A Multi-Indicator Assessment of Rural Household Food Security in Niger: Evidence from Integrated Household Survey and Market Data

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ABSTRACT

Despite sustained efforts by the government of Niger and its partners, food insecurity remains a major challenge for rural households, which rely heavily on rain-fed agriculture and local markets, and are increasingly exposed to climate change and insecurity. This study assesses rural household food security using a multi-indicator approach that incorporates market dynamics, aiming to inform policymakers, humanitarian actors, and track progress toward Sustainable Development Goal 2 (SDG 2).A cross-sectional survey of 404 households across four regions (Niamey, Dosso, Tillabéri, and Tahoua) measured food availability, access, and stability through household food stocks, food expenditures, the Food Consumption Score (FCS), the Household Hunger Scale (HHS), and the Coping Strategy Index (CSI). Market analysis examined functionality, household dependence on markets, and commodity prices for key staples.Results reveal chronic and widespread food insecurity: only 19.7% of households achieved acceptable food consumption, while 9.1% experienced severe hunger. More than 74% of households relied primarily on markets for food, exposing them to price fluctuations and supply constraints. Market disruptions were observed in Tillabéri, Tahoua, and Dosso, and staple prices were highest in Tillabéri, highlighting the combined effects of insecurity, logistical constraints, and reduced market integration. Negative coping strategies were widely adopted, including reducing meal portions, limiting adult consumption in favor of children, and borrowing food.These findings indicate that food insecurity in rural Niger is shaped by structural vulnerabilities, market dependence, and localized insecurity. Integrating market analysis into food security assessments is critical for designing context-specific, resilience-oriented interventions.

Keywords: Food security, Rural households, Niger, Market data, multi-indicator Assessment

1. INTRODUCTION

Eliminating hunger through food sovereignty remains a major challenge for many households worldwide, particularly in low-income countries [1,2]. Yet, over the past decades, the commitment of states and international institutions toward Sustainable Development Goal 2 (SDG 2) has strengthened, notably through the implementation of numerous investment plans and initiatives engaging both national and international actors. The Aquila G8 declaration (2009) exemplifies this global mobilization [3,4,5].

Unfortunately, these efforts have not succeeded in breaking the vicious cycle of hunger. Globally, between 713 and 757 million people were affected by hunger in 2023, representing approximately 8.5 % of the world population, compared to 8.7 % in 2022 and 8.8 % in 2024. By 2030, this number is expected to reach around 512 million, over 60 % of whom would live in Africa [6,7].

This situation highlights the urgent need to accelerate deep transformations of agricultural systems and to enhance their resilience to ensure access to and availability of sufficient, safe, and nutritious food for all [6]. This issue is particularly acute in sub-Saharan Africa, where agricultural systems face multiple constraints, including limited access to arable land, soil degradation, climate shocks, and structural insecurity, all contributing to chronic food insecurity [3,8].

Niger, a Sahelian country with an estimated population of 27 million, exemplifies these dynamics. Nearly 80 % of households engage in rain-fed agriculture, making them highly vulnerable to climatic shocks and food insecurity, thereby justifying agricultural system reforms [9][10].

Structural factors (unfavorable environment, chronic poverty, population pressure) and cyclical factors (droughts, pests, price increases, floods, armed conflicts) further exacerbate this situation [9,10,11].

In 2025, approximately 2.2 million people are projected to face acute food insecurity, including nearly 1.5 million children suffering from moderate acute malnutrition and 400,000 from severe malnutrition. Around 47 % of children under five would be affected by chronic malnutrition [8,12]. Given its chronic nature, emergency-focused response strategies have struggled to provide sustainable solutions.

Moreover, a substantial proportion of households rely on markets for food purchases due to low domestic production [13]. This justifies integrating market dynamics and household income sources into food security assessments [14].

While food insecurity in Niger is well-documented using various approaches, its strong spatio-temporal variability and the impact of climate change make measurement complex, requiring regular monitoring and innovative approaches [15,16,17,18]. In this context, the present study explores rural household food security in Niger using a multi-indicator approach that incorporates market dynamics to inform policymakers and humanitarian actors.

This approach allows for moving beyond unidimensional measures and provides a deeper understanding of the complex factors shaping food security and household resilience in Niger.

