emerged as a major global environmental and socio-economic challenge, with enormous quantities of edible food discarded daily. Current global estimates indicate that nearly one-third of all food produced, approximately 1.3 billion tons each year, is lost or wasted across various stages of the supply chain (Food and Agriculture Organization, 2011; Saha, 2023). Losses occur from production through processing, retail, and final household consumption, driven by factors including spoilage, physical damage, inefficient logistics, overproduction, and inappropriate consumer behavior (Gustavsson et al., 2011).

The environmental implications of food waste are extensive. To begin with, wasting food results in a direct loss of natural resources such as water, land, energy, and agricultural inputs invested in its production (Philippidis, Sartori, Ferrari, & M'Barek, 2019). This accelerates the degradation of ecosystems and intensifies environmental pressures, such as soil erosion, freshwater depletion, and deforestation linked to agricultural expansion (Ishangulyyev, Kim, & Lee, 2019). In effect, every unit of wasted food embodies avoidable resource use and magnifies the ecological footprint of the food system.

A significant environmental issue is the contribution of food waste to global greenhouse gas (GHG) emissions. When discarded food decomposes in landfills under anaerobic conditions, it produces methane, a greenhouse gas with a global warming potential approximately 25 times greater than carbon dioxide. Estimates indicate that food waste generates about 3.3 billion metric tons of CO_2-equivalent annually, making it one of the largest sources of human-induced GHG emissions worldwide (Nordahl et al., 2020).

Food waste further exacerbates biodiversity loss. Agriculture, fisheries, and forestry already exert substantial pressure on ecosystems, and wasted food amplifies this strain by increasing demand for land, water, and biomass extraction. Producing food that is never consumed results in unnecessary disturbance of habitats and accelerates declines in species richness and ecosystem services (Read, Hondula, & Muth, 2022).

The economic repercussions are equally significant. Discarded food represents a major loss of economic value embedded in production, processing, transportation, and labor. FAO estimates place the global financial cost of food waste at nearly US$1 trillion annually, reflecting not only inefficiency but also a missed opportunity to allocate edible food to food-insecure populations (Kotykova & Babych, 2019).

There are also significant social implications, especially in developing regions. Inadequate infrastructure, poor transportation systems, and insufficient storage facilities lead to substantial food waste occurring before food reaches consumers. These losses undermine food security and impose financial hardships on smallholder farmers and supply-chain actors (Santeramo, 2021).

In summary, food waste contributes to the depletion of natural resources, greenhouse gas emissions, biodiversity loss, and significant economic and social costs. Addressing this problem requires coordinated action across the entire

supply chain, from producers to retailers and consumers, to promote efficient resource use, minimize losses, and strengthen global food security (Morone, Koutinas, Gathergood, Arshadi, & Matharu, 2019).

2.3. Education and Awareness Campaign

Education and awareness campaigns remain some of the most cost-effective demand-side strategies for reducing household food waste and enhancing organic waste management in urban environments (Diana, Martianto, Baliwati, Sukandar, & Hendriadi, 2022). By strengthening household knowledge on food storage, correct interpretation of date labels, portion control, safe redistribution or donation, and low-energy preservation methods, such initiatives help shift both attitudes and everyday practices that contribute to avoidable spoilage. These outcomes are especially critical in Southwestern Nigerian cities, where rapid urban expansion, irregular power supply, and inconsistent waste management systems heighten food-spoilage vulnerabilities.

Evidence from global and Nigerian studies indicates, however, that providing information alone yields only limited improvements unless supported by hands-on training, enabling infrastructures, and periodic reinforcement. International examples, including FAO's *Save Your Food* initiative show that multi-channel outreach strategies (such as household workshops, chef demonstrations, social media campaigns, and broadcast media) significantly strengthen behavioral change. Nigerian interventions such as ColdHubs similarly demonstrate that when education is paired with technical solutions (e.g., solar cold rooms), the effectiveness of outreach increases substantially. Campaigns that translate environmental messages into clear monetary savings and relatable actions (proper tomato storage, meal planning, reuse recipes, and basic preservation tips) tend to resonate more with budget-conscious urban households.

