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Enhancing food and nutritional security through Gender-Disaggregated Analysis: A case study of Lake Victoria Shore, Tanzania

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ABSTRACT

Background: Understanding the extent and the domains under which food and nutrition insecurity is more critical is essential for designing appropriate interventions and targeting strategies. However, it has been very undesirable that access to such information in Lake Victoria Shores has been undeniably very rare. **Aims:** This study was conducted in Mara and Simiyu regions along the Lake Victoria shores aiming to investigate the extent of food and nutrition security in the study area, exploring the variation of food and nutritional security across genders of the household head and examining the influence of household income on food and nutrition security. **Material and Methods:** A total of 450 households were involved in this survey. Data collection methods were a focus group discussion, household surveys, key informant interviews, and observations. **Results:** Results indicated that: Food consumption, food access stability, and nutritional quality in the surveyed areas were substantially unsatisfactory and varied across studied areas; When data are disaggregated by gender, the results indicated that male-headed households were slightly better than female-headed households in nearly all food security aspects, with the difference between two types of households for food consumption and sufficiency aspects being marginally significant ($p < 0.10$). Furthermore, the finding indicates that household food security improves with household income. The proportion of households with food insufficiency and food instability generally tended to decline significantly with increased household income. **Conclusion:** The study, therefore, recommends strengthening horticultural crop production, fish farming, and paddy production and introducing high-value and nutritious food crops like Orange fleshed Sweet Potatoes to increase income, food and nutrition security. Sensitization and emphasis on using various food groups should be carried out to improve food and nutritional diversity.

Keywords: Food and nutrition security, Gender disaggregation, Lake Victoria shore, Household income, Intervention strategies.

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1 Introduction

Food and nutrition insecurity is increasingly becoming a major policy concern not only at the national and regional levels but also in the global arena ^{1,2}. The world aspires to achieve zero hunger and improved food and nutrition by 2030, yet there exists a substantial number of people who are hungry and undernourished ³. Despite the fact that food security continues to improve in many countries of the world in response to several deliberate measures undertaken, there are still notable problematic food situations in some parts of the globe hence underscoring the immense challenge of achieving the 2030 global food agenda ³. Empirical evidence

has indicated that Food insecurity and undernourishment are more severe in less developed countries of Africa, Central Asia, and Latin America ⁴.

The major exacerbators of the recent food crises have been unfavorable climatic variation which generates a series of events and actions including environmental degradation, drought, and loss of biodiversity ⁴. The combined effects of these events and actions altogether culminate into food and nutrition insecurity. Interventions to avert these crises have been the adoption of climate-smart agricultural practices which include among others irrigation practices ⁵.

Areas adjacent to huge water bodies like zones surrounding Lake Victoria are exposed to numerous potentials that could be exploited for mitigating the effects of food crises caused by climatic variation. The geographical positioning of these areas just adjacent to a huge water body (Lake Victoria) makes the area very favorite for horticultural crop farming, fish farming, and establishment of irrigation schemes. Despite such exposure, improving food and nutrition security in these regions has remained very challenging⁶⁻⁸. Empirical evidence from the southern part of Tanzania has proven that employing climate-smart agricultural practices including the adoption of irrigation practices; the use of high-value crops like horticultural crops and the use of drought-tolerant crops usually results in high productivity⁵. However, considering the fact that resources are always scarce, employing such intervention requires prioritization, proper planning, and targeting strategies.

While understanding the extent of food insecurity and the domains under which food and nutrition insecurity is more critical is essential for designing any appropriate intervention and targeting strategies, it has been very undesirable that access to more refined information in Lake Victoria zones has been undeniably rare. Tanzania faces a greater challenge in identifying households most in need of food security rather than relying on regional food availability to identify regions potentially in need of food assistance while in a real sense, food insecurity isn't only about food availability but also other factors as access, utilization, and stability⁷. It is difficult to implement any response mechanism while lacking evidence-based information on the nature, magnitude, subjects, and categories of the population most vulnerable to food and nutrition insecurity and the reason for their vulnerability⁷. It is through this fact that, Cochrane & D'Souza⁷ observed that policies to address food insecurity in Tanzania have frequently been hindered by a lack of accurate estimates of production and existing food needs. Apart from this weakness, it has also been evident that cases of food and nutritional security vary across regions and time^{7,9,10}. In this case, obtaining more refined and up-to-date evidence-based information is inevitable for undertaking informed decisions.