2. Methodology

2.1. Study Area

The study was conducted in four regions of Niger (Tillabéri, Niamey, Tahoua, and Dosso) located in the south-western and central parts of the country. These regions are characterized by recurrent exposure to food insecurity, high climatic variability, strong dependence on markets, and structural socio-economic vulnerability of households [19].

2.2. Sampling Strategy

A cross-sectional household survey using a two-stage cluster sampling design was conducted for the quantitative component, complemented by purposive key informant interviews with local salespersons to capture market-related perspectives.

First stage: Twelve villages were randomly selected across the four regions (three per region), taking into account accessibility and security constraints.

Second stage: Households were selected using systematic sampling. The first household was identified from the center of the village by randomly determining a direction, after which subsequent households were selected using a fixed sampling interval (k).

Sample Size

The sample size was determined using the standard formula for estimating proportions:

$$n = \frac{z^2 \times p(1-p)}{e^2}$$

where n is the minimum sample size, z corresponds to a 95% confidence level, p is the estimated proportion of food-insecure households, and e is the margin of error. Accounting for an estimated non-response rate of 5%, the final sample size was increased to 404 households (z = 1.96; e = 0.05).

2.3. Data Collection

The main food security indicators assessed included:

- Food availability at the regional level (household and market) and physical access;

- Household food sources;

- Duration of household food stocks;

- Household food expenditures;

- Food Consumption Score (FCS): frequency and nutritional quality of food groups consumed over the previous seven days;

- Household Hunger Scale (HHS);

- Coping Strategy Index (CSI): frequency and severity of coping strategies related to food insufficiency over the previous seven days.

The World Food Programme (WFP) classification thresholds were applied to categorize households [20].

For market analysis, the key variables are collected

- Food prices

- Market functioning

- Household dependence on markets

2.4. Statistical Analysis

Data were analyzed using SPSS software. Analyses included descriptive statistics (means, proportions) and comparative analyses across regions to identify spatial disparities in food security and livelihoods. Statistical significance was set at a 5% level.

2.5. Ethical Considerations

The study adhered to ethical principles of voluntary participation, confidentiality, and anonymity. No personally identifiable information was collected from participants.

3. Results

3.1. Demographics characteristic of respondents

Table 1 summarizes the sociodemographic characteristics of the 404 surveyed households. The majority of respondents were aged 35-44 years (35%), followed by those aged 45-54 years (17.5%) and 25-34 years (16.5%). Respondents aged 18-24 years accounted for 11.5%, while those aged 65 years and above represented 6.5% of the sample. Women constituted 54% of respondents.

Regarding education, 38.5% of respondents had basic literacy skills and 38% attended Quranic schools. Only 13.5% completed primary education, 9.5% reached secondary education, and 0.5% attained higher education.

Household size was generally large. 39.5% of households comprised 5–8 members, while 44% had nine or more members. Smaller households (1-4 members) represented 16.5% of the sample.

Table 1. demographics characteristic of respondents

| Characteristic	Description	N	%
Age	18–24 years	46	11.50%
	25–34 years	67	16.50%
	35–44 years	142	35.00%
	45–54 years	71	17.50%
	55–64 years	53	13.00%
	65 years and above	26	6.50%
	Total	404	100%
Sex	Female	218	54.00%
	Male	186	46.00%
	Total	404	100%
Educational attainment	Literacy	155	38.50%
	Quranic school	154	38.00%
	Primary	55	13.50%
	Secondary	38	9.50%
	Higher education	2	0.50%
	Total	404	100%
Household size	1–4 persons	67	16.5%
	5–8 persons	160	39.5%
	9 or more persons	177	44%
	Total	404	100%

