ADAN J. Agric. 2025, 6: 88-95

ISSN 2736-0385
DOI:10.36108/adanja/5202.60.0190

Food insecurity response and severity to changes in integrated household dependency ratio in Maiduguri Metropolis, Borno State, Nigeria

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Abstract

This study analyzed food insecurity response and severity to changes in integrated household dependency ratio in Maiduguri Metropolis, Borno State, Nigeria. It covered 15 and five peripheral wards of Maiduguri Metropolitan and Jere LGAs respectively. A two-stage sampling procedure was adopted to draw respondents for the study; Purposive selection of ten large concentrations of integrated household wards and proportionate random selection of 376 integrated households. Both primary and secondary data were used for the study. Descriptive and inferential statistics were employed to analyze the data collected. The descriptive statistics used were frequency tables, percentages and mean while inferential statistics included food insecurity response model (FIRM). The integrated household food insecurity response was positive with a coefficient of 0.307, 0.895 and 1.507 for mild, moderate and severe food insecure households respectively.

Keywords: *Dependency Ratio, Food Insecurity, Severity Changes*

Introduction

Food insecurity remains a critical global challenge, affecting millions of households across diverse socio-economic contexts. Defined food security as the "lack of consistent access to sufficient, safe, and nutritious food necessary for an active and healthy life". Food insecurity has profound implications for physical health, cognitive development, and Overall well-being, especially among vulnerable groups like children and adolescents. The complexity of food insecurity is often exacerbated by various factors, including household composition, economic stability, and social support systems (Mkhize *et al.*, 2022).

Recent studies have highlighted the significant role of household dependency ratios in influencing food security outcomes. The dependency ratio, which reflects the proportion of dependents (children and elderly) to the working-age population within a household, can serve as a critical indicator of economic strain and resource allocation (Mkhize *et al.*, 2022). Households with higher dependency ratios may face increased pressure on their financial resources, leading to heightened vulnerability to food insecurity. Conversely, households with lower dependency ratios

may have more economic flexibility, potentially enhancing their food security status (Goda *et al.*, 2023).

The COVID-19 pandemic has further complicated the landscape of food insecurity, revealing the fragility of food systems and the disproportionate impact on low-income households (O'Hara & Toussaint, 2021). As economic disruptions led to job losses and reduced incomes, many households experienced increased food insufficiency, particularly those with higher dependency ratios (Duong *et al.*, 2024). This underscores the need for a nuanced understanding of how changes in household dependency ratios can affect food security, especially in the context of economic shocks and social safety nets (Haile *et al.*, 2021).

Both COVID-19 and Boko Haram have worsened food insecurity by increasing household dependency ratios. While COVID-19 caused economic shocks that deepened food insufficiency in low-income households, Boko Haram's insurgency has strained resources in Maiduguri due to the large influx of internally displaced persons (IDPs). This study focuses on analyzing the impact of changes in household dependency ratios on food insecurity severity among IDP-integrated households in Maiduguri (Ezeokana, 2021).

In 2016, the International Organization for Migration (IOM) reported that 1,317,524 internally displaced persons (IDPs) integrated into host communities at two levels: 402,424 individuals in IDP households (primary integration) and 914,600 within existing households (secondary integration). This phenomenon highlights the rise in food insecurity driven by Boko Haram (BH) due to the increased number of IDP dependents in existing households within Maiduguri metropolis, the center of the northeastern crisis. This figure excludes those housed in Maiduguri's authorized camps.

As a result of changes in the integrated household reliance ratio in these communities, food insecurity and vulnerability in the area intensify, but there is still an information gap regarding the degree and severity of food insecurity. In particular, there hasn't been much research done on how severe food insecurity is in integrated households in response to changes in household composition. The number of IDPs living in leaving families, as well as the degree and severity of their food insecurity, are therefore still pertinent and of interest to those who study food insecurity. The response and severity of food insecurity to shifts in the dependency ratio among integrated households in Maiduguri Metropolis, Borno State, Nigeria, were thus rigorously examined in this study.