Owing to this fact, this study therefore aimed at documenting food and nutrition security and its gender desegregation in the Lake Victoria Zone. Specifically, the study aimed at investigating the status of food and nutrition security in the study area, exploring the variation of food and nutritional security across gender of the household head, and examining the influence of household income on food security.

1.1 Literature Review

Both Food and Nutritional security are essential for maintaining the good health status of an individual¹¹. While food security emphasizes access to adequate food by all people,

at all times, nutritional security on the other hand demands the intake of a wide range of foods that provide the essential nutrients according to age, gender, occupation, and health status of an individual¹².

Food and/or nutrition insecurity has been a daily experience of many rural households in Tanzania, with most areas including, Lake-Victoria zones being victims of the situation^{6,8,13}. The 2019 baseline survey conducted by the United Nations Development Program (UNDP) in collaboration with the Institute of Rural Development Planning (IRDP) in lake zone areas observed a high prevalence of food insecurity and malnutrition among households in lake zone areas despite exposure to numerous opportunity that could be exploited to overcome the situation. The literature attributes such a situation as a result of low technological capability, inefficient production, highly prevalent poverty levels, increasing populations, and climate variability that affect food production, leading to either stagnation or modest gains in food and nutrition security^{11,14}.

Various interventions are being carried out to revert the situation including adopting climate-smart agriculture. However, the lack of up-to-date information for monitoring the progress and initiating further interventions has been the main challenge. Tanzania lacks an effective mechanism for obtaining accurate and evidence-based information on food and nutritional security, a situation that hinders effective efforts to plan and monitor the situation⁷. Mostly the country relies on regional estimates of food availability to identify regions potentially in need of food assistance. This situation not only narrows down food crises into food insecurity but also undermines the importance of nutritional security in food crisis dialogue. Moreover, such a dearth of information provides insufficient evidence-based information on the nature, magnitude, subjects, and categories of the population most vulnerable to food and nutrition insecurity and the reason for their vulnerability which are essential for monitoring and planning new interventions to revert the situation.

Along with this challenge, several attempts to document food crises have been elevating food access while paying little or no attention at all to the quality of food consumed^{10,15,16}. For example, Korir *et al.*¹⁶ documented food insecurity in the region; yet did not place substantial effort on food quality. Similarly, the Integrated Food Security Phase Classification (IPC) had a similar orientation. There has been plenty of evidence from literature suggesting that the current food crises facing the world aren't food access only but also the nutritional quality of food consumed^{11,14,17}.

Forero-Cantor *et al.*¹⁰ had a clear description of food security in very similar areas (i.e. Mleba and Ukerewe) yet fell short of a similar weakness. The findings from this study not only

placed little emphasis on nutritional quality but also cautioned that food security is a locational and time-specific aspect and that any attempt to document it should consider such an attribute.

2 Material and Methods

2.1 Study area

The study was conducted in two regions, namely, Mara and Simiyu regions along the lake shore of Lake Victoria. Two districts and one Town council, namely, Busega District, Bunda District, and Bunda Town Council, were involved in the survey. The study involved a total of 15 selected villages in these districts, covering a total of 450 households. Figure 1 shows that these studied areas are far east of Lake Victoria's shores.

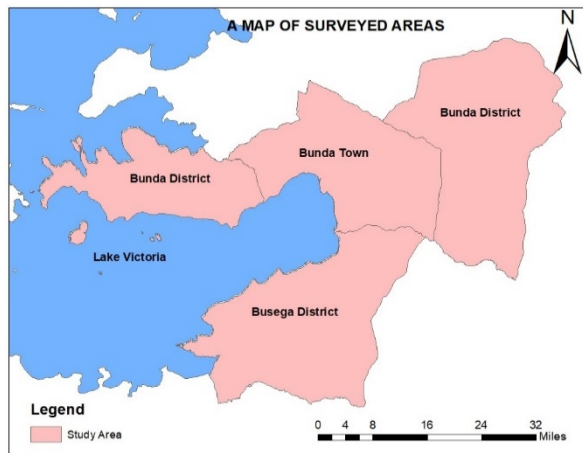


Figure 1. Map of Surveyed Areas

Source: Drawn by Authors using Tanzania District Shape Files 2019

2.2 Sampling Procedures and Sample Size

This study employed multistage sampling procedures using a combination of random and purposive sampling techniques. Simple random sampling was used to select the villages in Bunda Town, Bunda District, and Busega District to represent other villages along the shores in the Councils. It was also used to select 30 households from each village for the household survey. The selection of 30 sample size per village was based on the fact already established in the literature that, for a researcher to have data that are scientifically justifiable and statistically acceptable in social sciences, a sample of at least 30 is required^{19,20}. Random sampling gave an equal chance to households to be involved in the baseline socio-economic household survey and, thus, reduced bias and contributed to increased data reliability. An overall sample of 450 households was involved in the survey. This sample size was calculated using the formula proposed by Cochran (1963)