3.2. Assessment of Food Availability, Access, and Stability in the targeted regions

Figure 1 illustrates food availability at the regional level (household and market availability) in rural areas during the assessment period. Food was available in most localities, either at the household level or through markets. Specifically, food availability reached 98.06% in Niamey, 96% in Dosso, 93% in Tahoua, and 78.43% in Tillabéri.
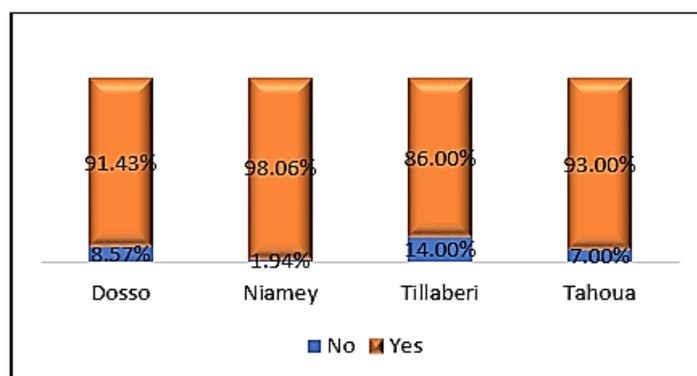
Figure 1. Food Availability Across the Study Regions

Regarding household food sources, **Figure 2** indicates a strong reliance on markets, with 74.3% of households reporting that they primarily source their food from local markets. These finding nuances household-level food availability highlighted in **Figure 1**, underscoring the dependence of households on market access.
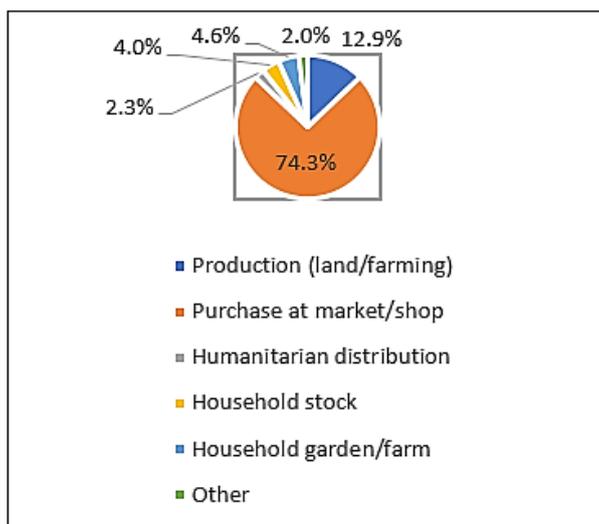
Figure 2. Household Food Sources

Regarding the duration of household food stocks, **Table 2** highlights marked regional disparities with varying levels of vulnerability. In Dosso, 17.65% of households reported having food stocks for less than a week, and 5.88% indicated that their supplies were completely exhausted. In Niamey, around 34.43% of households had stocks lasting less than a week, while 23% reported having depleted their reserves. In the Tillabéri region, 26.67% of households had less than a week's supply, compared to 14.56% in Tahoua. However, food stocks were entirely exhausted in 32% of households in Tillabéri and 47.57% in Tahoua.

Table 2. Expected Duration of Household Food Stocks

Duration of Food Stocks	Dosso (%)	Niamey (%)	Tillabéri (%)	Tahoua (%)
Two weeks	0	10,67	13,59	17,65
Less than a week	15,14	14,56	26,67	33,33
More than a month	4,12	2,97	0,97	31,37
Four weeks	5,33	2,91	1,33	0
Three weeks	8,48	8,74	6,87	7,87
One week	3,92	34,43	11,65	20
Zero days	5,88	23	32	47,57

**Table 3** examines the annual duration of food crises experienced by households.

Overall, more than one-third of households (an average of 32.5%) face crises for 8 to 9 months, while nearly 10% experience food insecurity throughout the year. In Dosso, chronic food insecurity is most pronounced, with 58.6% of households affected for 8 to 9 months, 19.5% for 6 to 7 months, 13.1% for 4 to 5 months, and a small proportion (3.4%) in crisis almost year-round. Niamey shows a different pattern, with 28% of households experiencing 8 to 9 months of food insecurity, 23.2% for 4 to 5 months, and 18.9% almost year-round. In Tillabéri, 43.3% of households face crises for 4 to 5 months, 24.5% for 6 to 7 months, and 15.7% for 8 to 9 months. Finally, Tahoua displays a mixed pattern, with 32.5% of households in crisis for 8 to 9 months, 27.3% for 4 to 5 months, 17.9% for 6 to 7 months, and nearly 10% almost year-round.

