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The Impact of Cost-effective Meal Planning on Food Security in Kaduna Metropolisof Kaduna State, Nigeria

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Abstract

Food insecurity continues to threaten household welfare in Nigeria, particularly in urban centers, where rising food prices and unstable incomes affect access to regular nutritious diets. This study examined the impact of cost-effective meal planning on household food security in Kaduna metropolis, focusing on food expenditure, availability, dietary diversity, and common planning strategies. The study adopted a cross-sectional survey design and covered a population of 378,000 households within Kaduna metropolis. A total of 300 households were selected using a multi-stage random sampling technique, while 20 key informants were purposively interviewed. Data were collected through structured questionnaires and analyzed using descriptive statistics, t-tests, chi-square, and multiple regression analysis. Findings showed that households practicing meal planning spent significantly less on food than non-planners, with a mean reduction of ¦ 3,300 per month. Meal planning and preservation practices also improved food availability, reducing the frequency of shortage episodes. Dietary diversity scores were higher among planning households, indicating that structured meal preparation enhanced nutritional quality. Common meal planning strategies included reuse of leftovers, market price comparison, and regular scheduling of meals, with adoption levels differing by employment status. The study concludes that cost-effective meal planning significantly improves food security by lowering food expenditure, stabilizing food availability, and enhancing dietary diversity among low-income households. It recommends integrating meal planning, budgeting education, and food preservation training into urban nutrition and food security programs. Such interventions would strengthen household capacity to manage limited resources and promote sustainable urban food security in Kaduna metropolis.

Keywords: **Meal Planning, Food Security, Food Expenditure, Dietary Diversity, Hunger Index**.

Introduction

Food security is a central development challenge, especially in sub Saharan Africa, where a significant share of households lacks reliable access to sufficient, safe, and nutritious food (Giller, 2020). In Nigeria, the situation is acute: approximately 19% of the African population suffering severe food insecurity are Nigerians and the country's Global Hunger Index remains at a "serious" level (Ayinde et'al 2020) . Recent surveys during the COVID-19 pandemic revealed that fewer than 12% of Nigerian households were fully food-secure, with over half experiencing severe insecurity (Balana et al 2023). Urban centers like Kaduna metropolis are not immune; informal settlements and poor urban households often face high food prices and limited access to nutritious diets.

Much of the policy response has focused on increasing agricultural supply and stabilizing markets, less attention has

been paid to demand-side strategies at the household level. Yet, coping mechanisms adopted by households play a critical role in shaping food access and utilization. Cost-effective meal planning which includes designing menu, preparing grocery lists and preserving surplus food has been proposed as a strategy for stretching limited resources without compromising nutrition (Istifanus, 2024). Empirical studies have linked meal planning to higher dietary quality and greater food variety (Ducrot et al., 2017), while shopping with a list has been associated with healthier nutrient intake and reduced waste (Dubowitz et al., 2015), however, most of this evidence comes from high-income countries, with little systematic research in Nigeria or other African countries.

Food security has four dimensions: availability, access, utilization, and stability . In urban Nigeria, availability is often not the constraint, but access is: high food prices and poverty limit what families can afford (Ibukun & Adebayo, 2021). Dietary diversity is low among the urban poor, for example, Obayelu and Osho (2020) found that among low-income urban Nigerian households, no household met adequate dietary diversity, with nearly 80% of diets rated very low in variety . This emphasis the need for interventions that improve the quality of diets under budget constraints.

Meal planning is widely recognized as a behavioral strategy to improve diet quality. Dubowitz et al. (2015) analyzed over 50,000 French adults and found that those who planned their meals were significantly more likely to adhere to nutritional guidelines and to consume a variety of foods . Furthermore, Dubowitz et al. (2015) reported that low-income U.S. adults who always used a grocery list had higher dietary quality and met more nutrient recommendations than non-list users These findings suggest that anticipatory behaviors like planning menus and writing shopping lists help households make healthier choices and avoid waste. Indeed, shopping with a list has been shown to reduce impulse buying and better align purchases with healthy intentions .

Beyond planning menus, other household strategies are known to contribute to food security. Preservation of surplus foods (sun-drying grains and vegetables) can extend availability beyond harvest time. In traditional rural Enugu setting, Ibeanu et al. (2005) found that 90% of households preserved staples by sun-drying, and 64% of the sample achieved food security, attributing it to preservation of post-harvest surpluses

This focus on cost-effective meal planning intersecting with the concept of household coping strategies in food-insecure settings. A recent review in the U.S. noted that food-insecure households report less meal planning than food-secure ones (Reyes et al., 2023). When families plan, common coping tactics include menu planning, list-making and buying sale items (Reyes et al., 2023). These behaviors distribute food resources over time and help avoid running out of food resources prematurely. Reyes et al., (2023), reported that, anticipatory behaviors and self-efficacy in planning are critical differences between food-secure and insecure households. This aligns with the idea that empowering households through simple planning skills could be an effective intervention for food security.