which was then adjusted by 17% to take into account for missing response. This formula is as shown below:

$$n_0 = \frac{(Z_{\frac{\alpha}{2}})^2 Pq}{(\lambda)^2}$$

Whereby, n_0 is the original sample, $(Z_{\frac{\alpha}{2}})^2$ is the square of the abscissa value of the normal curve at a 95% confidence level (the critical value of the desired confidence level) in each tail, P is the proportion of the occurrence of the attribute of interest in the population, q is the proportion of non-occurrence of the attribute of interest in the population ($q = 1 - p$) and λ^2 is the square of acceptance margin of error (error the researcher is willing to accept). Since the Z value at a 95% confidence level is 1.96, the maximum proportion of the occurrence of the variable of interest is 50% or 0.05 which makes $q = 1 - 0.5$ be equal to 0.5 and the acceptance margin of error is 0.05, the substituting these values in the equation, the original sample will be:

$$n_0 = \frac{(1.96)^2(0.5)(1 - 0.5)}{(0.05)^2} = 385$$

Adjusting the original sample by 17% to capture for missing response, the final sample (n) becomes

$$n = n_0 + \frac{17}{100}n_0 = 385 + \frac{17}{100}(385) = 450.45 \approx 450$$

Apart from random sampling, purposive sampling was also used. Purposive sampling was used to select key informants for the interview.

2.3 Data Types, Methods, and Tools of data collection

The study used quantitative and qualitative data collection methods using the Multidimensional Poverty Assessment Tool (MPAT) on a large survey conducted in the study area to measure multidimensional poverty. MPAT is a free and open survey tool designed with the support of the International Fund for Agricultural Development (IFAD) for poverty measurement. The tool provides a means for assessment of several dimensions of poverty, including food and nutritional security. This study extracted and used data to measure food and nutritional security. Data collection methods were documentary review, key informant interviews, household surveys, and observation. The household survey was administered using tablets through the computer-aided personnel interview (CAPI) and Survey Solutions Interviewer Application. In MPAT, food and nutritional security are measured by three subcomponents: Food consumption, food access stability, and nutritional quality. Each sub-component consists of a set of questions that are displayed in Supplementary Material 1. Qualitative data were collected

through key informant interviews and focus group discussions.

2.4 Study design

This study assumes that food and nutritional security is a derivative of a combination of three dimensions namely: food consumption, food access stability, and nutritional quality. The weighted aggregation of these subcomponents forms the food and nutritional security component. Each dimension consists of a set of items with several options (Supplementary Material 1) which are then assigned weights (Supplementary Material 2) as proposed by a team of experts and presented in a multidimensional Poverty assessment tool ¹⁹. For each sub-component, Items for measuring each subcomponent are aggregated using a weighted arithmetic average formula (Eq.1) and then converted into a 10-100 scale for increased resolution as proposed by International Food and Agricultural Development (IFAD) (2014).

$$y_{jk} = \sum_{i=1}^n (W_{ik} x_{ijk}) \dots \dots \dots \text{Eq1}$$

Where:

- y_{jk} = the score for household “j” in subcomponent “k”
- W_{ik} = weights attached to the survey question “i” in subcomponent “k”
- x_{ijk} = scaled score for household “j” in survey item “i” in subcomponent “k”

For the food and nutrition component, the values for each subcomponent are then aggregated using the weighted geometric average (Eq2) to calculate the food security and nutrition component value for each household as proposed by IFAD (2014).

$$y_{jk} = \prod_{i=1}^n x_{ijk}^{W_{ik}} \dots \dots \dots \text{Eq2}$$

Where:

- y_{jk} = the score for household “j” in subcomponent “k”
- W_{ik} = weights attached to the survey question “i” in subcomponent “k”
- x_{ijk} = scaled score for household “j” in survey item “i” in subcomponent “k”

The obtained scores were categorized into four groups as proposed by IFAD (2014) and then assigned labels as indicated below to simplify interpretation.

