Knowledge, Attitude, and Practices towards Food Waste Management among Households in Karu Local Government Area, Nasarawa State, Nigeria

Aliyu Umar Sadiq*, (ID) **Sunday Yusuf Kpalo,** (ID) **Ife Dosunmu** (ID) **and Sylvia Chidimma Obiukwu** (ID)

Department of Geography, Nasarawa State University Keffi, North Central Nigeria, Nasarawa State, P.M.B 1022, Keffi, Nigeria

ABSTRACT

Food waste continues to receive global attention by policymakers, academics and businesses as it undermines the sustainability of the global food systems, posing environmental and economic challenges as well as impacting food security. In Africa's largest economy, Nigeria, a third of food produced eventually up as waste. This work evaluated the knowledge, attitude and practice towards food waste management amongst households in Karu Local Government Area, Nasarawa State by administering a structured questionnaire. The results show that 67.41% of the respondents have a good knowledge, 63.51%, have a good attitude, and good practice was displayed by 83.57%. Significant association was discovered of food waste management practices with knowledge and attitude, suggesting that both knowledge and attitude play a crucial role in shaping household food waste behaviors. However, the level of food waste management practices among the households is not the same as the level of knowledge and attitude they displayed, suggesting a gap between awareness and actual behavioral implementation. The overall findings imply that interventions aimed at improving food waste management should not only focus on increasing knowledge but also emphasize shaping positive attitudes and behavioral reinforcement strategies to drive sustainable change.

Keywords: KAP Study, food waste, waste management, Nigeria.

1 Introduction

The global community faces a dilemma, mitigating climate change by reducing global greenhouse gases (GHGs) and ensuring people have access to food. Food systems – production, aggregation, processing, distribution, and consumption– currently account for about one-third of total anthropogenic GHG emissions (37%), driving up climate change [39]. Again, FAO's Food Loss Index (FLI), states that approximately 14% of global food production is lost between post-harvest and the stage preceding retail [8].

Consumer-level food waste has been identified as having the greatest environmental impact due to its accumulation throughout the food product lifecycle [20], with global environmental, economic, and food security threat. Amongst food products, beef and dairy have the highest environmental footprint, making them the largest contributors to these emissions [9,42,40]

Food loss and food waste are commonly used terms in literature to describe edible materials intended for human consumption that are discarded, degraded, or diverted from the food supply chain [41]. [32] defined food loss as any reduction in availability, quality, or safety of food during the post-harvest period until it reaches consumers. [33] expanded this to include the production stage of the food supply chain. In contrast, [35] described food waste specifically as losses occurring at the retail and consumption stages, driven largely by consumer and retailer practices. More recently, the European FUSIONS project [34] defined food waste as both edible and inedible parts of food removed from the food supply chain for recovery or disposal through pathways such as composting, bioenergy production, landfill, or incineration. Importantly, only food originally produced for human consumption but diverted from the supply chain is classified as food waste, while biomass intended for non-food purposes is excluded [41]. Food waste at the consumer level often arises from inappropriate purchasing, poor storage, excessive preparation and portioning, as well as misinterpretation of "best before" and "use by" labels [36]. At the household level, its occurrence is further shaped by interconnected factors such as socio-demographic characteristics, consumption habits, and dietary patterns [37].

In 2022, 19% of food available to consumers was wasted at the retail, food service, and household level, in addition to the 13% of the world's food lost in the supply chain [46,47]. In addition, food loss and waste account for 8-10% of global annual GHGs emissions, about five times the total emissions from the aviation sector, contributing to biodiversity loss, using up almost a third of the world's agricultural land [7,41,44]. In 2015, food systems were responsible for an estimated 34% of global anthropogenic greenhouse gas (GHG) emissions, with values ranging between 25% and 42% [6].

Food waste has severe consequences for both the environment and global food security and as a significant global challenge is addressed under Sustainable Development Goal (SDG) 12 (responsible consumption and production), with a specific target (SDG 12.3) to cut global per capita food waste at the retail and consumer levels in half, reduce food loss throughout production and supply chains, including post-harvest loss, by 2030 [8]. In 2019, nearly 690 million individuals, equivalent to 8.9% of the world's population [52], experienced undernourishment [48]. With the rapid growth of the global population, issues of food waste and food security have emerged as key areas of concern for researchers and policymakers in both developed and developing countries [38].

In Nigeria and many other developing nations, food waste is intensifying, exacerbated by rapid population growth. The country faces significant challenges with food security and waste. With a population of over 200 million, about 13 million Nigerians are affected by hunger, and the country's Global Hunger Index score stands at 31.1, indicating a "serious" level of food insecurity [14,43]. With the population anticipated to double by 2050, from 201 million in 2019 to around 400 million, the demand for food is expected to increase [49]. At present, food waste contributes to 5% of the nation's GHG emissions [45,14]. These findings underscore the urgent need for improved food management and waste reduction initiatives to meet the demands of a growing population and reduce hunger [14]. Therefore, understanding household behaviors is critical to addressing food waste challenges, yet research in this area remains limited, particularly in Nigeria.

Several studies have been conducted on KAP Study [9,10,18]. Their studies identified a disparity between knowledge, attitudes, and behaviors regarding food waste management. [9] discovered that despite consumers' knowledge about food waste and its associated concerns, their waste remained high, contributing to carbon emissions. This paradox is similar with findings from [10] whose study in India demonstrated that while individuals possess significant knowledge and positive attitudes toward food waste reduction, their actual practices do not align. Similarly, [18] explored this phenomenon among food service operators in Malaysia, concluding that high levels of knowledge did not necessarily translate into reduced food waste. These studies reinforce the argument that awareness alone is insufficient in driving behavioural change.

Furthermore, sociodemographic factors have been identified as crucial determinants of food waste behaviors. [9] emphasized the role of generational differences in shaping food waste practices, arguing that tailored interventions are necessary to effectively address varying attitudes across age groups. [10] also assessed sociodemographic influences, demonstrating that gender and education levels significantly impact food waste behaviours. These findings suggest that food waste management policies should not adopt a one-size-fits-all approach but should instead be designed to accommodate specific demographic characteristics.

While the above studies provide a strong application of KAP study on food waste within a global context, limited research has been conducted in Nigeria. [14] represent one of the few to conduct this study in Nigeria, assessing household knowledge, attitudes, and practices related to food waste management. However, a critical limitation of their study is the limited study demography which is insufficient to represent Nigeria's vast and diverse population of over 200 million. Again, the relationship between knowledge, attitude and practice may vary in different locations.