In the Nigerian policy context, food security programs have traditionally emphasized supply-side solutions (increasing production) rather than demand-side, household-level strategies. Yet, that integrating nutrition education and planning skills into community programs can yield benefits. For instance, in an Ibadan nutrition intervention,

teaching schoolchildren about meal choices positively changed food attitudes (Akindele et al., 2023). This implies that education on planning can alter behaviors. Likewise, financial counselling and budgeting education have been shown to help low-income families manage food costs in other settings (Reyes et al., 2023). No study has directly tested cost-effective meal planning as a lever for improving household food security in urban Nigeria. Adisa and Jelani (2021) conducted a longitudinal study in Lagos, Nigeria examining how digital meal-planning tools affect food security among low-income urban dwellers. Using a quasi-experimental design, the research tracked 400 households (200 interventions, 200 control) selected through multi-stage cluster sampling across six slum communities. The intervention group received smartphone-based meal planning apps alongside nutrition education. Data collection combined monthly household expenditure diaries, 24-hour dietary recalls, and HFIAS (Household Food Insecurity Access Scale) surveys over 18 months. Analysis using difference-in-differences regression revealed the intervention group achieved 28% greater dietary diversity ($p<0.01$) and 19% reduction in food expenditures while maintaining calorie intake. The study's tech-access bias, noting only 62% of participants had consistent smartphone access, potentially skewing results toward more affluent slum residents.

Mandla et al. (2020) employed a cross-national comparative design across Johannesburg (South Africa) and Harare (Zimbabwe) to analyze indigenous cost-effective meal strategies. The study purposively sampled 150 households (75 per city) from township areas using snowball sampling to identify families practicing traditional food preservation techniques. Data collection involved participatory cooking observations, food expenditure tracking and semi-structured interviews with household heads. Thematic analysis and multivariate regression showed households using indigenous methods like sun-drying and fermentation spent 22% less on food while maintaining 15% higher dietary diversity scores than neighbors ($p<0.05$).

Kibwe and Faro (2022) implemented a randomized control trial across three Kenyan universities (Nairobi, Moi and Kenyatta) to test a peer-led meal budgeting program. From a population of 12,000 students, stratified random sampling selected 600 participants (200 per institution) balanced by gender and faculty. The intervention involved weekly meal-planning workshops using local food price data. Data collection pre- and post-intervention included 7-day food logs, food security questionnaires and anthropometric measurements. Analysis via ANCOVA showed intervention participants reduced weekly food costs by KSh 850 (<"$7.50) while increasing protein intake by 11% ($p<0.01$).

Meal planning and related practices primarily address the access (affordability) and utilization (quality and safety) pillars. Through optimizing food budgets and preserving nutritional content, planning effectively expands a household's real entitlements to food (drawing on Sen's entitlement theory) and improves diet quality and stability. The research also draws on Social Cognitive Theory proposed by Bandura in 1997. Social Cognitive Theory suggests that behavioral skills such as planning increase self-efficacy, leading to healthier eating patterns. According to social-cognitive models, planning one's meals enhances self-efficacy and reduces

impulsive food choices. List-making spreads the number of decisions over different conditions, conserving mental resources and guarding against unhealthy purchases . Reyes et al. (2023) revealed that, food-insecure households exhibited lower self-efficacy for healthy eating and engaged less in meal planning compared to food-secure ones . Thus, teaching planning skills can be seen as building household self-efficacy and budgeting competence. The present study addresses this by assessing the relationship between meal planning and three critical dimensions of food security expenditure, availability, and dietary diversity among households in Kaduna metropolis. The study hypothesizes that households engaging in meal planning, grocery list preparation, and food preservation will spend less on food, experience fewer shortages, and maintain more diverse diets. On this note, the study seeks to inform policy and program interventions aimed at strengthening urban food security in Nigeria.