Food insecurity is a pressing global issue, particularly in low- and middle-income countries (LMICs). It is defined as the lack of consistent access to enough food for an active, healthy life (Mkhize *et al.*, 2022). The integrated household dependency ratio, which considers the proportion of dependents (children and elderly) to working-age individuals in a household, plays a crucial role in understanding food insecurity dynamics. This literature review synthesizes existing research on food insecurity, focusing on how changes in household dependency ratios affect food security outcomes.

Methodology

The research was conducted in the Maiduguri metropolis, which includes the Maiduguri metropolitan area and the surrounding wards of Jere, Konduga, and Mafa in Borno State. This urban setting, marked by limited agricultural land, high population density, a significant gap between food demand and supply, and rising food

prices, presents a risk of food insecurity. The region lies between latitudes 10°9″N and 13°44″N and longitudes 12°26″E and 14°38″E. It has a brief rainy season lasting from June to September and a long dry season of over 8 months, which supports the farming of cereals, legumes, and other annual crops. The 2021 census reports a population of approximately 3,601,124 in the Maiduguri metropolis. Of this population, 33.51% are primarily engaged in agricultural activities, while the remaining 66.49% work in other sectors, which could contribute to varying degrees of food insecurity within the community (Ali et al., 2022).

The study employed both primary and secondary data. Primary data on the status, prevalence, and severity of food insecurity were collected through structured questionnaires. This was supplemented by secondary data from various published sources, including books, conference proceedings, government reports, internet materials, academic journals, and theses (both published and unpublished).

Sampling Procedure and Sample Size

A two-stage sampling method was used to select participants for the study. In the first stage, 10 wards with a high density of integrated households were deliberately chosen, including Bolori 1, Gomari Airport, Gwange 1, Gwange 2, Mai Musari, Mairi, Maisandari, Mashamari, Old Maiduguri, and Shehuri North. In the second stage, 387 heads of integrated households (IHH) were selected randomly in proportion to their numbers; however, 11 were excluded from the survey due to relocation. This led to a final sample size of 376, from an initial total of 10,615 households, which was provided by NGOs (ICRC, WFP, IOM, and IDMC). The sample size was calculated using Yamane's (1967) formula with a 95% confidence level, as outlined by Umar and Yachiko (2021), and is further described in Table 1. The Yamane formula is outlined as follows:

$$n = \frac{N}{1+N\,(e)^2} \qquad (1)$$

Where:
n = sample size
N= population size
e = level of precision used (0.05)

Table 1: Sample Selection Procedure

S/N	Ward	No. of IHH (N)	Proposition of IHH	Sample size of IHHH
1	Bolori 1	1136	10.70	41
2	Gomari Airport	1271	11.97	46
3	Gwange 1	812	07.65	30
4	Gwange 2	1454	13.69	53
5	Mai Musari	916	08.63	33
6	Mairi	852	08.03	31
7	Maisandari	1207	11.37	44
8	Mashamari	866	08.16	32
9	Old Maiduguri	1092	10.29	40
10	Shehuri North	1009	09.51	37
Total		**10615**	**100**	**387**

Source: Adopted from Otabo and Kingsley, 2016

The analysis used descriptive statistics such as means, frequency distribution tables, percentages, and graphs. The conceptual framework for this study was based on previous research examining the relationship between food insecurity levels and the

number of dependents in households. It suggests that the extent of food insecurity in a household is influenced by socioeconomic factors, particularly the number of dependents, and is also indirectly affected by income through household food spending (Abdulrahaman, 2013; Adepoju and Adejere, 2013). In this model, household income acts as an intermediary, affecting how the number of dependents influences food insecurity (Headey, 2011). Consequently, the framework depicts how integrated households respond to food insecurity based on fluctuations in their dependency ratios.

The main aim of the model is to show how food insecurity levels change with variations in dependency ratios, while holding other socioeconomic factors and interventions constant. This provides insight into the specific impact of the dependency ratio on food insecurity levels in integrated households, represented as a point on the food insecurity curve. The dependency ratio is calculated by dividing the number of dependents (non-working members) by the total number of household members (working and non-working) (Ali et al., 2023). Thus, the model represents the relationship between changes in the Household Food Insecurity Level (HFIL) and changes in the Household Dependency Ratio (HDR).

$$\frac{\delta \text{HFIL}}{\delta \text{HDR}}$$

That is the slope of the household food insecurity response curve (Figure 1 below).