Given the limited KAP studies on food waste management in Nigeria, our study offers a new knowledge by evaluating the food waste management trend among household in Karu Local Government Area of Nasarawa State in Nigeria. The study aimed to evaluate the extent of households' knowledge, attitudes, and practices regarding food waste management, as well as to examine the relationship between knowledge and attitudes with actual practices. The underlying assumption is that household food waste management in Karu is influenced by their level of awareness and perceptions. Findings from this research are expected to inform stakeholders in designing effective interventions that promote sustainable food waste

management and help mitigate its negative impacts.

2 Methodology
2.1 Study area
Karu Local Government Area (LGA) is situated in Nasarawa State, Nigeria, covering a designated Planning Area of approximately 800 square kilometers. It shares boundaries with Jaba LGA of Kaduna State to the north, Nasarawa LGA to the south, Keffi LGA to the east, and the Federal Capital Territory (FCT) to the west [23]. Geographically, Karu LGA is located approximately between latitudes 8º 5′N and 9º 25′E, and longitudes 7º 54′E and 10º 42′N, east of the Greenwich Meridian [23]. The local government had a projected population size of 291,900 in 2016 [5].

The region experiences a tropical climate characterized by distinct wet and dry seasons. Annual rainfall ranges between 1,100 mm and 2,000 mm, with approximately 90% of the rainfall occurring between May and September [30]. The peak rainy months are July and August. The predominant soil type in Karu LGA consists of ferruginous tropical soils, which are characteristic of most parts of Nasarawa State [26,29]. These soil characteristics influence agricultural activities and land use patterns in the region.
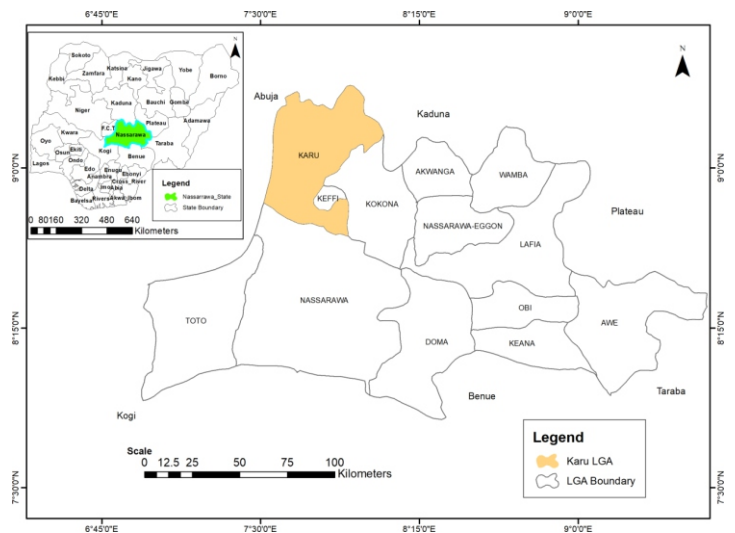

Figure 1: A map of the study area [17]

2.2 Sampling Procedures
This study employed a multistage sampling technique to ensure a robust and representative sampling scheme. Initially, purposive sampling was utilized to select five wards within Karu, a method deemed appropriate for identifying respondents with relevant background knowledge and experience while considering population density and geographic distribution. Karu LGA comprises a total of 205,477 households across various districts. The sample size of 382 households was determined using Krejcie and Morgan's table [15]. However, the actual number of households interviewed was 359. Data collection employed a systematic sampling approach with a five-interval scale applied across the selected wards [51].

2.3 Data Collection Techniques
A structured questionnaire was the primary instrument for data collection, administered through face-to-face interviews. The questionnaire underwent validation by experts in the field of sustainable consumption to ensure its relevance and clarity. A pre-test involving 20 respondents was conducted to refine

survey questions, followed by a pilot study with 38 respondents, representing 10% of the total sample size to assess reliability. The pilot study results were analyzed using Cronbach's alpha coefficient to determine the consistency of knowledge, attitude, and practice statements. Based on the findings, necessary modifications were made to improve clarity and encourage respondent participation.

The final survey targeted 382 households across four districts in Karu town, the most densely populated area of Karu LGA. Data collection was scheduled in the mornings and afternoons when respondents were more available. The study was voluntary, with all participants informed about its objectives, procedures, and confidentiality measures before the interviews commenced. Each interview lasted approximately 15–20 minutes. For respondents with reading difficulties, the researcher assisted in completing the questionnaire.

2.4 Questionnaire Structure

The questionnaire was structured into four sections, comprising a total of 40 questions. These sections included: (1) socio-economic characteristics (6 questions), (2) knowledge of food waste (14 statements), (3) attitudes toward food waste (12 statements), and (4) food waste management practices (8 questions) [53]. The level of knowledge, attitude, and practice was assessed using an individual scoring system. Negatively worded statements were reverse-scored to ensure consistency in interpretation.

The knowledge section employed a true/false format, with correct answers awarded 1 point and incorrect answers assigned 0 points, resulting in scores ranging from 0 to 10. Attitudes toward food waste were measured using a five-point Likert scale (5 = strongly agree, 4 = agree, 3 = not sure, 2 = disagree, and 1 = strongly disagree) adapted from [51]. with total scores ranging from 0 to 60. The food waste management practices section utilized a yes/no response format, with correct responses earning 1 point and incorrect responses receiving 0 points, yielding scores from 0 to 8. Individual scores were categorized into three levels: Poor (≤50%), Fair (51%–80%), and Good (≥80–100%) [53].

2.5 Data Analysis and Interpretation

Data collected from the questionnaire were analyzed using the Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics, including frequencies, percentages, and means, were computed to summarize social and demographic characteristics and levels of food waste knowledge, attitudes, and practices. Binary logistic regression analysis was used to examine associations between variables. Statistical significance was assessed at a 95% confidence level ($p \leq 0.05$). Outliers and erroneous data were identified and excluded from the final dataset, ensuring that the analysis was based on a total of 382 valid responses.

2.6 Ethical Considerations

Before data collection, all respondents provided informed consent before participating in interviews and discussions. The objectives, procedures, potential benefits, and any associated risks of the study were clearly explained, and participants confidentiality was assured.

3 Results and discussion

3.1 Demographic profile

This section presents the socio-economic characteristics of respondents in the study area.

