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HOUSEHOLD FOOD SECURITY DETERMINANTS AND NUTRITIONAL STATUS OF INHABITANTS OF A PERI-URBAN COMMUNITY: A CASE STUDY IN THE VOLTA REGION OF GHANA

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ABSTRACT

Food shortages and malnutrition widely persist and continue to be rural peculiarities across the sub-region. A cross-sectional study was conducted in a peri-urban community of Dzodze in the Volta region to ascertain the level of food security as well as the nutritional status of the inhabitants using a random sampling technique. This community-based comparative cross-sectional study conducted from May to July 2018 adopted a multistage random sampling and selected 105 households. Socio-demographic data were collected using a structured questionnaire. Chi-square, Cramer's-V, and Pearson's correlations models were used to assess the association of socio-demographic, anthropometric and food frequency data while the Logit model, FSI, HCR were used to measure food security. Over half of the sample (59.6%) were in the normal range of BMI which implied good nutritional status. Remarkably, a majority of those in this normal BMI range 81 (77%) were female. Women aged 41years and above constituted a large portion of study participants (54.3%) of which many 43 (41%) were married. Just 4.8% of this group said they were both separated and cohabited with their partners non-customarily. Data on the frequency of food intake by the community revealed that, a majority of 63.4% of the respondents ate three times a day. Most of the people (77.2%, 68.7%, and 86.9%) ate breakfast, lunch, and supper, respectively, daily over a week. The fallouts from the work showed majority (71.5%) of the respondents were food secure and the remaining (about 28.5%) were food insecure. Factors such as age, gender, educational level, household size, and age were found to be significant predictors that influenced food security of the peri-urban community according to the logit model used. The smallholder households according to the computed food security index of 1.13 and normal range of BMI were identified to be indices of food security.

Key words: Household food security, peri-urban community, Ghana, Volta Region, Nutritional status

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INTRODUCTION

Food represents one of the essential items for people in the world as it is one of the three basic needs that are essential to human survival, accompanying shelter and clothing [1]. Food insecurity is described as a circumstance in which people experience inadequate or inexact physical and economic access to safe, ample, and nutritious food to meet their dietary needs or food predilections for a productive, healthy, and active life [2-4]. Food insecurity is linked to malnutrition, which refers to energy and nutrient deficits, excesses, or imbalances in a person's diet. Malnutrition causes serious health problems, as well as a loss of human potential for growth in underdeveloped countries [3]. Food insecurity's probable public health significances are not restricted to hunger and acute malnutrition, but also include severe chronic diseases like hypertension, hyperlipidemia, and reduced health and quality of life [2, 5], as it remains a common occurrence in developing countries, and it has increasingly been recognized as a serious public health problem in both developing and developed countries over the last two decades [5].

We are unable to meet the dietary energy requirements of 842 million people, accounting for about 12% of the global population, according to recent estimates from the Food and Agriculture Organization (FAO) [6], while 226.4 million people in Africa were undernourished, representing a prevalence of 21.2%.

In general, household food insecurity in Africa is connected with the socio-economic level of the household, as measured by income, job status, and food spending [7]. As a result, total household income is critical for achieving food security [8, 9], and given the high degree of poverty in Africa, most African households find it difficult to buy enough food to feed their entire family [10]. Climate change, the agriculture sector's poor performance, and poverty are all factors that contribute to food insecurity, according to the World Food Program [11]. Food insecurity affects a huge section of the Ghanaian population and varies according to geography and season.

According to the United States Agency for International Development (USAID), 22% of Ghana's population has chronic food insecurity on a yearly basis (per capita consumption of 1800 kcal/person/day). Furthermore, according to a 2009 World Food Programme assessment, 1.2 million people from Ghana's northern and higher regions (savanna zones) suffer from limited access to healthy food, accounting for 10% of the country's population (about 5% of Ghanaians). While food insecurity rates in southern Ghana are around 1-7%, they range between 10 and 30% in the north [12]. In northern Ghana, households that produce the majority of food crops are frequently victims of food insecurity [10]. Even so, food insecurity is not a new phenomenon in these areas. A review of relevant historical literature indicated that early colonial narratives highlighted poverty, with stories of bad harvests and famine in the Gold Coast's northern regions [now northern Ghana] [13, 14].

Food insecure families blame their condition on a lack of resources and poor coping mechanisms. Food consumes up to 72% of these households' income [15]. High rates of rural poverty exacerbate food insecurity, resulting in low purchasing power, lack of

access to food for vulnerable groups, widespread malnutrition, and limited access to health services [16]. Ghana is classified as a low middle-income country with moderate per capita purchasing power; the country has a poverty rate of 23% and a GDP of 6.3% as of 2019 [17, 18]. Over-reliance on subsistence farming is one of the main causes of poverty in Ghana, as is limited access to meaningful off-farm employment and other sources of income. The combination of a high poverty rate and a large population is a major factor affecting household food security.