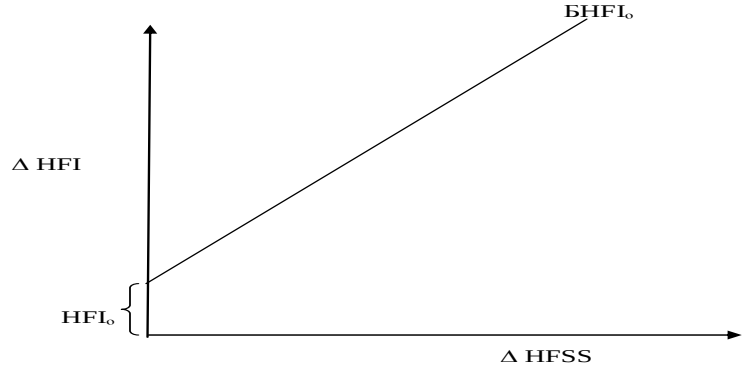

Figure 1 Household Food Insecurity Level Response Curve

Source: Conceptualized from the Study

$$\sum_{i=1}^{n} \frac{(HDR)}{n} / \sum_{i=1}^{n} \frac{(HFI)}{n}$$

The second part focuses on the specific point on the curve where a measurement is taken. The model defines a food insecurity response index (HFIRI) that ranges from 0 to 1, quantifying the impact of changes in the dependency ratio on food insecurity levels. However, the IHFIR model does not allow for the simultaneous analysis of multiple socioeconomic factors affecting food insecurity in integrated households.

The Household Food Insecurity Access Scale (HFIAS) classifies households into four progressive levels of food insecurity severity (FANTA, 2004). These categories include food-secure households and three levels of food insecurity, each

representing increasing severity based on the frequency and intensity of food insecurity experiences. The framework is designed to place each household into a specific category within this continuum. A household is considered food secure when its members do not experience food insecurity or only occasionally worry about their food supply.

$HFIC_1$: if [(f_1=0 or f_1x_1=1) and f_2=0 and f_3=0 and f_4=0 and f_5=0 and f_6=0 and f_7=0 and f_8=0 and f_9=0]…….... (2)

A mildly food insecure household is one that occasionally or frequently worries about not having enough food, and/or is unable to access preferred foods. It may have a more limited or monotonous diet than desired, and occasionally consumes food that is considered less desirable. However, such households do not reduce food quantity and do not experience the most severe forms of food insecurity, such as running out of food, going to bed hungry, or going a full day and night without eating.

$HFIC_2$: if [(f_1x_2=2 or f_1x_3=3 or f_2x_1=1 or f_2x_2=2 or f_2x_3=3 or f_3x_1=1 or f_4x_1=1) and f5=0 and f6=0 and f_7=0 and f_8=0 and f_9=0]…… ……(3)

A moderately food-insecure household frequently compromises on food quality by consuming a monotonous or undesirable diet occasionally or often. It may also begin to reduce food quantity by decreasing meal sizes or the number of meals rarely or occasionally. However, it does not experience any of the three most severe conditions.

$HFIC_3$: if [(f_3x_2=2 or f_3x_3=3) or f_4x_2=2 or f_4x_3=3 or f_5x_1=1 or f_5x_2=2 and f_6x_1=1 or f_6x_2=2 and f_7=0 and f_8=0 and f_9=0]……..(4)

A household is classified as severely food insecure if it has progressed to frequently or occasionally reducing meal sizes or the number of meals and/or encounters any of the three most extreme conditions (as previously described). Essentially, any household that experiences at least one of these three conditions, even once within the recall period, is deemed food insecure.