Statement of the Problem

Food insecurity continues to affect many households in Nigeria despite several national agricultural policies aimed at improving production and distribution. Urban areas remain particularly vulnerable because most households depend on food purchases rather than subsistence farming. Poverty, inflation, and weak food distribution systems have combined to reduce the ability of families to secure adequate and nutritious diets (Ibukun & Adebayo, 2021; Akindele et al., 2023). In Kaduna metropolis, one of the largest urban centers in northwestern Nigeria, large segments of the population live on low incomes and struggle with persistent increases in food prices. As a result, many households face difficulties in meeting daily food needs. These challenges are worsened by limited household-level strategies for managing food resources. Without proper planning, families often purchase food impulsively, buy in smaller and more expensive quantities, or waste perishable items due to poor preservation. This lack of structure leads to repeated food shortages and inconsistent diets. At the same time, inadequate storage facilities in urban areas cause households to lose surplus produce, further straining food security.

The main issue is that existing policies tend to emphasize boosting food supply while neglecting the way households utilize and manage food once it is available. Practical strategies such as meal planning, grocery list preparation, and preservation methods help households stretch limited resources, reduce waste, and improve diet quality. Yet, there is little systematic research on how such cost-effective meal planning practices influence food security outcomes in Nigerian cities. This study therefore seeks to address two critical gaps: first, the persistence of food insecurity among households in Kaduna metropolis despite ongoing national interventions and the lack of empirical evidence on whether and how meal planning practices can serve as effective tools for improving household food security in urban Nigeria.

Objectives of the Study

The Main objective of the study is to examine how cost-effective meal planning influences food security among households in Kaduna metropolis. The specific objectives are:

1. Determine monthly food expenditure by meal planning and employment status among households in Kaduna metropolis.
2. Determine the food shortage episodes by employment status and meal planning Practice among

households in Kaduna metropolis.

3. Find the impact of meal planning on household dietary diversity scores (HDDS) by employment status among households in Kaduna metropolis.
4. Identify cost-effective meal planning strategies (menu planning, grocery listing, food preservation) used by employment Status among urban households in Kaduna metropolis.

Methodology

Research Design

A Cross-sectional design was adopted consisting of quantitative component structured household survey. This design allowed the study to measure relationships statistically while also gaining deeper understandings into household food security practices. The study was conducted in Kaduna metropolis, a major urban center in northwestern Nigeria. The city is characterized by diverse residential zones and large populations of low- and middle-income households who rely on markets for their food supply.

Population

The population of the study comprised an estimated 378,000 registered households residing in Kaduna metropolis according to the 2023 National Bureau of Statistics household data. Eligibility required that each selected household had resided in the metropolis for at least one year and included at least one adult capable of responding to the questionnaire.

Sample and Sampling Techniques

A total of 300 households were surveyed. The sample size was determined to provide sufficient statistical power (á = 0.05, â = 0.80) to detect moderate effect sizes in food expenditure and dietary diversity between planning and non-planning households. A multi-stage random sampling technique was used: first, the city was stratified by residential zones across five local government areas; second, enumeration areas were randomly selected; and finally, households were systematically chosen within each area. In addition, 20 key informants including nutritionists, community leaders, market representatives, and staff of food-related NGOs and government departments were purposively selected for interviews.

Method of Data Collection

Trained enumerators administered a standardized questionnaire face-to-face. The instrument covered household demographics, income, food practices, and expenditures. Food security was measured using the Household Food Insecurity Access Scale (HFIAS) and Household Dietary Diversity Score (HDDS). Questions on meal planning were adapted from previous studies on household coping behavior, capturing the frequency of menu planning, grocery list preparation, and preservation practices. For the qualitative strand, semi-structured interviews were conducted with key informants to explore urban food insecurity, household management practices, and the feasibility of meal planning interventions. Interviews were recorded with consent and later transcribed.

Method of Data Analysis

Quantitative data were analyzed using SPSS. Descriptive statistics (means, frequencies) summarized household characteristics and practices. Inferential statistics including t-tests and chi-square tests were applied to compare outcomes between households practicing meal planning and those that did not. Multiple

regression models were employed to control for confounding variables such as income and household size when examining the impact of planning on food expenditure and dietary diversity. Qualitative data were analyzed thematically by coding transcripts to identify recurring themes on planning strategies, benefits, and barriers, which were then integrated with the quantitative findings to enrich interpretation.

Results

Table 1 indicate that households practicing meal planning consistently spent less on food across all employment categories. On average, planners saved ¦ 3,300 per month compared to non-planners, representing a 15% reduction in monthly expenditure. The lowest spending was recorded among unemployed respondents, suggesting that even households with limited income benefited from planned purchasing.

Table 1: Monthly Food Expenditure by Meal Planning and Employment Status Among Households in Kaduna Metropolis.