S/No	Categories	Category Label
1	Below 30	Very unsatisfactory
2	30-60	Unsatisfactory
3	60-80	Satisfactory
4	Above 80	Very satisfactory

2.5 Data Processing and Analysis

Collected data were synchronized by enumerators to allow easy download of data for analysis. Data were then downloaded from survey solution software for analysis in both MPAT Excel and SPSS software. Data were analyzed using descriptive and inferential statistics. The MPAT Excel spreadsheet and SPSS were used to analyze the data collected. The MPAT Excel file spreadsheet was used for the calculation of MPAT indicators. The MPAT Excel file has embedded data analysis with the formula that automatically analyses the data for households and villages/*Mtaa* (street). With SPSS, descriptive statistics were performed for all MPAT sub-components and components and were aggregated at the Council level. The descriptive statistics generated include frequencies, percentages, and mean scores. Furthermore, inferential statistics (chi-square test of independence) was also performed to test the association among some variables. Qualitative data were analyzed using thematic/Content analysis which emphasizes pinpointing, examining, and recording patterns of meaning (or “themes”) within data.

3 Results

3.1 Status of Food and Nutrition Security

This section aimed at measuring the experiences of surveyed households on three dimensions of food and nutrition security (i.e., food consumption, food access stability, and nutrition quality) as well as the overall food and nutrition security aggregating the three dimensions of food and nutritional security. For each subcomponent, scores for each household were calculated by aggregating the values for each item using a weighted arithmetic average as indicated in sub-section 3.4 above. Then the score for the food and nutritional security component was calculated by aggregating the scores for each sub-component (i.e., food consumption, food access stability, and nutritional quality) using the weighted geometric mean as shown in sub-section 3.4 above. Then the analysis was performed for each subcomponent and the overall food and nutritional security component.

3.1.1 District Experience in Food and Nutrition Security

The descriptive statistical analysis of the mean was performed to examine the extent to which households in the surveyed districts experienced several dimensions of food security and overall food and nutritional security. The results on the food and nutritional security component (Figure 2) indicated that Bunda district experienced unsatisfactory food and nutritional security (i.e., scores ranging from 30 to 60) while the rest of

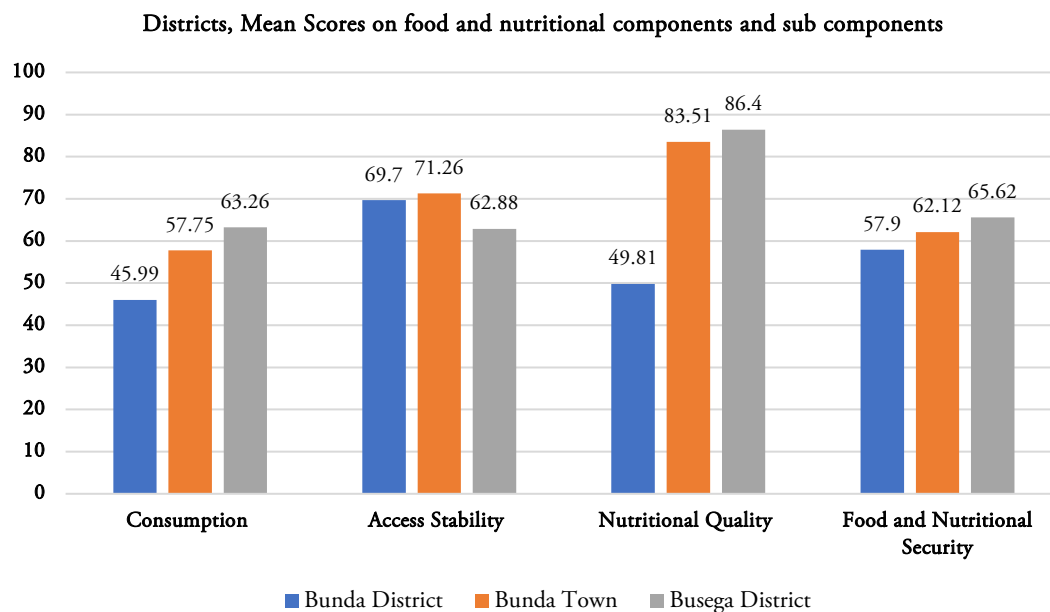
Table 1. Household experience of food and nutritional security

Classification	Bunda District	Bunda Town	Busega District	Total
Very Unsatisfactory (<30)	32 (20.9)	14 (9.5)	15 (10.3)	61 (13.6)
Unsatisfactory (30-60)	33 (21.6)	14 (9.5)	28 (19.2)	75 (16.8)
Satisfactory (60-80)	70 (45.8)	92 (62.2)	51 (34.9)	213 (47.7)
Very satisfactory (80+)	18 (11.8)	28 (18.9)	52 (35.6)	98 (21.9)
Total	153 (100)	148 (100)	146 (100)	447 (100)

Data is displayed as n (%).