A total of 382 questionnaires were administered, out of which 359 valid responses were obtained, representing a response rate of 94%. The analysis covers key demographic factors, including gender, age, marital status, education level, occupation, and income level of the respondents. These characteristics provide insight into the background of the participants and help in understanding their perspectives on food waste management.

Table 1 presents the socio-economic characteristics of respondents in the study area. The findings indicate that males (57.9%) outnumber females (42.1%) among the respondents. This suggests a relatively higher participation of men in the survey, which may reflect household decision-making patterns in the study area, particularly regarding food purchasing and waste disposal.

Regarding age distribution, respondents were categorized into youth (18–35 years) and adults (36 years and above). The results show that 42.3% of respondents are youth, while 57.7% are adults. The larger proportion of adults suggests that the sample consists mostly of mature individuals who are likely responsible for household food management decisions.

The marital status of respondents shows that 47.9% are married, 25.6.7% are single, 14.28% are divorced, and 13.3% are widowed. The dominance of married individuals suggests that many respondents belong to family units, which could influence household food consumption and waste patterns. Previous studies by [4] have shown that family size and marital status can impact food waste generation, as larger households tend to have higher food expenditures and potential food wastage.

In terms of education level, a significant proportion of respondents (58.8%) have low education, while 41.2% have attained higher education. The relatively high percentage of individuals with low education may impact their knowledge and attitudes toward food waste management practices. According to [25], education level plays a crucial role in shaping food waste awareness and behavior, as individuals with higher education tend to adopt more sustainable consumption habits.

The occupational distribution reveals that the largest group of respondents is engaged in small trade businesses (21.7%), followed by housewives (17.3%), students (12.5%), skilled workers (13.9%), and farmers (8.4%). Additionally, 26.2% of respondents are unemployed. The high percentage of self-employed and unemployed individuals may suggest economic constraints that could influence food purchasing and waste disposal habits. Research by [21] highlights that financial insecurity often leads to more careful food management and reduced waste generation.

Finally, an analysis of income levels shows that most of the respondents (69.6%) fall into the low-income category, while only 30.4% are classified as high-income earners. This suggests that most households in the study area may face financial limitations, which could impact their food purchasing behavior and waste reduction strategies. A study by [50] emphasizes that low-income households tend to waste less food due to budget constraints, whereas higher-income households may discard more due to affordability and lack of awareness.

Table 1: Socio-Economic Characteristics of Respondents
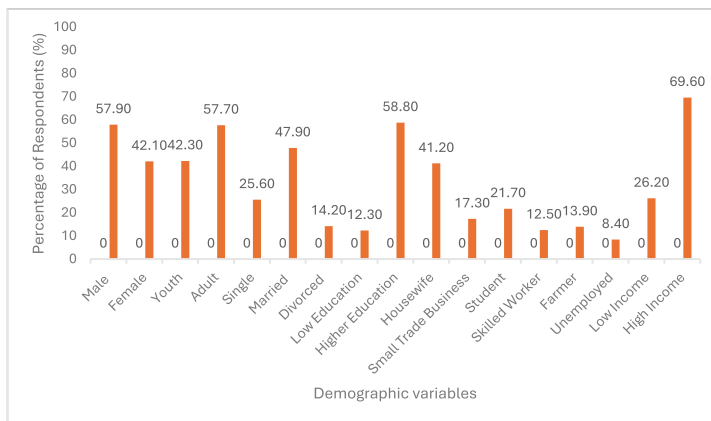
3.2 Description of food waste by respondents

The results presented in Figure 2 show that 57.5% of respondents described food waste as edible food that is discarded, indicating that they have some basic knowledge about food waste. However, 25.28% described food waste as leftovers stored in the fridge. However, most of the respondents were guilty of discarding either edible or inedible food. This finding is similar to a study by [18] which study that most of the respondents have basic knowledge when saying food waste occurs due to the individual's own choice, similar with finding by [16] in Malaysia. This finding of the study implies that the level of knowledge about food waste by the households will improve food waste management of the study area. A study conducted by [12] has stated that inadequate knowledge of food waste will contribute to even more food waste because knowledge influences attitude and practices in generating food waste. Previous research has reported that the United Kingdom experienced a substantial reduction in food waste from 8.3 million tons to 7.2 million tons between 2009 and 2011 because of the successful campaign in developing the knowledge on food waste [12].
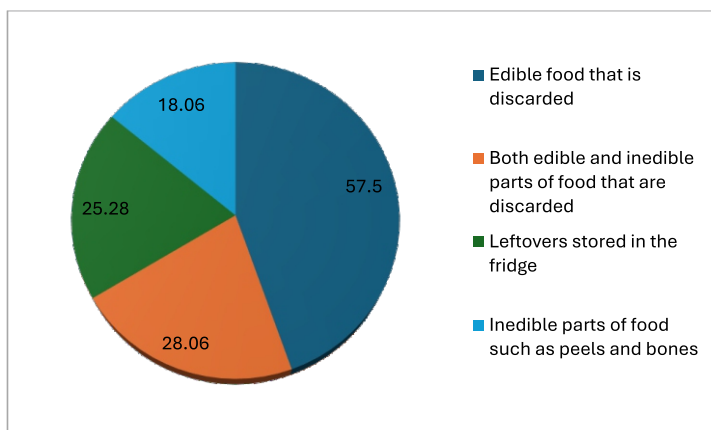

Figure 2: Description of food waste by respondents

Figure 3 highlights the primary causes of food waste among households as reported by respondents. The findings reveal that most households identified buying too much food as the leading cause (43.33%), followed by the lack of refrigeration (21.9%), not knowing how to preserve food (21.3%), and poor cooking skills. Effective food storage with proper ordering arrangements enhances visibility and prevents food from being overlooked or concealed, thereby reducing food waste [24]. Similarly, [1] emphasized that in developed countries, food waste is strongly influenced by individuals' attitudes and practices regarding food management.
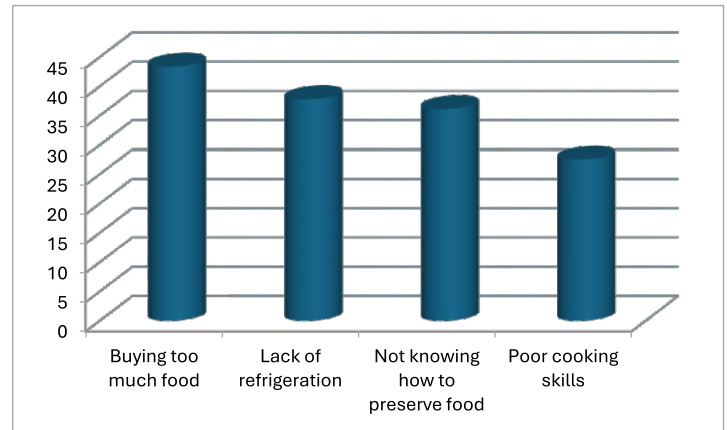
Figure 3 Primary cause of food waste in households