Table 3. Number of Months Households Face Food Insecurity

Month	Dosso	Niamey	Tillaberi	Tahoua
0-1	0%	5,12%	0,55%	2,04%
2-3	5,39%	14,56%	10,47%	10,48%
4-5	13,13%	23,18%	43,25%	27,35%
6-7	19,53%	10,24%	24,52%	17,94%
8-9	58,59%	28,03%	15,70%	32,49%
10-12	3,37%	18,87%	5,51%	9,70%
Total	100%	100%	100%	100%

3.3. Analysis of Household Food Expenditures

Figure 3 shows the distribution of households according to monthly food expenditure categories relative to the minimum food basket threshold in Niger (40,000 XOF). Overall, 72.05% of households report food expenditures equal to or above the threshold, while 27.95% remain below it.
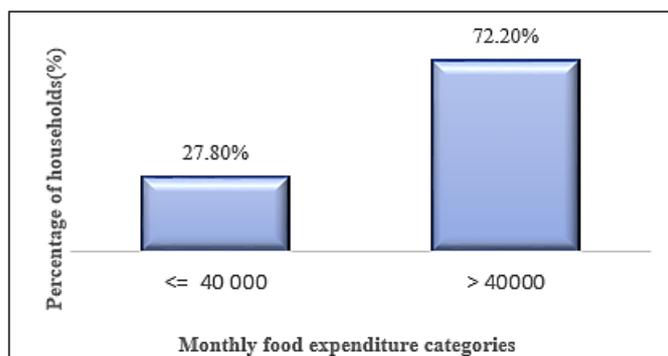

Figure 3. Household Food Expenditures Relative to the Minimum Food Basket Threshold

3.4. Analysis Using the Household Food Consumption Score, Coping Strategies Index, and Household Hunger Scale

3.4.1. Food Consumption Score (FCS)

Figure 4 shows the Household Food Consumption Score (FCS) across the studied regions, revealing notable geographic disparities. In Dosso, only 11% of households have an acceptable FCS, while 54.9% are borderline and 34.1% are severely food insecure. In Niamey, 43.7% are acceptable, 29.1% borderline, and 27.2% severely food insecure. Tillabéri presents the most critical situation, with 10.7% acceptable and 57.3% severely food insecure. In Tahoua, 13.5% of households are acceptable, 64.9% borderline, and 21.7% severely food insecure.
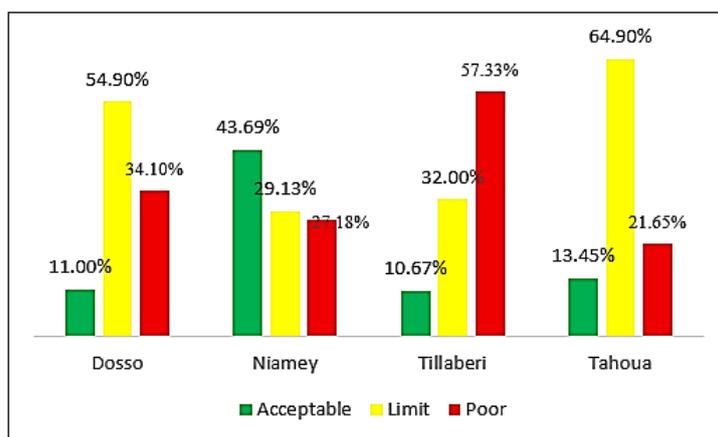

Figure 4. Household Food Consumption Score

3.4.2. Coping Strategies Index (CSI)

Faced with persistent food insecurity, households are forced to adopt various coping strategies, often involving difficult trade-offs that affect the quality and quantity of their food consumption. **Figure 5** summarizes the strategies households employed during the seven days preceding data collection.