Effective campaigns must also be tailored to the specific drivers of food waste among targeted population groups. This requires reliable data on the volume, patterns, and causes of household food waste, as well as an understanding of consumer motivations, preferred communication channels, and proven behavior-change techniques. Continuous monitoring and evaluation are equally important in order to track measurable reductions in food waste and guide campaign refinement. Broader engagement of actors across the food supply chain is also necessary to ensure the development of integrated, cross-sectoral solutions (Schinkel, 2019).

Traditional communication channels, including leaflets, interpersonal communication, newspapers, films, and television, have proven effective for disseminating food-waste information, while online media provide additional reach (Schanes, Dobernig, & Gözet, 2018). The use of social media is particularly recommended for large-scale educational and communication efforts due to its capacity to reach diverse audiences, facilitate interactive learning, and stimulate behavioral shifts (Vittuari, Politan, Gaiani, Canali, & Elander, 2015). Nevertheless, campaigns that rely solely on social media tend to produce weaker results compared to multi-modal strategies that combine digital outreach with practical demonstrations, community engagement, and local partnerships (Jenkins, Brennan, Molenaar, & McCaffrey, 2022). Experiences from Indonesia illustrate that food-waste education initiatives are increasingly implemented by communities, private sector actors, and government institutions, demonstrating the importance of distributed responsibility (Bank DBS Indonesia, 2022).

3. EMPIRICAL REVIEW

This section presents empirical evidence from Nigeria and other regions to contextualize the determinants, magnitude, and implications of food waste in relation to urban environmental and household dynamics.

Babatunde, Opeyemi, and Ola (2019) investigated the relationship between household food waste and food security in Kwara State using survey data from 120 households selected through a three-stage sampling technique. Using the recommended calorie intake benchmark of 2,260 Kcal, the study found that 82.5% of households were food-insecure, despite wasting an average of 496.75 Kcal per week among food-secure households. Logistic regression results showed that household size, the quantity of wasted food, and knowledge about food waste significantly influenced food security outcomes. A Tobit model further identified income as the major driver of household food

waste. The study concluded that food waste contributes directly to household food insecurity and emphasized the need for targeted awareness campaigns, especially among high-income earners, to promote food-saving practices. This research is particularly relevant for Southwestern Nigeria, where income disparities and urban consumption patterns similarly drive wasteful behavior.

Mmereki, David Jr, and Wreh Brownell (2023) examined food loss and waste (FLW) across low- and middle-income countries by utilizing grey literature, case studies, technical documents, and peer-reviewed research. Their study reported that per-capita food waste in sub-Saharan Africa ranges between 6 and 11 kilograms per year. Key constraints identified include inadequate infrastructure, weak policy frameworks, poor recovery systems, limited incentives for recycling, and insufficient educational programs on proper waste separation and collection. These systemic challenges have significant environmental and public health consequences and hinder the adoption of sustainable waste management practices. The research also highlighted untapped opportunities for composting and bioenergy recovery. The findings offer valuable insights relevant to Southwestern Nigeria, where rapid urbanization and weak municipal waste processing systems undermine sustainable food-waste management efforts.

Nnoli et al. (2024) provided a comprehensive assessment of the drivers, impacts, and mitigation opportunities related to food waste in Nigeria, with a particular focus on tomatoes, onions, and chili peppers. Utilizing secondary data from previous studies, policy documents, and media reports, the study identified key factors contributing to food waste, including inadequate infrastructure, pest and disease infestations, inefficient transportation systems, and policy shortcomings. The socioeconomic consequences, such as rising food costs, increased poverty levels, and environmental degradation, highlight the urgent need for effective waste reduction strategies at the national level. The study advocates for a multi-stakeholder approach involving government agencies, civil society organizations, and households to address these issues comprehensively. These findings are especially relevant to Southwestern Nigeria, where vegetable spoilage and weak supply chain systems continue to be significant contributors to household-level food waste.

Martianto, Diana, Baliwati, Sukandar, and Hendriadi (2024) conducted a cross-sectional comparison of household food waste in urban and rural areas using waste composition analysis and food diaries across 215 households in Bogor Regency, Indonesia. The results showed an average household food waste of 77 kg per capita per year, with 37.7% being edible waste and 62.3% inedible waste. Urban households generated significantly more waste (79.4 kg per capita per year) than rural households (45.8 kg per capita per year), indicating the influence of urban lifestyles, consumption patterns, and access to packaged foods. These insights mirror the context of urban Southwestern Nigeria, where urban households tend to generate higher food waste due to higher incomes, diverse diets, and greater dependence on purchased foods.