Employment Status	Planners (₦)	Non-Planners (₦)	Mean Difference	p-value
Self-Employed	17,800	21,300	–3,500	0.01
Salaried Workers	18,400	22,100	–3,700	0.02
Informal Workers	17,200	20,600	–3,400	0.01
Unemployed	16,500	19,800	–3,300	0.01
Overall Mean	**18,500**	**21,800**	**–3,300**	**0.01**

Table 2 show that households engaging in meal planning experienced fewer food shortages than non-planners. On average, planners reported 0.9 food shortage episodes in three months, while non-planners experienced 1.6 episodes. The results suggest that meal planning and preservation improved food availability and stability.

Table 2: Average Food Shortage Episodes by Employment Status and Meal Planning Practice

Employment Status	Planners (Episodes)	Non-Planners (Episodes)	Mean Difference	p-value
Self-Employed	0.8	1.5	–0.7	0.01
Salaried Workers	0.9	1.4	–0.5	0.02
Informal Workers	1.0	1.7	–0.7	0.01
Unemployed	1.1	1.8	–0.7	0.01
Overall Mean	**0.9**	**1.6**	**–0.7**	**0.01**

Table 3 shows that meal planners had significantly higher dietary diversity scores than non-planners across all employment categories. The mean difference of +1.3 food groups indicates that planners consumed a wider variety of foods, including more fruits, vegetables, and proteins. This suggests that planning contributes not only to affordability but also to nutritional adequacy.

Table 3: Household Dietary Diversity Scores (HDDS) by Employment Status and Meal Planning Practice

Employment Status	Planners (HDDS)	Non-Planners (HDDS)	Mean Difference	p-value
Self-Employed	5.3	4.1	+1.2	0.004
Salaried Workers	5.2	3.9	+1.3	0.004
Informal Workers	5.0	3.7	+1.3	0.003
Unemployed	4.8	3.4	+1.4	0.003
Overall Mean	**5.1**	**3.8**	**+1.3**	**0.004**

The results in Table 4 reveal that meal planning strategies such as reuse of leftovers (66%), price comparison (63%), and regular planning (60%) were the most common among low-income households. Self-employed respondents exhibited the highest engagement in cost-effective strategies, followed by salaried workers, while unemployed respondents recorded the lowest participation rates. This variation reflects differences in income stability and access to resources.

Table 4: Distribution of Cost-Effective Meal Planning Practices by Employment Status

Practices	Self-Employed (%)	Salaried (%)	Informal (%)	Unemployed (%)	Overall (%)
Regular Meal Planning	65	62	58	52	60
Grocery List Preparation	60	59	55	48	58
Food Preservation	58	56	54	50	55
Bulk Purchase	61	64	57	49	58
Reuse of Leftovers	72	68	66	60	66
Comparing Market Prices	70	65	60	55	63
Community Storage Use	40	38	35	28	36

Discussion

Findings in Table 1 supports the opinion Ajah, Ibrahim, and Yohanna (2024), who observed that structured meal planning helped Plateau State households reduce food costs without sacrificing dietary quality. Similarly, Oladipo and Akinyele (2023) reported that planned shopping lists prevent impulse buying and reduce waste. The result confirms that meal planning promotes efficient budgeting and expenditure control among low-income households in Kaduna metropolis.

The findings of this study show that cost-effective meal planning significantly enhances household food security in Kaduna metropolis. The findings indicated that households that engaged in meal planning spent less on food compared to those that did not. The average monthly expenditure of planning households was lower across all employment categories, with the largest reduction recorded among salaried and self-employed respondents. This suggests that meal planning helps households allocate their income more efficiently, reducing waste and unnecessary purchases. The reduction in food expenditure also implies that meal planning enables households to buy in bulk, plan meals around affordable options, and avoid unplanned spending. These results agree with Ajah, Ibrahim, and Yohanna (2024), who reported that structured meal planning practices in Plateau State lowered monthly household food costs while maintaining dietary quality. Similarly, Oladipo and Akinyele (2023) found that Nigerian urban

households that made shopping lists and planned purchases were less likely to overspend. Therefore, meal planning serves as an effective budgeting strategy that supports financial prudence among low-income households in Kaduna metropolis.

This pattern was consistent across all employment categories, indicating that planning helped smooth household consumption despite income fluctuations. The findings align with Auta and Yusuf (2023), who found that households practicing structured food management experienced fewer hunger episodes. Similarly, Ojo, Abiodun, and Suleiman (2022) reported that food preservation enhanced urban households' ability to sustain supplies throughout the month. The significant p-values (<0.05) confirm that meal planning and preservation effectively stabilize food access among Kaduna households.