It appears that 96.07% of households reported consuming cheaper or less preferred foods, while 64.63% borrowed food or relied on assistance from friends or family members. More severe strategies, reflecting reductions in food quantity and intra-household allocation, were also widely reported. Specifically, 75.55% of households indicated limiting portion sizes at meals, 60.70% reduced adult consumption in favor of children, and 74.67% reported reducing the number of meals consumed per day.
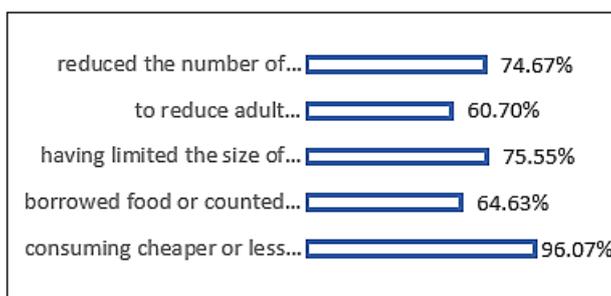
Figure 5. Household Coping Strategies Index

3.4.2. Household Hunger Scale (HHS)

Table 3 presents households classified according to the Household Hunger Scale (HHS). The study reveals that nearly 47.6% of households fall into the "little or no hunger" category, while the remaining 52.4% experience food insecurity: 25.3% moderate hunger, 17.5% moderate to severe hunger, and 9.6% severe hunger, indicating the use of extreme coping strategies.

Table 4. Household hunger scale (HHS)

HHS Score	%	Categories of Household Hunger
0–1	47.60%	Little or no hunger
2–3	25.33%	Moderate hunger
4–6	17.47%	Moderate to severe hunger
7–9	9.61%	Severe hunger

3.5. Market functionality and commodities prices

Table 4 presents the functionality of markets and the prices of key commodities across the four regions during the study period. Market operations were reported as fully functional in Niamey. However, disruptions were observed in a small proportion of cases, notably in Tillaberi (15%), Tahoua (10%), and Dosso (5%). These disruptions likely reflect localized constraints related to transportation challenges and security concerns associated with non-state armed groups, including terrorism and banditry.

Regarding commodity prices, the analysis reveals notable regional disparities. The average prices per 100 kg were approximately 29,800 XOF for millet, 27,000 XOF for sorghum, 30,000 XOF for maize, and 30,300 XOF for cowpea. Overall, commodity prices were highest in Tillaberi and lowest in Dosso.

Table 5. market functionality and commodities prices

Market functionality		Dosso	Niamey	Tillabéri	Tahoua
	Yes	95%	100%	85%	90%
	No	5,00%	0,00%	15,00%	10,00%
Commodities prices (XOF) for 100 kg	Millet	27 000	30000	32000	27500
	Sorghum	25 000	26 000	28000	26000
	Maize	30 000	28 000	30000	28000
	Cowpea	28 000	31000	31000	29000

4. Discussion

The simultaneous use of multiple key indicators, combined with an analysis of market dynamics, enabled the assessment of food security among rural households in Niger. Located in the heart of the Sahel, the country is known to be exposed to climatic vulnerabilities, insecurity, and significant demographic pressure. The study provides a comprehensive view of the factors shaping food security and household resilience in rural Nigerien communities.

The results indicate that food insecurity in Niger is both chronic and multifactorial, affecting nearly all the regions studied to varying degrees. From a socio-demographic perspective, the study reveals very large household structures, with more than nine members in 44% of cases. Household size thus appears as a major structural factor, placing significant pressure on already fragile domestic food resources. This finding corroborates studies conducted in Nigeria and Mali [21,22], which establish a causal link between demographic pressure and food vulnerability in at-risk communities.

Food availability and access in the studied regions reflect this insecurity. While food is generally available, averaging 91.37% across regions and households, it is largely dependent on regular market purchases. The study shows a strong reliance on markets for food supply (74.3%), even in regions with high agricultural potential, such as Dosso. This highlights the central role of markets in household food security, particularly for those with limited domestic production. Nevertheless, availability varies by region: Niamey benefits from better accessibility due to stable supply chains and higher purchasing power, while Dosso maintains relative stability due to its agricultural potential, despite localized pockets of insecurity. In contrast, Tillabéri and Tahoua, heavily impacted by insecurity, population displacement, and climatic shocks, face more limited availability, further accentuating their vulnerability. These findings are consistent with a study conducted in Niger by Zakari [23].

Regarding household food stocks, an indicator of household-level food stability, the study indicates that, on average, more than 23.3% of households have food stocks lasting less than one week. Even more concerning, 27.6% reported having completely exhausted their reserves, revealing acute food vulnerability, consistent with the work of Amandoulougou [24].