4. METHODOLOGY

This study was conducted in South-Western Nigeria, one of the six geopolitical zones of the country. The region comprises six states: Lagos, Ogun, Oyo, Osun, Ondo, and Ekiti, situated approximately between latitudes 6°N and 9°N and longitudes 2°31′E and 6°00′E. The area experiences a tropical climate characterized by distinct wet and dry seasons, with an average annual rainfall of about 1,500 mm and mean temperatures ranging from 25°C to 32°C. The population is estimated at approximately 40 million people (National Bureau of Statistics, 2022). Southwestern Nigeria is among the most urbanized and economically vibrant regions in the country, with major activities in trade, manufacturing, services, and agriculture. Agriculture continues to play a significant role in the region's economy, with common crops including cassava, yam, maize, rice, plantain, and vegetables, as well as livestock production. However, rapid urbanization, rising income levels, and changing dietary preferences have altered food consumption behaviors, leading to increased household food waste. The region also faces environmental and waste management challenges stemming from irregular electricity supply, weak municipal waste collection systems, and inadequate

storage infrastructure. These conditions make South Western Nigeria an appropriate setting for assessing food waste dynamics and the influence of environmental factors among urban households.

4.1. Sampling Procedure and Sample Size

A multi-stage sampling technique was employed to ensure representativeness across urban areas of the region. In the first stage, two states were randomly selected from the six states within the region. The second stage involved the purposive selection of two urban Local Government Areas (LGAs) from each state, based on criteria such as high population density, rapid urbanization, and increased incidence of food waste. From each selected LGA, three communities were purposively chosen according to varying levels of urban characteristics and proximity to local markets or food outlets. This process resulted in a total of twelve communities. In the final stage, a simple random sampling technique was used to select twenty households from each community, resulting in a total sample size of 240 households.

Data Collection: Primary data were collected using a structured interview schedule, administered through well-designed questionnaires. The instrument covered sections on: socio-economic characteristics of respondents; causes and perceptions of household food waste; and food-related environmental conditions (e.g., electricity availability, storage infrastructure, and waste disposal methods). Secondary information was sourced from relevant scholarly materials such as journal articles, books, and institutional reports.

Likert scale techniques were used to collect data on respondents' attitudes and perceptions towards food waste, environmental awareness, household waste management practices, and food storage and consumption behaviors.

4.2. Method of Data Analysis

The study employed the following analytical tools:

Descriptive Statistics (frequencies, means, and percentages) were used to describe the socio-economic profile of respondents and to summarize information on food waste causes, food handling practices, and storage conditions.

Multiple Regression Analysis was applied to examine the determinants of food waste levels among urban households. The model incorporated socio-economic variables (e.g., income, household size, occupation, education), cultural factors, and environmental variables (e.g., access to electricity, storage facilities, waste disposal methods). The model is specified as follows.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \ldots. + \beta_n X_n + \mu_i \qquad (1)$$

Where Y is households' level of food waste (Index based on waste frequency and volume).

The explanatory variables are: X_1 = Sex of the household head (1 if male, 0 otherwise); X_2 = Age of the household head (in years); X_3 = Level of education of the household head (years spent in school).

X_4 = Marital status (Married = 1, Not married = 0), X_5 = Household size (Number of persons in a household), X_6 = Presence of children below 10 years in the household (1 if yes, 0 otherwise), X_7 = Occupation of household head (1 if civil servant, 0 otherwise), X_8 = Total household monthly income (₦), X_9 = Frequency of food shopping (times/month), X_{10} = Adequate storage facilities (1 if adequate, 0 otherwise), X_{11} = Presence of refrigerator in the household (1 if yes, 0 otherwise), X_{12} = Planning meal before cooking (1 if yes, 0 otherwise), X_{13} = Food available in the house/week (₦), X_{14} = Average number of meals per day (number), X_{15} = Number of times household eat out per week, X_{16} =Number of times food not consumed is disposed of per week by the household, X_{17} = Regular access to electricity (1 if yes, 0 otherwise), X_{18} = Waste disposal method (1 if municipal collection, 0 otherwise), X_{19} = Environmental awareness of food waste (index), X_{20} = Distance to major food market (Km), μ_i = Error term.