3.3 Knowledge of food waste management amongst households

The results in Table 2 indicate that most respondents demonstrated a strong understanding of key food waste concepts. The majority (92.5%, n=332) correctly identified that meal planning helps in reducing food waste, and 91.1% (n=327) understood that not all fruits and vegetables should be refrigerated, showing awareness of proper food storage techniques. Similarly, 88.9% (n=319) of respondents acknowledged that overcooking and burning food contribute to food waste, highlighting recognition of waste prevention strategies at the household level.

However, some areas of misconception remain. From the result, 67.1% (n=241) of respondents incorrectly believed that leftovers should always be discarded if not eaten within 24 hours, indicating a lack of awareness about safe food storage and reuse. Additionally, while 80.5% (n=289) believed that buying in bulk reduces food waste, previous research [4,24] suggests that bulk purchasing can sometimes lead to higher food waste, particularly for perishable items if not properly managed.

Another important knowledge gap was seen in the understanding of expiration dates. While 87.7% (n=315) correctly recognized that "use-by" dates indicate the last safe consumption day, the remaining 12.3% (n=44) were unaware of this distinction. Misinterpretation of date labels has been identified as a major contributor to avoidable household food waste [11,13].

One notable positive finding was that 78.6% (n=282) of respondents correctly disagreed with the statement that "food waste has no impact on global hunger." This suggests that most households understand the broader socio-economic consequences of food wastage, including its link to food insecurity and resource depletion.

Overall, these findings indicate that while respondents have a strong foundational knowledge of food waste management, certain misconceptions, particularly around bulk purchasing, leftover reuse, and expiration date interpretation, persist. Addressing these knowledge gaps through targeted educational campaigns could further enhance food waste reduction efforts at the household level.
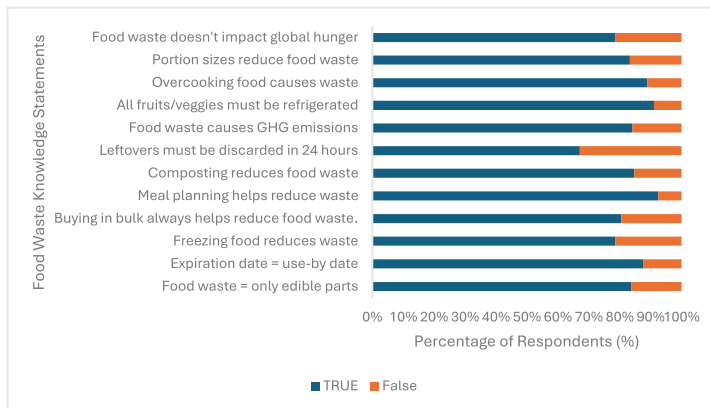
Table 2: Distribution of Knowledge on Food Waste Management

Table 3 presents the classification of respondents based on their level of knowledge regarding food waste management. Most households (n=242, 67.41%) demonstrated a good understanding of food waste concepts, while 30.36% (n=109) fell into the fair knowledge category. A small fraction of respondents (n=8, 2.23%) exhibited poor knowledge, indicating limited awareness of food waste issues.

The knowledge scores ranged from a minimum of 0 to a maximum of 12, with the lowest recorded score being 5 and the highest reaching 12. The mean knowledge score was 10.01 ± 2.08, suggesting that, on average, respondents possess a relatively strong understanding of food waste management practices.

Given that a significant proportion of respondents have low educational attainment, these results suggest that food waste awareness could influenced by experience, cultural practices, or community engagement. However, the presence of knowledge gaps in certain areas highlights the need for targeted educational initiatives to reinforce accurate food waste management practices.

Table 3: Level of Knowledge on Food Waste Management

	Level	Frequency	Percentage	Mean ± Std
Knowledge	Poor	8	2.23%	10.01 ± 2.08
	Fair	109	30.36%	
	Good	242	67.41%	

3.3 Attitude towards food waste management among households

The findings in Table 4 suggest an overall positive attitude toward food waste management among respondents. A significant proportion (89.1%, n=320) recognized the importance of reducing food waste for environmental sustainability, with 57.9% (n=208) strongly agreeing and 31.2% (n=112) agreeing. This indicates a widespread awareness of the environmental consequences of food waste and the need for responsible waste management.

A similar trend is observed in the emotional response to food waste, where 90.8% (n=326) of respondents strongly agreed or agreed that they feel guilty when throwing away food. This suggests a high level of consciousness about food wastage, which could serve as motivation for adopting better food conservation practices. Additionally, 82.2% (n=295) of respondents expressed willingness to change their shopping habits to minimize food waste, further reinforcing a proactive attitude toward household food waste reduction.

Education was also recognized as a key factor in addressing food waste, as 93.1% (n=334) of respondents believed that educating people about food waste can significantly minimize the waste generated.

Similarly, 79.7% (n=284) supported the idea that supermarkets should do more to reduce food waste, suggesting that respondents view food waste as a systemic issue requiring both individual and institutional interventions.

However, attitudes toward composting and portion control were slightly more varied. 84.9% (n=305) supported composting, with 40.1% (n=144) strongly agreeing and 44.8% (n=161) agreeing. Meanwhile, 12.3% (n=44) remained unsure, and a small fraction (2.2%, n=8) disagreed to some extent, suggesting that barriers such as lack of awareness, accessibility, or convenience may limit composting adoption.

On the other hand, 89.7% (n=322) recognized meal planning as an effective way to reduce food waste, reinforcing the role of planning in minimizing food loss. This aligns with previous findings that knowledge of meal planning correlates with better food waste management practices.

When asked about policy measures, 82.7% (n=297) supported government policies aimed at reducing food waste, indicating a willingness for legislative action to reinforce sustainable food management. Additionally, 82.7% (n=297) believed that reducing food waste could help address global hunger issues, though 8.6% (n=31) remained unsure, showing that some respondents may still lack a clear understanding of the link between food waste and food insecurity.