Table 2. Food consumption and food sufficient

Council	Never	Once or twice	For about 1 week	For a few weeks	For about 1 month	For more than 1 month	Most days	n
Bunda District	1.3	10.7	12.7	8.7	0.7	0.7	64.7	150
Bunda Town	9.3	10.0	16.7	4.7	0.7	2.0	56.7	150
Busega District	21.1	23.8	14.5	12.9	3.4	12.2	16.3	147
Overall	10.5	14.8	13.0	8.7	1.6	4.9	46.1	447

**Figure 2.** District variation in food and nutrition security scores

the districts enjoyed a marginal satisfactory food and nutritional security (i.e., scores 60-80). Further investigation on individual dimensions (i.e., food consumption, food access stability, and nutritional quality) revealed that Bunda district experienced relatively low mean scores on every dimension, indicating that the district is less privileged in terms of food consumption, food access stability, nutritional quality as compared to the rest of the surveyed districts. Busega districts had a relatively high score except for food access and stability

subcomponents, indicating a relatively better experience of food and nutritional security as compared to the rest of the surveyed districts.

3.1.2 Household Experience of Food and Nutritional Security

The descriptive statistics were performed to examine the experience of food and nutrition security among individual households. Results (Table 1) indicated that 30.4 percent of

Table 3. The proportion of household members who went to sleep at night hungry due to lack of food

Council	Never	Once or twice	For about 1 week	For a few weeks	For about 1 month	For more than 1 month	Most days	n
Bunda District	14.7	38.7	21.3	16.7	2.7	3.3	2.7	150
Bunda Town	22.1	38.3	22.8	8.7	1.3	2.7	4.0	150
Busega District	29.3	31.3	6.8	15.6	3.4	5.4	7.5	147
Overall	22.0	36.1	17.0	13	2.5	3.8	4.7	447

Table 4. The proportion of households which experienced longer than two weeks without food

Council	No	One period	Two period	Three periods	Four periods	More than four periods	n
Bunda District	52.0	17.3	12.0	4.7	4.0	6.7	150
Bunda Town	61.1	6.7	17.4	4.0	2.0	8.1	150
Busega District	38.1	17.0	10.9	4.1	2.7	26.5	147
Overall	50.4	13.7	13.5	4.3	2.9	13.7	447

Table 5. Households which went one full day without food to eat

Council	Never	Once or twice	Approximately once a month	Approximately every two weeks	Approximately every week	n
Bunda District	29.3	46.0	12.7	6.7	5.3	150
Bunda Town	30.9	39.6	18.8	5.4	5.4	150
Busega District	44.2	30.6	8.8	8.2	7.5	147
Overall	34.4	38.8	13.5	6.7	6.1	447

households experienced either unsatisfactory or very unsatisfactory food and nutritional security. The situation was worse in the Bunda district council, where 42.5 percent of households experienced such a situation compared to 19 percent of households in Bunda Town and 29.5 of Busega District.

3.1.3 Food Consumption and Food Sufficiency

To establish the first of these elements, households were asked whether, during the last 12 months, any member of the households had eaten fewer meals or smaller portions than usual because there was not enough food and whether the household went to sleep at night hungry. Table 2 indicates that in all Councils, only 10.5% of the households had never skipped meals or reduced portions of meals due to lack of food. About 21.1% of them are in Busega, 9.3% in Bunda Town, and the least in Bunda District (1.3%). Nevertheless, it's alarming that about half of households (46.1%) reported to have skipped meals or reduced portions in most days, with a higher proportion in Bunda District (64.7%) and Bunda Town (56.7%).

The other concern was whether household members had gone to sleep hungry due to a lack of food for the last 12 months

(Table 3). Overall, a notable proportion of households (36.1%) went to sleep hungry due to a lack of food once or twice. The findings show that members in about one out of every five of the households in all Councils never went to sleep hungry due to lack of food (22.0%). About 4.7% of households reported to have slept hungry due to a lack of food for most days.