5. RESULTS AND DISCUSSION

5.1. Socio-Economic Characteristics of the Respondents

Table 1 summarizes the socio-economic characteristics of the surveyed households. The findings reveal that a majority (65%) of the households were headed by males, indicating a male-dominated household structure in urban areas of the region. This agrees with the findings of Akerele, Afolayan, Oyawole, and Sanusi (2017), who also reported a higher proportion of male-headed households in similar urban studies. More than half (54.2%) of the household heads were within the age bracket of 41–50 years, with a mean age of approximately 42 years, suggesting that most respondents were within their economically productive years. This observation is consistent with the study by Sunday et al. (2022), which reported a similar age distribution among household heads.

Table 1. Summary of the selected socio-economic characteristics of the respondents.

Variable	Frequency	Percentage (%)	Mean
Sex			
Male	156	65.0	
Female	84	35.0	
Age (years)			
≤40	40	16.6	
41-50	130	54.2	42.47±4.560
>60	70	29.2	
Educational qualification			
Secondary	52	21.7	
Tertiary	188	78.3	
Marital status			
Married	194	80.8	
Unmarried	46	19.2	
Household size			
≤5	172	71.7	
6-10	68	28.3	5±1.911
Presence of children under 10 years			
No	44	18.3	
Yes	196	81.7	
Major occupation			
Paid employment	136	56.7	
Artisan	72	30.0	
Farming	32	13.3	
Monthly income			
≤100,000	20	8.3	187,333±18543.60
101,000-200,000	136	56.7	
>200,000	84	35.0	

Note: n = 240.
Source: Field Survey, 2024.

In terms of educational attainment, over 78% of respondents had a tertiary education, while approximately 20% had attained secondary education. This indicates a relatively high literacy level among the respondents, which may contribute to increased awareness of food preservation techniques and environmental concerns related to food waste. Analysis of marital status revealed that 80.8% of respondents were married, with an average household size of five members. This relatively small household size could influence food management practices, as married individuals are generally more conscious of household wellbeing and resource utilization, including food consumption. Additionally, the presence of children under the age of 10 was reported in 81.7% of households, a factor that may contribute to food waste due to children's selective eating habits. This finding supports earlier studies by Akerele et al. (2017), which identified households with young children as having higher tendencies toward food wastage. Regarding occupational status, 56.7% of household heads were engaged in paid employment, with an average monthly income of ₦187,333. Higher income levels and busy work schedules may lead to increased food waste, particularly due to bulk food

purchases, improper storage, and frequent leftovers. Households with greater disposable income may also exhibit higher food waste due to convenience-based consumption behaviors and a reduced sensitivity to the economic value of wasted food.

5.2. Households' Food Purchase and Consumption Characteristics

Table 2 presents results on the food purchasing and consumption patterns of households. The findings indicate that 65% of household heads purchase food on a monthly basis, 21.7% bi-weekly, and only 13.3% daily. This pattern suggests that most household heads, likely salaried civil servants, receive income monthly and tend to buy food items in bulk. However, this bulk-buying behavior may increase the risk of over-purchasing and subsequent food spoilage, leading to greater food waste. A significant majority (90%) of households own functional refrigerators.

Which potentially aid in reducing food spoilage by extending the shelf life of perishables. Nevertheless, 85% of the respondents reported experiencing irregular power supply. This, combined with poor storage habits and over-purchasing, often leads to food spoilage, forgotten food items, and the expiration of stored foods, thus undermining the potential benefits of refrigeration. The dominant food preservation methods among respondents were refrigeration (80.8%), freezing (70.8%), and smoking (56.7%). While these methods are effective in prolonging the usability of perishable foods, their efficacy is diminished in the face of inconsistent electricity supply and improper handling practices. These findings agree with those of Busari, Alabi, Bayero, and Idris-Adeniyi (2022), who observed that refrigeration was the most common preservation method in Osogbo metropolis, largely influenced by the income level of the respondents, which enabled them to purchase refrigerators and afford electricity access.

Additionally, 55% of households reported planning their meals before cooking. Meal planning is a valuable practice that reduces the likelihood of over-preparation, optimizes ingredient use, and helps minimize food loss and waste. Regarding meal frequency, 61.7% of households consumed meals regularly.