$HFIC_4$: if [f_5x_3=3 or f_6x_3=3 or f_7x_1=1 or f_7x_2=2 or f_7x_3a=3 f_8x_1=1 or f_8x_2=2 or f_8x_3=3 or f_8x_3=3 or f_9x_1=1 or f_9x_2=2 or f_9x_3=3]…….(5)

Where:

$HFIC_i^n$ = Household Food Insecurity categories (i = 1...4)

f=frequency of occurrence of food insecurity condition which is indicated by X

This indicator guide provides the following summary information that were considered for the study:

1. Integrated household food insecurity Access Prevalence
2. Integrated household food insecurity Access Scale Score

Measures of severity of integrated household food insecurity are food security indicators comprising the following:

Household Food Insecurity Prevalence and Severity

The HFIAP serves as the ultimate categorical indicator for assessing and reporting the status and severity of household food insecurity (access). Changes in HFIAP will be calculated using the HFIAS continuous score variable, as it is more sensitive in detecting smaller incremental changes over time compared to the HFIAP indicator. The HFIAP is determined by calculating the proportion of households within each Household Food Insecurity Category (HFIC) as outlined below:

$$HFIAP = \frac{\text{HFIC}}{\text{TSH}} \text{ X } 100 \ldots\ldots\ldots\ldots (6)$$

Where;

HFIAP = Household Food Insecurity Access Prevalence

HFIC = Household Food Insecurity Category

TSH = Total Sampled Households

Results and Discussion

Impact of Dependency Ratio Shifts Caused by BH-Induced IDPs on Integrated Household Food Insecurity

It was projected that 97.07% of Maiduguri's integrated households were food insecure. With relative prevalence of 5.32%, 27.65%, and 64.10%, these families were divided into three categories: mild, moderate, and severe. Table 2 displays the estimated Food Insecurity Response (FIR) coefficients for each of these households.

The table provides an analysis of integrated households based on food insecurity responses (FIR) and severity variables, categorized as Food Secure, Mild, Moderate, and Severe. The Slope reflects changes associated with severity, starting from a baseline of (0.000) for food-secure households and increasing significantly to (0.8683) in severe cases. Household Member Dependency Ratio (HMDR), representing the percentage of dependents, is lowest in food-secure households (0.31%) and peaks in moderate food insecurity (58.17%). Similarly, Household Members Facing Inadequate Living conditions (HMFIL) rises from (0%) in food-secure households to (71.24%) in severe cases, indicating worsening living conditions with severity. The HMFIL/HMDR ratio, which measures the burden of inadequacy per dependent, increases progressively from (0.588) in mild to (1.736) in severe, highlighting a growing strain as food insecurity intensifies. The Household Food Insecurity Response (HFIR) values, lowest for mild (0.307) and highest for severe (1.507), show greater household effort to cope with increasing insecurity. This progression illustrates the compounded challenges of dependency, inadequate living conditions, and intensified responses as food insecurity worsens, emphasizing the need for targeted interventions. These findings are consistent with those of Babatunde et al. (2007), Omonona and Agoi (2007), and Ali *et al.* (2023).

Table 2: Distribution of Integrated Households Based on Food Insecurity Response (FIR) and Severity

Variable	Food Secure	Mild	Moderate	Severe
Slope	0.000	0.523	0.77	0.8683
HMDR (%)	0,31	52.17	58.17	41.02
HMFIL (%)	0	30.60	50.02	71.24
HMFIL/HMDR	-	0.588	1.163	1.736
HFIR	-	0.307	0.895	1.507

Source: Field Survey 2018

Conclusion and Recommendation

The study assessed the response to food insecurity and its severity in relation to shifts in the Integrated Households Dependency Ratio (HMDR) in Maiduguri Metropolis, Borno State, Nigeria. Conducted across five wards in Jere LGA and fifteen wards in the Maiduguri Metropolitan District, the study utilized a two-stage sampling technique to select 376 integrated households. Using both primary and secondary data sources, the analysis employed descriptive statistics, including frequency tables, percentages, and means, alongside the Food Insecurity Response Model (FIRM) for inferential analysis. The findings revealed that 97.07% of Maiduguri's integrated households experienced food

insecurity, with 5.32%, 27.65%, and 64.10% categorized as mild, moderate, and severe, respectively. The severity variables highlighted an increase in the HMDR from 0.31% for food-secure households to 58.17% in moderate cases, alongside a rise in Household Members Facing Inadequate Living conditions (HMFIL) from 0% to 71.24%. The HMFIL/HMDR ratio increased from 0.588 in mild to 1.736 in severe cases, emphasizing the growing burden of inadequate living conditions per dependent as food insecurity worsened. The Household Food Insecurity Response (HFIR) coefficients, ranging from 0.307 in mild to 1.507 in severe cases, indicated intensified household efforts to cope with worsening insecurity.

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