3.1.4 Stability of Food Access

Stability in food access by households was assessed in this study. Households were asked whether, during the past 12 months, the household has experienced a period of time longer than two weeks when there was not enough food and whether the households ever experienced one day with no food to eat. Findings (Table 4) show that overall, half of the households did not experience periods of longer than two weeks without sufficient food (50.4%), with the highest proportion in Bunda Town (61.1%). Comparatively, Busega had the highest proportion of households that experienced more than four periods with insufficient food (26.5%). Further analysis of findings revealed that a substantial proportion (49.6%) of households in the study area

Table 6. Household member's frequency in consumption of seven food groups

Council	Never	Almost never	Appro. Once a month	A few times a month	About once a week	A few times a week	Every day	n
Grain (%)								
- Bunda District	8.0	0.7	3.3	4.7	2.0	8.0	73.3	150
- Bunda Town	6.7	0.7	0.7	4.0	2.0	4.0	81.9	150
- Busega District	0.7	0.7	1.4	5.4	2.0	10.2	79.6	147
- Overall	5.2	0.7	1.8	4.7	2.0	7.4	78.3	447
Roots and tubers (%)								
- Bunda District	5.3	4.0	6.0	33.3	12.7	25.3	13.3	150
- Bunda Town	3.4	4.0	6.0	23.5	9.4	35.6	18.1	150
- Busega District	2.7	15.0	7.5	27.9	14.3	25.2	6.8	147
- Overall	3.8	7.6	6.5	28.3	12.1	28.7	12.8	447
Vegetables and greens (%)								
- Bunda District	0.7	2.7	3.3	8.7	2.0	36.7	46.0	150
- Bunda Town	0.0	0.0	0.7	2.7	3.3	41.1	52.3	150
- Busega District	0.0	0.7	0.7	5.3	4.0	66.0	23.3	147
- Overall	0.2	1.1	1.6	5.5	3.1	47.9	40.6	447
Fruits (%)								
- Bunda District	8.7	30.7	14.7	24.0	8.7	12.0	1.3	150
- Bunda Town	10.1	28.2	12.8	20.8	12.1	15.4	0.7	150
- Busega District	8.8	19.7	14.3	20.4	15.0	21.1	0.7	147
- Overall	9.2	26.2	13.9	21.7	11.9	16.1	0.9	447
Dairy products and eggs (%)								
- Bunda District	44.7	19.3	8.0	12.0	2.7	7.3	5.3	150
- Bunda Town	8.1	34.2	4.7	8.1	8.7	14.1	22.1	150
- Busega District	10.9	23.1	13.6	19.7	11.6	15.6	5.4	147
- Overall	21.3	25.6	8.7	13.2	7.6	12.3	11.0	447
Meat and fish (%)								
- Bunda District	0.0	0.0	0.0	2.0	2.0	20.7	74.7	150
- Bunda Town	0.0	0.7	2.7	4.0	7.4	49.7	35.6	150
- Busega District	0.7	2.7	5.4	19.7	10.9	34.7	25.9	147
- Overall	0.2	1.1	2.7	8.5	6.7	35.0	45.5	447
Nuts and legumes (%)								
- Bunda District	2.7	0.0	2.7	32.0	16.7	28.7	17.3	150
- Bunda Town	2.7	6.0	0.7	24.8	6.7	55.0	4.0	150
- Busega District	5.4	19.0	7.5	14.3	17.0	33.3	3.4	147
- Overall	3.6	8.3	3.6	23.8	13.5	39.0	8.3	447

experienced at least one or more occasions of staying consecutively for two weeks without enough food to eat in the household.

The household that never went one full day without food to eat in the surveyed Councils was around one in every three (34.4%), with higher proportions in Busega (44.2%) (Table 5). The majority of the households (38.8%) had one or two experiences. About 13.5% of households went one full day without food to eat approximately once a month. Very few households experienced it approximately every two weeks (6.7%) and approximately every week (6.1%).

3.1.5 Household Nutritional Diversity

This MPAT sub-component on food stability and access assessed the diversity of a household's diet as a proxy measure for balanced nutrition intake by household members in terms of frequency of consumption of seven food groups which include grains, roots and tubers, vegetables and greens, fruits, dairy products and eggs, meat/fish or seafood and nuts and legumes. As presented in Table 6, the results indicate that grains are consumed by a relatively high proportion of households (78.3) daily of all seven food groups. With exception to the vegetables and greens food group as well as fish and meat food group which is consumed every day by 40.6 percent and 45.5 percent of households respectively, the