Table 2. Households' Food Purchase and Consumption Characteristics

Characteristics	Frequency	Percentage
Frequency of Food Item Purchases		
Daily	52	21.7
Bi-weekly	32	13.3
Monthly	156	65.0
Ownership of a functional refrigerator		
No	24	10.0
Yes	216	90.0
Regular electricity supply		
No	204	85.0
Yes	36	15.0
*Methods of preservation of food items		
Refrigeration	194	80.8
Freezing	170	70.8
Drying	66	27.5
Smoking	136	56.7
Salting	56	23.3
Meal planning before cooking		
No	108	45.0
Yes	132	55.0
Number of times households ate per day		
Twice	92	38.3
Thrice	148	61.7
Frequency of meal preparation at home		
Daily	192	80.0
Rarely	48	20.0
Monetary value of total food available in households/Week (₦)		
≤30,000	96	40.0

Characteristics	Frequency	Percentage
31,000-50,000	128	53.3
>50,000	16	6.7
Mean	43,091.65±5989.87	
*Households' use of leftover foods		
Eat it the next day	72	30.0
Store it for later	44	18.3
Give it to others	24	10.0
Throw it away	156	65.0
Feed it to animals	56	25.3

Note: *Multiple responses.
Source: Field survey data, 2024.

Three meals per day, while 38.3% had two. Furthermore, 80% of the households reported cooking meals at home daily. Higher meal frequency and home meal preparation may increase the volume of leftovers, thereby contributing to food waste. This observation is consistent with the findings of Sunday et al. (2022), who found that increased meal frequency correlates with more food waste due to leftovers. The analysis also reveals that 53.3% of households spent between ₦31,000 and ₦50,000 on food weekly, with a mean weekly expenditure of ₦43,091.65. This relatively high food expenditure may elevate the likelihood of food wastage, especially when perishable items are not consumed before spoilage. On leftover management, 65% of households reported discarding leftover food, 18.3% stored leftovers for later consumption, and only 30% consumed them the next day. The high rate of food discard indicates a tendency toward convenience and an attitude of abundance, which exacerbates household food waste, increases household expenditure, and contributes to environmental degradation due to waste accumulation.

5.3. Types of Foods Commonly Wasted Among Households

As illustrated in Figure 1, the most frequently wasted food items among urban households include legumes (70%), noodles and pasta (63.4%), bread and bakery products (56.6%), and cereals (50%). The high level of wastage for these food groups can be attributed to factors such as bulk purchasing, limited shelf life, and the preference for convenience foods, which often results in overstocking and eventual spoilage. This trend contributes not only to increased household food expenditure but also to the generation of avoidable waste. This finding supports the report of Kasavan, Ali, Ali, Masarudin, and Yusoff (2021), who noted that excessive food waste at the consumer level is largely driven by the over-purchasing of food items, especially those with short shelf lives or that are frequently consumed for convenience.

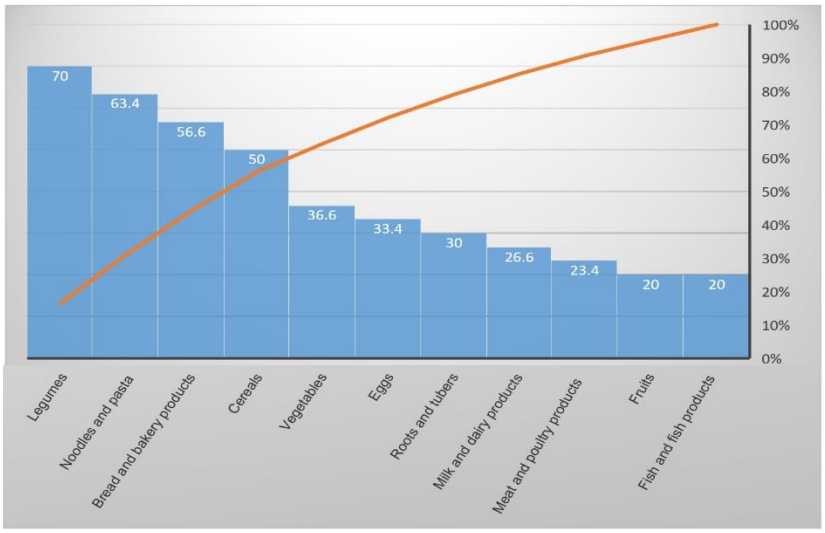

Figure 1. Types of foods commonly wasted among households.