Additionally, the data analysis shows that households experience food crises over extended periods throughout the year. Specifically, 17.94% of households report facing food insecurity for six to seven months annually, illustrating the persistence of food insecurity and the need to combine emergency responses with long-term resilience strategies, as recommended by the United Nations Special Adviser for Africa through Mwaniki [25].

Household food expenditures are generally very high and often exceed purchasing power. With the minimum food basket set at 40,000 XOF in Niger, approximately 27.95% of households are unable to meet these needs, forcing them to adopt negative coping strategies. Most of these households resort to borrowing or altering their dietary habits, which in turn affects their ability to meet other essential household needs. This observation confirms the causal link documented in Sahelian studies between income, market access, and household food security [23,26].

Furthermore, the analysis using standard food security indicators confirms previous findings, revealing chronic, multifactorial, and widespread food insecurity. The Household Food Consumption Score (FCS) assessment indicates that only 19.7% of households have acceptable food consumption, while 9.1% suffer from severe hunger, reflecting serious food insecurity and deep structural vulnerability.

Coping strategies adopted by households further illustrate the severity of the situation: 96.07% consume cheaper or less preferred foods, 64.63% borrow food or rely on assistance from relatives, 75.55% limit portion sizes, 60.7% reduce adult consumption in favor of children, and 74.67% decrease the number of meals consumed daily.

The Household Hunger Scale (HHS) shows that 52.4% of households experience food insecurity, including moderate hunger (25.3%), moderate to severe hunger (17.5%), and severe hunger (9.6%). This underscores extreme household vulnerability and the difficult choices they must make to survive, while also highlighting the complexity of food insecurity in Niger and the Sahel in general. These results align with previous studies on these indicators in Niger [27,28,29].

At last, for market functionality and price stability, the study reveals clear spatial disparities. While markets in Niamey are fully functional, geographical disruptions are observed in Dosso, Tahoua, and Tillaberi. These disruptions likely result from a combination of factors, including insecurity, logistical constraints, and reduced market integration in conflict-affected Sahelian areas.

Food commodity prices are particularly high in Tillaberi and relatively low in Dosso, indicating that insecurity and market frictions significantly contribute to higher transaction costs and supply constraints. This suggests that price dynamics are more strongly influenced by logistical and security constraints, as well as regional agricultural potential, than by the actual operational status of markets.

These results are consistent with previous studies demonstrating the negative impacts of conflict and insecurity on food security, particularly through their effects on market functionality, price stability, and household access to food [30,31].

These findings serve as a reminder to policymakers and humanitarian actors that initiatives aimed at strengthening household resilience should address not only food security but also income diversification and the strengthening of local agricultural systems.

Access to essential goods should be ensured consistently, guaranteeing market stability and continuity. Finally, nutrition policies and programs targeting children, pregnant women, and lactating mothers will be critical for preventing malnutrition and contributing to the achievement of the Sustainable Development Goals, in line with the strategies of global food programs [6,7,8]. Any response option should also take into account local and regional specificities, drawing on indigenous knowledge and community experiences.

Despite its contributions, the study has certain limitations. While the sample is representative, it does not encompass the full diversity and complexity of rural areas in Niger. In addition, the cross-sectional design of the assessment prevents capturing seasonal variations in food security.

Nonetheless, the multi-indicator approach combining food security measures, household coping strategies, and market dynamics offers a robust framework for informing policymakers and guiding humanitarian interventions.

5.Conclusion

This study demonstrates that food insecurity in Niger remains severe, chronic, and multifactorial, shaped by demographic pressures, insecurity, low domestic production, climatic shocks, and market dependencies. Despite widespread regional food availability, reliance on markets exposes households to price volatility and supply disruptions, particularly given their generally low purchasing power. The multi-indicator approach revealed critical vulnerabilities, with over half of households experiencing some degree of hunger and most adopting negative coping strategies to maintain consumption.

These findings imply that policy and humanitarian responses should go beyond emergency food aid, emphasizing long-term resilience through income diversification, strengthening local agricultural systems, ensuring stable market access, and implementing nutrition interventions targeting children and women. Program design must account for local and regional specificities, leveraging indigenous knowledge and community experiences to maximize impact. Integrating household-level food security indicators with market dynamics provides a powerful tool for guiding targeted, evidence-based interventions in Niger and similar Sahelian contexts.

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