Table 7. Food and nutritional security and gender of the household head

Item	Gender of the household head		Total (n=449)	χ^2 -value	P-value
	Male (n=338)	Female (n=111)			
Households with at least one member who ate less than three meals or smaller portions than usual during the last 12 months because there was not enough food (%)	88.2	93.7	89.5	2.725	0.099
Households with at least one member who went to sleep at night hungry during the last 12 months (%)	76.3	83.8	78.2	2.72	0.099
Households experienced a period of time longer than 2 weeks when there was not enough food during the past 12 months (%)	48.5	54.1	49.9	1.023	0.321
Households experienced one full day with no food to eat during the past 12 months (%)	63.6	71.2	65.5	2.114	0.146

Table 8. Household food consumption, sufficiency, and access stability by the income of the household

Item	Total Annual Household Income (in "000" TZS)			Total (n=449)	χ^2 -value	P-value
	<500 (n=293)	500-1,000 (n=75)	>1,000 (n=81)			
Households with a member who ate less than three meals or smaller portions than usual during the last 12 months because there was not enough food (%)	92.5	81.3	86.4	89.5	8.955	0.011
Households with a member who went to sleep a night hungry during the last 12 months (%)	82.3	70.7	70.4	78.2	8.225	0.016
Households experienced a period of time longer than 2 weeks when there was not enough food during the past 12 months (%)	51.5	50.7	43.2	49.9	2.651	0.041
Households experienced one full day with no food to eat during the past 12 months (%)	71.0	54.7	55.6	65.5	11.344	0.003

consumption of the rest of the food groups than grain on a daily basis lies below 15 percent.

The results also indicated that the daily consumption of dairy products and eggs is very low in the surveyed areas. The situation is worse in Bunda District, where the daily consumption lies below 5.3 percent. Furthermore, although there was a very low proportion of households (between 0-11 percent) who reported having never consumed at least one of the seven groups of food, however, in Bunda District, a large proportion of households (44.7) reported to have never consumed dairy products and eggs in the past 12 months.

Further analysis revealed minor variations among households across food groups and the location of the household. For example, Bunda District was relatively better than other councils in everyday consumption of meat and fish (74.5 percent), nuts and legumes (17.3 %), and fruits (1.3 %), while Bunda Town was relatively better in daily consumption of

grain (78.3 percent); roots and tubers (18.1 percent); vegetables and greens (52.3 percent); as well as dairy products and eggs (22.1 percent). Busega District was relatively disadvantaged in terms of daily consumption of every category of food group except for the grains, where it surpasses Bunda District by 5 percent.

3.2 Food and Nutritional Security and Gender of the Household Head

Four items to measure food consumption, sufficiency, and food access stability were constructed and related to the gender of the household. Generally, the findings indicate that male-headed households were slightly better than female-headed households in nearly all food security aspects, with the difference between the two types of households for food consumption and sufficiency aspects being marginally significant ($p < 0.10$) (Table 7).

3.3 Household food security and household income

The relationship between household food security and household income was assessed in this study. Several items measuring food consumption, food sufficiency, and food access stability were subjected to scrutiny. Results indicated that household food security significantly improves with household income. As displayed in Table 8, the proportion of households with food insufficiency and food instability generally tended to decline significantly with an increase in household income ($p < 0.05$) (Table 8).

4 Discussion

4.1 Status of Food Security and Nutrition in the Study Area

Food and nutritional security in the surveyed areas as measured by MPAT scores on food and nutritional security components were substantially unsatisfactory for all surveyed areas and varied across studied areas and households. As shown by the results (Figure 2 and Table 1), Bunda district was a bit disadvantaged in almost all dimensions of food and nutrition security. The variation might be attributed to locational differences in food production resulting from different climatic variations^{7,21}. Of the three districts surveyed, Bunda experiences adverse climatic conditions in terms of rainfall availability. Considering that the surveyed districts mostly rely on agriculture for their livelihood, this might have contributed to this scenario. The fact that food and nutritional security vary across areas has also been observed in other parts of Tanzania. Forero-Cantor *et al.*¹⁰ in their study in Ukerewe and Muleba observed some variation in food security. Marriott *et al.*⁹ observed that food security and nutritional cases varied across households and time. Similarly, Cochrane and D'Souza (2015) while measuring food access in Tanzania using a basket approach observed that food access varied across regions.