5.4. Households' Food Waste (FW) Characteristics

The characteristics of food waste (FW) among urban households are presented in Table 3. The results reveal that 61.7% of households reported disposing of unconsumed food at most twice a week, indicating a recurring pattern of food wastage. This frequency suggests persistent challenges related to portion control, improper storage, and poor meal planning, which collectively contribute to economic losses and environmental concerns. Several reasons were identified for food wastage among respondents, including poor electricity supply (84.2%), leftovers from large meals (80%), preference for food freshness (56.7%), picky eating habits of children (55%), over-purchasing (51.7%), spoilage before use (50.8%), and poor meal planning (50%). These findings reflect a consumption-driven waste culture, where households tend to over-purchase or prepare more food than required, leading to excessive leftovers and spoilage. Such behaviors not only escalate household expenses but also place pressure on waste management infrastructure and contribute to environmental degradation. These findings are consistent with Sunday et al. (2022), who noted that urban food waste often stems from leftovers, over-preparation, spoilage, and food expiration. Busari et al. (2022) similarly reported that inadequate electricity supply was a key driver of household food waste in Osogbo. A similar result was also reported by Zielińska et al. (2023).

In terms of environmental awareness, 60% of respondents indicated awareness of the environmental impacts of food waste, while 40% were unaware.

Table 3. Households' food waste characteristics.

Food Waste Characteristics	Frequency	Percentage
Times food not consumed is disposed/Week		
At most 2 times	148	61.7
3-4 times	72	30.0
More than 4 times	20	8.3
*Reasons for disposing/wasting food		
Poor meal planning	120	50.0
Over-purchasing	124	51.7
Lack of time to cook perishable items	68	28.3
Leftovers from large meals	192	80.0
Spoilage before use	122	50.8
Poor electricity supply	202	84.2
Expiry of food items	64	26.7
Improper storage	50	20.8
Preference for fast foods due to busy schedules	66	27.5
Preference for food freshness	136	56.7
Picky eating habits of children	132	55
Forgetting to eat stored food	108	45.0
Inadequate/faulty refrigerators/freezers	84	35.0
Awareness of the environmental impact of food waste		
No	96	40.0
Yes	144	60.0
Monetary value of total food wasted in households/Week		
≤5,000	72	30.0
5,100-10,000	136	56.7
>10,000	32	13.4
Mean	6,516.43±1003.97	

Note: *Multiple responses
Source: Field survey data, 2024

According to Soomro et al. (2021), food waste entails not just the loss of edible food but also the waste of essential resources used in its production: water, land, energy, and labor. For instance, approximately 24% of all water used in agriculture is lost through food waste. Moreover, land used for producing wasted food contributes to deforestation and habitat destruction, while the energy used in food production and transport increases greenhouse gas emissions. As decomposing food in landfills emits methane, a potent greenhouse gas, food waste significantly contributes to

climate change. Therefore, increasing public awareness can promote improved food management practices, reduce greenhouse gas emissions, and alleviate pressure on environmental resources and waste disposal systems. The study further assessed the monetary value of weekly food waste. A majority (56.7%) of households estimated that they waste between ₦5,100 and ₦10,000 worth of food per week. The mean weekly food waste value was estimated at ₦6,516.43, representing approximately 15.1% of the total weekly food expenditure. This high percentage supports earlier findings by Taghipour, Amjad, Aslani, Armanfar, and Dehghanzadeh (2016), who reported that urban households tend to waste more food due to higher income levels, bulk purchasing, and longer storage durations, which often result in spoilage and waste.

5.5. Perception of Households About Food Waste

A 5-point Likert-type scale was used to assess households' perceptions regarding food waste in the study area (Table 4). A cut-off mean value of 3.00 was adopted to determine the general direction of responses, mean values equal to or above 3.00 signified agreement with the statements, while those below 3.00 indicated disagreement.

Findings revealed that most households expressed awareness of food waste issues, as reflected in their responses. Notably, respondents disagreed with the statement *"My household income allows us to buy more food than we consume"* ($\bar{x}$ = 2.73), suggesting that excessive food purchasing is not primarily driven by household income. However, despite this, many respondents still admitted to buying more food than their household could consume, indicating behavioral inconsistencies or a lack of planning. Households also disagreed with the statement *"Adequate municipal waste collection services reduce food waste in my area"* ($\bar{x}$ = 2.02), reflecting dissatisfaction with local waste management infrastructure.