Overall, the results indicate a generally positive attitude toward food waste management, with strong agreement on its environmental and social impacts. However, uncertainty in areas like composting and the connection between food waste and hunger suggests that more awareness campaigns and structural interventions could further improve attitudes and encourage action.
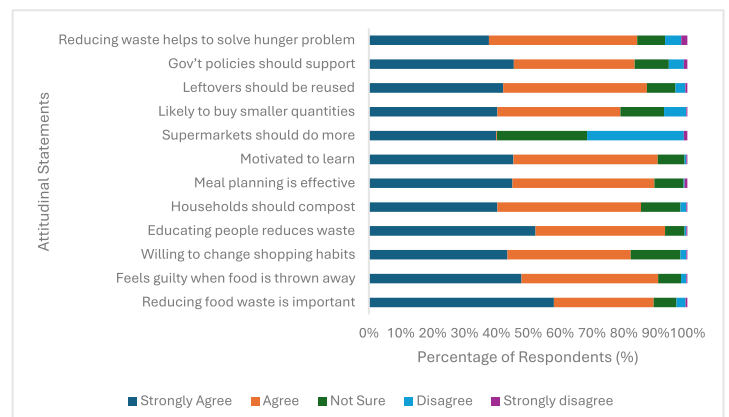
Table 4: Distribution of Household Based on Attitude

Table 5 presents the classification of respondents based on their attitude toward food waste management. Most of the households (63.51%, n = 228) demonstrated a good attitude, indicating a strong commitment to adopting behaviors that minimize food waste. Additionally, 36.21% (n = 130) exhibited a fair attitude, suggesting that while they recognize the importance of food waste reduction, their actions may not always align with their awareness. Meanwhile, only 0.28% (n = 1) of respondents displayed a poor attitude, reflecting a very limited motivation or understanding of food waste management practices.

The attitude scores ranged from a minimum of 12 to a maximum of 60, with the lowest recorded score at 50 and the highest reaching 60. The mean attitude score was 50.32 ± 6.34, suggesting that, on average, respondents exhibit a strongly positive disposition toward food waste management.

Given that a significant proportion of respondents belong to low-income and low-education groups, these findings imply that attitudes toward food waste management may be shaped by factors such as economic constraints, cultural perceptions, and household responsibilities. However, the presence of respondents in the fair attitude category (36.21%) highlights the need for targeted awareness campaigns and behavioral interventions to reinforce a more proactive approach to food waste reduction.

Table 5: Level of Attitude Toward Food Waste Management

	Level	Frequency	Percentage	Mean ± Std
Attitude	Poor	1	0.28%	50.32 ± 6.34
	Fair	130	36.21%	
	Good	228	63.51%	

3.4 Practices of Food Waste Management Among Households

The findings in Table 6 indicate that most respondents engage in proactive food waste management practices. A significant majority (82.2%, n = 295) reported that they regularly plan their meals before shopping, while 92.6% (n = 336) check their pantry and refrigerator before making grocery purchases. These behaviors play a crucial role in preventing over-purchasing and minimizing food waste, aligning with existing research that emphasizes meal planning as an effective waste reduction strategy [21,27].

Additionally, 87.7% (n = 315) of respondents stated that they often use leftovers instead of discarding them, reflecting an awareness of the importance of repurposing food. Similarly, 89.7% (n = 332) frequently check food labels for expiration dates, reinforcing the significance of date labeling in household food management. Proper food storage practices were also common, with 94.4% (n = 339) ensuring fruits and vegetables are stored correctly, and 93.3% (n = 335) freezing food items to extend shelf life, demonstrating efforts to reduce spoilage and waste.

However, sustainable disposal methods, such as composting, were less widely adopted. Only 57.9% (n = 208) of respondents reported composting their food scraps, indicating that many households do not engage in organic waste recycling. This is consistent with findings from previous studies [19,31] that cite low composting adoption rates in developing regions due to limited awareness, infrastructure challenges, and convenience issues.

Another important finding is that 82.7% (n = 297) of respondents actively avoid bulk purchasing to prevent food waste, suggesting a strong understanding of the risks associated with buying excessive quantities of perishable items. This is a positive shift from previous research, which indicated that bulk purchases often lead to higher food waste when items are not consumed in time.

Overall, the results suggest that while most households demonstrate good food waste management practices, composting adoption remains a challenge. Strengthening awareness campaigns and improving access to composting facilities could encourage more households to integrate sustainable disposal methods into their food waste management routines.

Table 6: Distribution of Households Based on Food Waste Management Practices
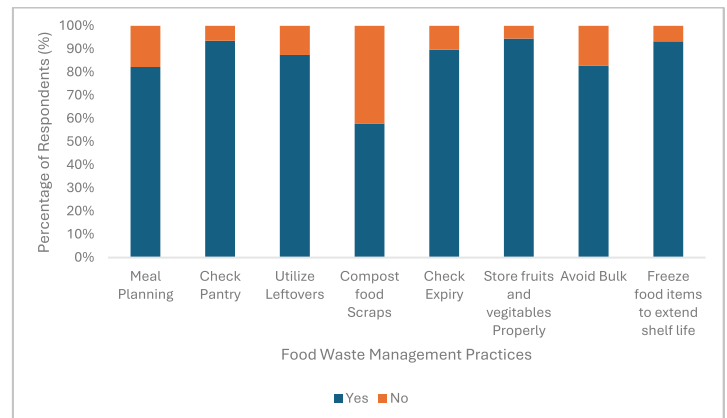

Table 7 presents the classification of respondents based on their food waste management practices. The majority of households (83.57%, n = 300) demonstrated good practices, indicating a strong commitment to minimizing food waste through meal planning, proper storage, and responsible consumption behaviors. Additionally, 13.64% (n = 49) of respondents exhibited fair food waste management practices, suggesting that while they engage in some waste-reducing behaviors, their practices may not be fully consistent or regularly implemented.

A small proportion of respondents (2.79%, n = 10) exhibited poor food waste management practices, meaning they implement few or no techniques to minimize food waste. The food waste management practice scores ranged from a minimum of 0 to a maximum of 8, with the lowest recorded score at 4 and the highest reaching 8. The mean practice score was 6.82 ± 1.45, indicating that, on average, respondents demonstrate a relatively high level of engagement in food waste management.