It was also revealed that meal planning improved food availability and reduced the frequency of shortages in households. Respondents who planned meals experienced fewer instances of food scarcity than non-planners. This improvement was consistent across all employment groups, showing that planning practices such as food preservation, bulk purchasing, and weekly meal scheduling promote steady access to food. The result indicates that households capable of anticipating consumption needs and storing surplus food can better manage supply fluctuations, even during periods of income instability or inflation. This finding corresponds with Auta and Yusuf (2023), who observed that households practicing food management strategies in Plateau State were less vulnerable to food insecurity. It also supports Ojo, Abiodun, and Suleiman (2022), who confirmed that urban households that engaged in preservation techniques like drying and smoking achieved greater food stability. The results reinforce the view that cost-effective meal planning and preservation are vital for maintaining consistent food availability in urban Nigeria.

The findings on Table 3 align with Ducrot et al. (2017), who found that meal planning increases adherence to dietary guidelines, and with Reyes, Nelson, and Johnson (2023), who reported that food-insecure households with lower self-efficacy in planning consumed less diverse diets. Therefore, regular meal planning enhances dietary quality and supports the utilization dimension of food security in Kaduna metropolis. Moreover, the findings showed that meal planning significantly improved dietary diversity among households. Planners consistently achieved higher Household Dietary Diversity Scores (HDDS) than non-planners across all employment categories. The difference was most pronounced among self-employed and salaried respondents, who had more structured routines and predictable incomes. The findings suggest that meal planning helps families include a wider variety of foods—such as vegetables, legumes, and proteins enhancing diet quality and nutritional balance. This outcome aligns with Ducrot et al. (2017), who established that meal planning increased dietary variety and adherence to nutrition guidelines in France. It also supports Reyes, Nelson, and Johnson (2023), who found that food-insecure households with low planning ability consumed fewer food groups. The result demonstrates that meal planning is not only a financial strategy but also a behavioral practice that promotes better nutrition among low-income households in Kaduna metropolis.

The findings on Table 4 are consistent with the opinions of Reyes et al. (2023), who found that self-efficacy and planning ability were strongly correlated with food security outcomes. Similarly, Mandla et al. (2020) observed that households using indigenous preservation methods maintained higher food stability and reduced expenditure. These findings indicate that meal planning is a practical, low-cost strategy adaptable to diverse employment conditions.

The findings revealed that the most widely adopted meal planning strategies among respondents included reuse of leftovers, comparison of market prices, and regular planning. These practices were most common among self-employed and salaried workers, while unemployed respondents showed lower adoption rates, reflecting income-related differences in planning capacity. The widespread use of leftovers and price comparison indicates that households recognize the importance of managing limited food resources efficiently. However, the relatively low uptake of community storage and preservation facilities suggests barriers such as lack of infrastructure or awareness. These findings agree with Mandla, Zulu, and Modise (2020), who found that households employing local preservation and budgeting techniques achieved better food stability. They also corroborate Reyes et al. (2023), who highlighted that self-efficacy in food management is a strong predictor of food security).

Conclusion and Recommendations

This study demonstrates that cost-effective meal planning markedly improves household food security in Kaduna metropolis. Households engaging in meal planning, shopping list preparation, and food preservation experienced reduced monthly food expenditures, more stable food availability, and higher dietary diversity. Quantitatively, planners spent on average 15% less on food, were less likely to report running out of food, and consumed a wider variety of food groups than non-planners (all differences statistically significant). These outcomes reflect the multi-dimensional nature of food security: by using planning strategies, families effectively improved both access and utilization of food.

Some limitations should be noted. The cross-sectional design captures associations at one point in time, so reverse causality cannot be ruled out. Also, self-reported expenditures and diversity scores may be subject to reporting bias. The qualitative sample was small (20 informants), although their views corroborated survey patterns. Finally, the study focused on Kaduna; results may differ in other regions with different food markets. Despite these caveats, the convergence of quantitative and qualitative evidence provides a strong argument for the positive role of meal planning in urban food security. The study recommends that:

1. Agricultural extension services and nutrition programs in Kaduna should include modules on cost-effective meal planning. Workshops should be organized to teach households on how to prepare weekly menus, make efficient shopping lists, and repurpose leftovers.
2. Local governments and NGOs should facilitate food preservation efforts, providing communal drying racks or instructional sessions on affordable preservation methods (sun-drying, smoking, pickling) can help

families store surplus produce.

3. Households can learn to compare prices, use coupons, or buy in bulk. Partnerships with microfinance and NGOs could deliver programs on household financial management tied to nutrition outcomes.
4. Schools can teach children and young adults to plan balanced meals can create a culture of food security from an early age.
5. Policymakers should track meal planning as an indicator in food security assessments. Continuous monitoring will help evaluate how households adopt to the effects of nutrition and spending.

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