The statement *"I believe disposing of food is not a serious problem"* ($\bar{x}$ = 2.25) was also strongly disagreed with, indicating that the majority of households consider food waste to be a serious issue that needs attention. Furthermore, respondents disagreed with the claim *"My family rarely eats stored or reheated food"* ($\bar{x}$ = 2.98), implying that many households do, in fact, utilize leftovers and reheated meals, which is a positive food management behavior. These findings underscore the significant role of perception in influencing household food waste behavior. Households that perceive food waste as a serious problem are more likely to adopt practices such as portion control, meal planning, appropriate storage, and the reuse of leftovers to reduce waste. On the other hand, those who regard food waste as insignificant may maintain wasteful consumption patterns, leading to increased financial losses and environmental damage. This outcome supports the reports by Olowa and Olowa (2017), who emphasized that food waste awareness significantly influences household food management behavior. Enhancing perception and awareness campaigns can thus be an effective tool in reducing household food waste and its associated socio-economic and environmental impacts.

Table 4. Perception of households about food waste.

Statement	Urban	S. D.
My household income allows us to buy more food than we consume.	2.73	1.706
I often forget about food items stored in the fridge or pantry, leading to waste	4.27	0.430
I believe that reducing food waste can help save money.	4.33	0.446
Lack of functional refrigerators or cold storage facilities increases food wastage in my home.	4.25	0.475
I often buy more food than my household can consume, leading to waste	4.42	0.571
I feel guilty when I have to throw away food.	4.53	0.503
Adequate municipal waste collection services reduce food waste in my area	2.02	1.566
Leftover food is often seen as undesirable in my household.	3.62	0.497
I often share excess food with neighbors or relatives to prevent waste	3.00	1.031
The high cost of living makes me more conscious of avoiding food waste	4.23	0.756
I often buy more food than I can consume	3.13	1.319
I tend to cook more food than necessary	3.03	1.033
I am not always careful about checking expiry dates at the point of purchase	3.17	0.468
Social events in my household often lead to excessive food waste.	4.18	0.736

Statement	Urban	S. D.
Environmental campaigns and public awareness programs on food waste are insufficient in my locality	4.00	0.137
I believe disposing of food is not a serious problem.	2.25	1.390
Food waste in my household is often due to busy schedules and lack of time for meal preparation	4.27	0.010
Poor kitchen storage contributes to food spoilage in my household.	3.40	0.582
Food is often wasted because it spoils before we have a chance to consume it	4.20	0.643
My family rarely eats stored or reheated food.	2.98	1.387
Promotional offers and bulk buying lead to excess food that often goes to waste	3.48	0.403
My household throws away food because it doesn't look or taste fresh	3.17	0.504

Note: Field survey data, 2024.

5.6. Factors Influencing the Level of Food Waste Among Households

Table 5 presents the results of the multiple regression analysis examining the factors influencing household food waste in the study area. Among the functional forms tested, the linear model was found to be the most appropriate for this analysis.

Table 5. Factors influencing the level of food waste among households.

Variable	Coefficient	T-ratio	Sig.
Constant	-39.31	-1.791	0.081
Sex	-13.52***	-4.557	0.001
Age	37.43	2.810	0.006
Education	30.88-	0.130	0.897
Marital status	-62.03**	-2.294	0.026
Household size	-57.05	-0.649	0.519
Occupation	57.96	0.486	0.630
Children under 10 years	94.90***	3.689	0.001
Monthly income	11.57***	3.363	0.001
Frequency of shopping	14.34	1.519	0.249
Presence of refrigerator	-51.33**	-2.296	0.312
Storage access	-32.18	-1.567	0.124
Plan meal before cooking	-58.20	-4.081	0.000
Times eaten daily	10.10*	1.801	0.075
Times meal is prepared at home	22.94	0.482	0.632
Environmental awareness	48.37***	3.347	0.002
Food available in the house/Week	62.10**	2.388	0.022
Regular access to electricity	-20.29**	-2.024	0.031
Waste disposal method	11.94**	1.210	0.014
Distance to major food market	23.85*	1.757	0.078
R	0.801		
R^2	0.741		
Adj.R^2	0.616		
F	22.417		

Note: ***, ** and * indicate significance at 1%, 5% and 10% respectively.