Given that some respondents fall into the fair and poor categories, food waste management behaviors may be influenced by economic constraints, cultural beliefs, or lack of awareness. These findings highlight the need for targeted interventions, such as training programs and community awareness campaigns, to reinforce effective food waste reduction strategies and ensure that more households adopt consistent, sustainable food management practices.

Table 7: Level of Food Waste Management Practices

	Level	Frequency	Percentage	Mean ± Std
Practice	Poor	10	2.79%	6.82 ± 1.45
	Fair	49	13.64%	
	Good	300	83.57%	

3.5 Association Between Dependent (Practice) and Independent (Knowledge, and Attitude) Variables

The results presented in Table 9 examine the relationship between knowledge, attitude, and food waste management practices. The findings indicate a statistically significant association between knowledge and practice (p = 0.012), suggesting that higher knowledge levels correspond with better food waste management practices. Among respondents with good knowledge, the majority (73.1%) exhibited good practice, while only 1.2% had poor practice. In contrast, those with poor knowledge had the highest proportion of poor practice (62.5%), reinforcing the notion that knowledge gaps hinder effective food waste management.

Similarly, attitude also demonstrated a significant association with practice (p = 0.027). Respondents with a good attitude were more likely to engage in good food waste management practices (59.2%), while those with fair attitudes exhibited moderate waste management behavior (73.85% in fair and good practice combined). Interestingly, the only respondent with a poor attitude (100%) exhibited poor practice, indicating that a negative attitude strongly correlates with poor waste management behaviors.

Overall, these findings suggest that both knowledge and attitude play a critical role in shaping household food waste management practices. Higher knowledge levels contribute to more effective food waste reduction behaviors, while positive attitudes further reinforce sustainable waste management habits. These results highlight the need for targeted awareness campaigns and behavior change interventions to strengthen both knowledge and attitude toward responsible food waste management.

Table 9: Level of Association between knowledge, attitude, and food waste management practice levels

		Count	Practice			p-value
			Poor	Fair	Good	
Knowledge	Poor	8	5 (62.5%)	2 (25%)	1 (12.5%)	0.012*
	Fair	109	3 (2.8%)	41 (37.6%)	65 (59.6%)	
	Good	242	3 (1.2%)	62 (25.6%)	177 (73.1%)	
Attitude	Poor	1	1 (100%)	-	-	0.027*
	Fair	130	3 (2.3%)	31 (23.85%)	96 (73.85%)	
	Good	228	29 (12.7%)	64 (28.1%)	135 (59.2%)	

*Significant: p ≤ 0.05

To further examine the influence of knowledge and attitude on food waste management practices, Table 10 presents the results of a simple linear regression analysis. The model indicates that both knowledge (p = 0.000) and attitude (p = 0.013) are significant predictors of practice, suggesting that these variables play a crucial role in shaping household food waste behaviors.

Among the predictors, knowledge (β = -0.466, p = 0.000) has a stronger negative influence on practice compared to attitude (β = -0.127, p = 0.013). This suggests that while knowledge provides the necessary foundation for good food waste management behaviors, attitude also contributes significantly to how individuals translate that knowledge into action. However, the negative coefficients indicate that as knowledge and attitude scores increase, practice scores tend to decrease, which may suggest a gap between awareness and actual behavioral implementation.

The constant value (B = 13.911, p = 0.000) indicates a baseline level of food waste management practice, even in the absence of variations in knowledge and attitude. The overall findings imply that interventions aimed at improving food waste management should not only focus on increasing knowledge but also emphasize shaping positive attitudes and behavioral reinforcement strategies to drive sustainable change. These results align with previous research [3,15] which emphasizes the interplay between knowledge, attitude, and behavior in promoting environmental sustainability practices.

Table 10: Relationship Between Knowledge, Attitude, and Practice of food waste management

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	13.911	0.597		23.315	0.000*
	KNOWLEDGE	-0.320	0.035	-0.466	-9.163	0.000*
	ATTITUDE	-0.031	0.012	-0.127	-2.506	0.013*
a. Dependent Variable: PRACTICE						

*Significant: p ≤ 0.05

4 Conclusion

This study highlights the intricate relationship between knowledge, attitude, and practice in food waste management among households in Karu Local Government Area (LGA), Nasarawa State. The findings reveal that while households generally possess high levels of knowledge on food waste management, attitudes towards waste management practices vary, and actual behaviors remain inconsistent. Despite the low formal education levels among most respondents, their awareness and understanding of food waste management were commendable.

The study further establishes that attitude serves as a mediating factor in translating knowledge into action, reinforcing the crucial role of behavioral perspectives in effective waste management. Households with both high knowledge and positive attitudes exhibited better food waste management practices, demonstrating the interdependent nature of these factors. Moreover, knowledge was found to have a stronger predictive value in influencing waste management behaviors compared to attitude. This suggests that enhancing awareness and correcting misconceptions through targeted educational interventions could significantly enhance the management of food waste.

Based on the influence of knowledge and attitude on food waste management behaviors, strengthening waste management practices in Karu LGA, such as bulk purchasing and food storage, composting, and other sustainable methods, requires a systematic approach to increasing both knowledge and positive attitudes among residents. This can be achieved through well-designed intervention programs and policies aimed at fostering educational awareness and behavioral change. Future studies could explore additional socio-cultural and economic factors influencing food waste behaviors, thereby providing a more comprehensive understanding of the dynamics at play in food waste management within the region.

References

1. Abdelradi, Fadi. 2018. "Food Waste Behaviour at the Household Level: A Conceptual Framework." *Waste Management* 71 (January):485–93. https://doi.org/10.1016/j.wasman.2017.10.001.

2. Afriyie, E., Zurek, M., Asem, F. E., Okpattah, B., Ahiakpa, J. K., & Zhu, Y. (2023). Consumer food storage practices and methods at the household-level: a community study in Ghana. *Frontiers in Sustainable Food Systems*, *7*. https://doi.org/10.3389/fsufs.2023.1194321

3. Ahamad, N. R., & Ariffin, M. (2018). Assessment of knowledge, attitude and practice towards sustainable consumption among university students in Selangor, Malaysia. *Sustainable Production and Consumption*, *16*, 88–98. https://doi.org/10.1016/j.spc.2018.06.006

4. Aschemann-Witzel, J., De Hooge, I., Amani, P., Bech-Larsen, T., & Oostindjer, M. (2015). Consumer-Related Food Waste: Causes and Potential for action. *Sustainability*, *7*(6), 6457–6477. https://doi.org/10.3390/su7066457

5. Brinkhoff, T. (n.d.). City Population: Nasarawa State in Nigeria. Retrieved July 13, 2022, from https://www.citypopulation.de/php/nigeria-admin.php?adm1id=NGA026

6. Crippa, M., E. Solazzo, D. Guizzardi, F. Monforti-Ferrario, F. N. Tubiello, and A. Leip. 2021. "Food Systems Are Responsible for a Third of Global Anthropogenic GHG Emissions." *Nature Food* 2 (3): 198–209. https://doi.org/10.1038/s43016-021-00225-9.