Results on the Household Nutritional Diversity sub-component (Table 6) indicate that of all the seven food groups, grains food is consumed by a relatively high proportion of households (78.3) every day. This finding perhaps supports earlier findings by Cochrane and D'Souza⁷ who observed that the consumption of starchy food mostly sweet potatoes is higher in the lake zone area. This might be attributed to the fact that these are the types of crops mostly grown in the area. Moreover, with the exception of the vegetables and greens food group as well as the fish and meat food group which is consumed every day by more than 40 percent of households, the consumption of the rest of the food groups than grain on a daily basis lies below 15 percent. Ntwenya *et al.*²⁰ attribute the higher consumption of grains

in Tanzania to the fact that is the food category that is frequently available and easily accessible by many households.

The results also indicated that the daily consumption of dairy products and eggs is very low in the surveyed areas. An earlier study by Cochrane and D'Souza⁷ have also observed the same scenario in lake zone areas. The situation is worse in Bunda District where the daily consumption lies below 5.3 percent. Furthermore, a large proportion of households (44.7) reported to have never consumed dairy products and eggs in the past 12 months. Considering that most households in Bunda District are in rural settings where most products including eggs and dairy products are obtained either freely or at a lower cost from farmers, the scenario that this high proportion of households never eat dairy products and eggs is very surprising and raises concerns that require special attention. Such a scenario might be attributed to the fact that the proximity of the area to large towns coupled with low-income households might have driven farmers to sell these products in town for income rather than consuming for themselves.

On food sufficiency, results indicated that nearly half of households (46.1%) reported skipped meals or reduced portions on most days, with a higher proportion in Bunda District (64.7%) and Bunda Town (56.7%). This is one of the mechanisms that household uses to cope with the food insecurity crisis Forero-Cantor *et al.*¹⁰. Skipping meals has been a typical strategy applied by many households experiencing food insecurity in Tanzania^{21,22} and is used by households as a means to keep away from food insecurity. A study by Forero-Cantor *et al.*¹⁰ in a very similar location in Lake Victoria Basin observed that skipping meals was more frequent among female-headed households.

4.2 Variation of food and nutritional security across gender of the household head

Findings in this study indicate that male-headed households were slightly better than female-headed households in nearly all food security aspects. This might be attributed to the fact that males are exposed to different opportunities including income acquired from migration than females which afford them to equally access food Forero-Cantor *et al.*¹⁰. The finding correlates with the global statistics on gender and food security³. Findings published in FAO report³, found that women experienced food insecurity of both moderate and severe than men from 2014 to 2021. The report also shows that in 2021 alone there were 150 million more women than men who are hungry and that such figure is 8.4 times higher than the gap in 2018.

The Literature suggests that household food insecurity may be perpetuated by gender inequality in employment ^{23,24}. Analyzing data from 109 countries. Care International (2022) observed that food insecurity increased with the increasing gender inequality. In their most recent studies in Senegal, Care International (2022) found that households, where women are employed, had an 11.3 percent probability of food insecurity while households where only men were employed showed no benefits of food security.

4.3 Influence of household income on food security

The findings further indicate that household food security improves with household income. This might be attributed to the fact that households not only rely on food produced by themselves but also on food purchased from other Sources ¹⁰. As displayed in Table 8 the proportion of households with food insufficiency and food instability generally tended to decline significantly with an increase in household income ($p < 0.05$). This signifies that households with relatively high incomes have a higher likelihood of being food secure than households with lower incomes. This finding correlates to the findings by Cochrane and D'Souza ⁷ in lake zone areas where they observed that households in the bottom quintiles face potential problems in accessing food.

5 Conclusion

Food consumption, food access stability, and nutritional quality in the surveyed areas were substantially unsatisfactory and varied across the studied areas. The situation was worse in the Bunda district. The variation in food and nutritional quality is attributed to different experiences of adverse impacts of climatic variations. Grain food is the most frequently consumed food category in the study area, while eggs and dairy products are the least consumed food category. The frequency of consumption of other food categories than grain, vegetable, and fish remained below 15 percent.

When data are disaggregated by gender, the results indicate that male-headed households were slightly better than female-headed households in nearly all food security dimensions, with the difference between the two types of households for food consumption and sufficiency aspects being marginally significant. Household food security improves with household income. The proportion of households with food insufficiency and food instability generally tended to decline significantly with an increase in household income.

Based on the findings of this study, it is recommended to strengthen horticultural crop production, fish farming, and paddy production to increase income and food and nutritional security of participating households and individuals. The study also recommends introducing high-

value and nutritional food crops like Orange fleshed Sweet Potatoes to increase income, food and nutrition security. Sensitization and emphasis on the use of various food groups should be carried out to improve food and nutritional diversity.

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