Emerged as the best fit, given its high coefficient of determination (R^2), significant F-value, and a substantial number of explanatory variables behaving as expected. The R^2 value of 0.741 suggests that approximately 74% of the variability in household food waste levels is explained by the model. The F-statistic, significant at the 1% level, further confirms the overall relevance of the model.

Several factors were found to significantly influence food waste levels. These include the sex of the household head ($p<0.01$), marital status ($p<0.05$), presence of children under 10 years ($p<0.01$), household head's income ($p<0.01$), availability of a refrigerator ($p<0.05$), number of meals consumed daily ($p<0.10$), environmental awareness ($p<0.01$), weekly household food availability ($p<0.05$), access to electricity ($p<0.05$), and distance to major food markets ($p<0.10$).

A negative and significant relationship was observed between the sex of the household head and food waste levels, indicating that female-headed households tend to waste less food. This may be attributed to women's stronger involvement in food management, including portion control and storage practices. Marital status was also negatively related to food waste, suggesting that unmarried individuals tend to generate less waste, likely due to smaller portion sizes, better self-regulation, and fewer social pressures to over-purchase. Households with children under the age of 10 showed a positive association with food waste, implying that such households tend to waste more. This can be attributed to children's selective eating habits and frequent leftovers. Similarly, household income showed a positive relationship with food waste levels, indicating that wealthier households tend to waste more food due to bulk purchasing and overstocking. The presence of a refrigerator in the household was negatively associated with food waste, meaning that refrigeration helps reduce waste by prolonging the shelf life of perishable items. The number of meals consumed per day showed a positive association with food waste, suggesting that households that eat more frequently tend to generate more leftovers.

Interestingly, environmental awareness was positively associated with food waste, contrary to expectations. This may indicate that, despite awareness, some households still neglect environmentally conscious practices due to cultural or behavioral factors. The monetary value of food available in the home per week was also positively linked to food waste, implying that households with larger food stocks are more prone to spoilage and discard. Access to regular electricity had a negative effect on food waste, suggesting that a consistent electricity supply helps reduce waste through refrigeration and better food preservation. This supports the findings of Kolawole et al. (2024), who emphasized the importance of electricity in food storage. The method of waste disposal was positively associated with food waste levels, indicating that lack of access to formal waste management services may lead to indiscriminate dumping, contributing to environmental and health risks, as noted by United Nations Environment Program (2021) Burning of food waste, in particular, contributes to environmental pollution and greenhouse gas emissions, with Cassou et al. (2020) estimating that food waste accounts for 5% of Nigeria's GHG emissions.

Lastly, the distance to major food markets showed a positive and significant relationship with food waste. Households located farther from food markets tend to buy in bulk to reduce the frequency of shopping trips, which can increase the likelihood of spoilage and waste. Closer proximity allows for smaller, more frequent purchases and better food management.

6. CONCLUSION

The study concluded that food waste among urban households is significantly influenced by socio-economic and environmental factors, including the sex and marital status of the household head, the presence of young children, income level, access to electricity, refrigeration facilities, and waste disposal methods. Higher income, frequent meals, and greater food availability were associated with increased waste, while households headed by females and those with better food storage facilities and efficient waste management systems recorded lower levels of waste. These findings highlight the need for integrated interventions that combine education, infrastructural improvements, and environmental awareness to effectively reduce household food waste.

Based on the findings of this study, it is recommended that public awareness campaigns be intensified to educate urban households on the economic and environmental impacts of food waste, with an emphasis on proper food planning, storage, and consumption practices. Governments and stakeholders should invest in infrastructure such as a consistent electricity supply and improved municipal waste collection services to enhance food preservation and reduce spoilage. Policy interventions should also focus on encouraging behavioral change by providing incentives for food conservation, especially among high-income and working households that are more likely to over-purchase and store food in bulk. Furthermore, support programs targeting female-headed households and families with young children should be strengthened to equip them with the necessary skills and tools for minimizing food waste and promoting better food utilization.

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Institutional Review Board Statement: The study involved minimal risk and followed ethical guidelines for social science fieldwork. Formal approval from an Institutional Review Board was not required under the policies of Yaba College of Technology, School of Agricultural Technology, Lagos State, Nigeria. Informed verbal consent was obtained from all participants, and all data were anonymized to protect participant confidentiality.
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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