7. Environment, U. N. 2021. "UNEP Food Waste Index Report 2021 | UNEP - UN Environment Programme." March 4, 2021. https://www.unep.org/resources/report/unep-food-waste-index-report-2021.

8. FAO. 2019. "The State of Food and Agriculture. Moving Forward on Food Loss and Waste Reduction." https://food.ec.europa.eu/document/download/b35701da-c178-4a37-b420-899195e5ba16_en?filename=fw_lib_fao-2019_en.pdf.

9. Flanagan, Angela, and Anushree Priyadarshini. 2021. "A Study of Consumer Behaviour towards Food-Waste in Ireland: Attitudes, Quantities and Global Warming Potentials." *Journal of Environmental Management* 284 (April):112046. https://doi.org/10.1016/j.jenvman.2021.112046.

10. Gupta, Shipra. 2022. "Knowledge, Attitude and Practices Related to Food Wastage among Indian Men and Women."

11. Ishangulyyev, R., Kim, S., & Lee, S. (2019). Understanding Food Loss and Waste—Why are we losing and wasting food? *Foods*, *8*(8), 297. https://doi.org/10.3390/foods8080297

12. Jarjusey F. (2017). Consumers' Awareness and Knowledge about Food Waste in Selangor, Malaysia. Int J Bus Econ Aff. 2017;2(2):91–7.

13. Keller, V., & Gombos, S. (2025). Household food waste reduction determinants in Hungary: towards understanding responsibility, awareness, norms, and barriers. *Foods*, *14*(5), 728. https://doi.org/10.3390/foods14050728

14. Kolawole, I. D., Sanni-Manuel, B. A., Kolawole, G. O., Idowu, D. E., Kolawole, S. K., Ewansiha, J. U., Oni, K., Kolawole, V. A., & Kolawole, F. O. (2024). Assessment of knowledge, attitude, and practices towards food waste management among Nigeria dwellers. *Food and Humanity*, *3*, 100385. https://doi.org/10.1016/j.foohum.2024.100385

15. Krejcie, Robert V., and Daryle W. Morgan. "Determining sample size for research activities." Educational and psychological measurement 30, no. 3 (1970): 607-610.

16. Naim, MN, and Haliza Abdul Rahman. 2020. "Knowledge, Attitude and Practice on Food Waste Management Among Food Vendors in Universiti Putra Malaysia, Serdang, Selangor."

17. Nassarawa State Ministry of Lands and Survey (2016) Map of Nasarawa State Map, Nassarawa State.

18. Noor, Nazora, Zainal Abidin, Muhammad Zaki, and Farah Shaffie. 2022. "Knowledge, Attitude and Practices of Food Waste Management Among Food Waste Foodservice Operators in Petaling Jaya Utara (PJU) 9 and 10, Selangor." *Journal of Sustainability Science and Management* 17 (12): 89–104. https://doi.org/10.46754/jssm.2022.12.009.

19. Parizeau, K., Von Massow, M., & Martin, R. (2014). Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario. *Waste Management*, *35*, 207–217. https://doi.org/10.1016/j.wasman.2014.09.019

20. Programme, United Nations Environment. 2024. *Food Waste Index Report 2024. Think Eat Save: Tracking Progress to Halve Global Food Waste*. https://wedocs.unep.org/xmlui/handle/20.500.11822/45230.

21. Quested, T., Marsh, E., Stunell, D., & Parry, A. (2013). Spaghetti soup: The complex world of food waste behaviours. *Resources Conservation and Recycling*, *79*, 43–51. https://doi.org/10.1016/j.resconrec.2013.04.011

22. Ramirez-Bryan, L., Golmohamadi, A., & Vojoudi, H. (2021). Declining knowledge on proper food storage and preparation causes an increase in household food waste. *International Journal of Applied Research*, *7*(8), 75–77. https://doi.org/10.22271/allresearch.2021.v7.i8b.8824

23. Rikko, Laraba S., John. Y. Dung-Gwom, and Sunday K. Habila. 2019. "Assessment of Informal Settlements Growth in Greater Karu Urban Area (GKUA) Nasarawa State, Nigeria." *Urban Studies and Public Administration* 2 (2): 61. https://doi.org/10.22158/uspa.v2n2p61.

24. Schanes, K., Dobernig, K., & Gözet, B. (2018). Food waste matters - A systematic review of household food waste practices and their policy implications. *Journal of Cleaner Production*, *182*, 978–991. https://doi.org/10.1016/j.jclepro.2018.02.030

25. Stefan, V., van Herpen, E., Tudoran, A. A., & Lähteenmäki, L. (2013). Avoiding food waste by Romanian consumers: The importance of planning and shopping routines. Food Quality and Preference, 28(1), 375-381.

26. Tomlinson, P. (1963). Soils of Northern Nigeria. Zaria: Institute for Agricultural. Research.

27. Van Rooijen, M., Gerdessen, J., Claassen, G., & De Leeuw, S. (2024). Optimizing household food waste: The impact of meal planning, package sizes, and performance indicators. *Resources Conservation and Recycling*, *205*, 107559. https://doi.org/10.1016/j.resconrec.2024.107559

28. Vereinte Nationen, ed. 2021. *Global Population Growth and Sustainable Development*. United Nations Publication. New York: United Nations.

29. Wright, S.B. and McCurry, P. (1970). Geology. In Mortimore, M.J. (1970). Zaria and Its Region (eds) Occasional paper No. 4 Department of Geography A.B.U., Zaria. Pg. 5 12.

30. Yari, K., Hadziga, B., and Ma-aruf, S. (2002). Karu City Alliance Initiatives, Karu Governance and Management Institutions, land use Management and Urban Services

31. Zhang, Z., Chen, Z., Zhang, J., Liu, Y., Chen, L., Yang, M., Osman, A. I., Farghali, M., Liu, E., Hassan, D., Ihara, I., Lu, K., Rooney, D. W., & Yap, P. (2024). Municipal solid waste management challenges in developing regions: A comprehensive review and future perspectives for Asia and Africa. *The Science of the Total Environment*, *930*, 172794. https://doi.org/10. 1016/j.scitotenv.2024.172794

32. FAO, 1981. Food loss prevention in perishable crops. FAO Agricultural Services Bulletin 43, Rome, 72.

33. Gustavsson, J., Cederberg, C., Sonesson, U., van Otterdijk, R., Meybeck, A., 2011. Global food losses and food waste. Extent, causes and prevention. Rome

34. Östergren, K., Gustavsson, J., Bos-Brouwers, H., Timmermans, T., Hansen, O-J., Møller, H., Anderson, G., O'Connor, C., Soethoudt, H., Quested, T., Easteal, S., Politano, A., Bellettato, C., Canali, M., Falasconi, L., Gaiani, S., Vittuari, M., Schneider, F., Moates, G., Waldron, K., Redlingshöfer, B., 2014. FUSIONS Definitional Framework for Food Waste. Full Report. 3 July 2014. ISBN 978- 91-7290-331-9.

35. Parfitt, J., Barthel, M., Macnaughton, S., 2010. Food waste within food supply chains: quantification and potential for change to 2050. Phil. Trans. R. Soc. 365, 3065–3081.

36. Papargyropoulou, E., Lozano, R., Steinberger, J., Wright, N., Bin Ujang, Z., 2014. The food waste hierarchy as a framework for the management of food surplus and food waste. J. Clean. Prod. http://dx.doi.org/10.1016/j.jclepro. 2014.04.020

37. Glanz, R., Schneider, F., 2009. Causes of food waste generation in household. In: Proceedings Sardinia 2009, Twelfth International Waste Management and Landfill Symposium. S. Margherita di Pula, Cagliari. CISA Publisher, Italy.

38. Chalak, A., Abiad, M. G., Diab, M., & Nasreddine, L. (2019).The determinants of household food waste generationand its associated caloric and nutrient losses: the case ofLebanon. PLoS One, 14(12), e0225789 *(PDF) Food Waste and Loss Management -Causes, Effects and Possible Solutions from A Nigeria Context*. Available from: https://www.researchgate.net/publication/380664829_F ood_Waste_and_Loss_Management_-Causes_Effects_and_ Possible_Solutions_from_A_Nigeria_Context#fullTextFileC ontent [accessed Aug 22 2025].

39. European Commission. n.d. "Food Waste." Accessed August 22, 2025. https://food.ec.europa.eu/food-safety/food-waste_en.

40. Gaillac, R., and S. Marbach. 2021. "The Carbon Footprint of Meat and Dairy Proteins: A Practical Perspective to Guide Low Carbon Footprint Dietary Choices." *Journal of Cleaner Production* 321 (October): 128766. https://doi.org/10. 1016/j.jclepro.2021.128766.

41. Girotto, Francesca, Luca Alibardi, and Raffaello Cossu. 2015. "Food Waste Generation and Industrial Uses: A Review." *Waste Management* 45 (November): 32–41. https://doi.org/10.1016/j.wasman.2015.06.008.

42. Ritchie, Hannah, Pablo Rosado, and Max Roser. 2022. "Environmental Impacts of Food Production." *Our World in Data*, December 2. https://ourworldindata.org/environmental-impacts-of-food.

43. Sunday, Calvin Oluwafemi, Fatai Abiola Sowunmi, Oluwakemi Adeola Obayelu, Abiodun Emmanuel Awoyemi, Abiodun Olusola Omotayo, and Adebayo Isaiah Ogunniyi. 2022. "Disentangling Drivers of Food Waste in Households: Evidence from Nigeria." *Foods* 11 (8): 1103. https://doi.org/10.3390/foods11081103.

44. UNFCCC. 2024. "Food Loss and Waste." https://unfccc.int/news/food-loss-and-waste-account-for-8-10-of-annual-global-greenhouse-gas-emissions-cost-usd-1-trillion.

45. Usman et., al. 2023. "Food Loss and Waste in Nigeria: Implications for Food Security and Environmental Sustainability." In *Advances in Food Security and Sustainability*, vol. 8. Elsevier. https://doi.org/10.1016/bs.af2s.2023.07.003.

46. FAO. 2024. "On the International Day of Awareness of Food Loss and Waste, Learn How FAO Is Leveraging Data to Save Food and Advance the 2030 Agenda." Statistics. https://www.fao.org/statistics/highlights-archive/highlights-detail/on-the-international-day-of-awareness-of-food-loss-and-waste--learn-how-fao-is-leveraging-data-to-advance-the-2030-agenda/en.

47. UNEP. 2024. *Food Waste Index Report 2024. Think Eat Save: Tracking Progress to Halve Global Food Waste*. https://wedocs.unep.org/xmlui/handle/20.500.11822/4 5230.

48. UN DESA. 2021. *Population, Food Security, Nutrition and Sustainable Development*. UN Department of Economic and Social Affairs (DESA) Policy Briefs. UN Department of Economic and Social Affairs (DESA) Policy Briefs. https://doi.org/10.18356/27081990-102.

49. UN DESA. n.d. "Policy Briefs | UN DESA Publications." Accessed August 22, 2025. https://desapublications. un.org/policy-briefs.

50. Silvennoinen, Kirsi, Juha-Matti Katajajuuri, Hanna Hartikainen, Lotta Heikkilä, and Anu Reinikainen. 2014. "Food Waste Volume and Composition in Finnish Households." *British Food Journal* 116 (6): 1058–68. https://doi.org/10.1108/BFJ-12-2012-0311.

51. Allport, G.W. and Ross, J.M. (1967), "Personal religious orientation and prejudice", Journal of Personality and Social Psychology, Vol. 5 No. 4, pp. 432-443, doi: 10.1037/h0021212

52. FAO. 2020. *In Brief to The State of Food Security and Nutrition in the World 2020*. FAO, WHO, IFAD, WFP, UNICEF. https://doi.org/10.4060/ca9699en.

53. Yusuf, Faiza Ali, Faradiella Mohd Kusin, and Sunday Yusuf Kpalo. 2021. "Knowledge, Attitude, and Practice Regarding Charcoal Consumption among Households in Sanaag Province, North-Eastern Somalia." *Sustainability* 13 (4): 2084. https://doi.org/10.3390/su13042084.