Thus according to FAO [19], there is no one metric for assessing a population's, community's, or individual's food security. Food security is complicated since it is determined by a number of interconnected agro-environmental, socioeconomic, and ecological elements, all of which must be considered in order to establish whether or not food security exists. Despite the Ghanaian government's, many international organizations', and non-governmental organizations' (NGOs) immense joint efforts in fighting and reducing hunger, food insecurity still affects a major portion of the Ghanaian people. As a result, it is a critical concern to assess and address the country's food security status [11]. The main goal of this study was to determine the food security status and factors influencing household food access in Dzodze (a peri-urban community) in the Volta Region, as this region was identified by the Ministry of Food and Agriculture as the least vulnerable to food insecurity in Ghana, and it was assumed that residents were food secure. This study may also give the much-needed baseline data on food security and contribute to the current literature in order to aid in the implementation of appropriate policies to address the population's food insecurity vulnerability. Because household food security fluctuates, it's critical to look into the factors that influence it in order to predict future shocks and better understand how people react to food poverty.

MATERIALS AND METHODS

Description of the Study Area

This study was conducted in Dzodze, located in the Ketu North District, Volta Region of Ghana from June through July 2018. The district is situated in Ghana's Volta Region's south-eastern corner, between latitudes 6o 03'N and 6o 20'N and longitudes 0o 49'E and 1o 05'E. It is bordered on the north by Akatsi District, the Republic of Togo on the east, the Ketu South on the south, and the Keta District on the west. It has a total size of 9804 km2 and an estimated population of around 18,957 people [20]. The district's infrastructure is in a terrible condition. Agriculture is the region's principal economic sector, with more than 90% of the population working in it. The study area's agricultural production is defined by subsistence farming, in which the scale of production is determined by the demands of rural households. Crop output is mostly dependent on a three-month rainy season (July to September), followed by a protracted dry period. The average yearly rainfall is between 350 and 450 millimeters. Individual owners or sub-owners cultivate small plots of land, which are usually inherited, employing traditional farming practices. Hand tools, which are possessed by practically every household, are by far the most commonly used agricultural implements. Vegetables like tomatoes and onions are cultivated for family consumption and only

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the surplus is sold in the local market. While the majority of villagers remain engaged in active agriculture, many continue to engage in other businesses such as small trading, animal keeping, and so on.

Data Collection

A random sampling technique was adopted, where the paper based questionnaires were administered through individually structured interviews with the heads of the households in 5 selected villages. A total number of 105 participants was calculated with a raosoft sample size calculator (http://www.raosoft.com/samplesize.html) with the following parameters: margin of error = 8.5%, Confidence Interval (C.I) = 91.5%, population of Dzodze = 18,957 and a Response Distribution = 50%. The survey gathered quantitative data about the social, demographic, economic, anthropometric, food frequency, dietary patterns, and some food security indices of the households. There were also questions about the reasons of food insecurity in the region, as well as market access, food help, and the distance between the village and the major road. The respondent's age, household size, level of education, main occupation, assets held, and gender were utilized as dependent and independent variables because they were frequently employed as food security predictors in prior studies.

Anthropometric measurements

The subjects' weights were collected with the HBF-516 Body Composition Monitor and Scale while wearing light clothing (IL, USA). The same device was used to calculate visceral fat. The Seca Stadiometer was used to measure their heights to the closest 0.1 cm following standard protocols (Hamburg, Germany). The BMI of the subjects was calculated using their height and weight information. Underweight (18.5 kg/m2), normal (18.5–24.9 kg/m2), overweight (25.0–29.9 kg/m2), and obese (30.0 kg/m2) were the categories used to describe them [21].

Identifying smallholder agricultural households' food security status

The food security standing of the study area's households was determined by computing each household's score on the food security index using the recommended daily calorie requirement approach as a yardstick. The study used the Food Security Index approach from Demi and Kuwornu [22] and Namaa [23], who investigated the food security condition of farming households in Ghana's central, northern, and upper regions, respectively. In a study to assess the socio-economic factors impacting the food security of rural households in Nigeria, Babatunde *et al* [24] developed the food security index.

The Food Security Index is calculated using the following formula:

$$Zi = \frac{Yi}{Ri} \qquad (1)$$

Where

Zi = Food security index of ith household
Yi = Actual Daily Calorie intake of ith households
Ri = Recommended Daily Calorie Requirement of ith household

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This work calculated household daily calorie consumption by dividing each household's daily calorie intake by the size of the household. The same approach was used to estimate household daily calorie requirements, which was done by dividing the necessary household calorie by the size of the household. Each household's food security score on the index was determined using the food security index.
Other pertinent measures, such as the Food Insecurity Gap (FIG), the Food Surplus Index (FSI), and the Headcount Ratio (HCR), were estimated to provide a more realistic picture of family food security. The food insecurity gap (FIG) is the extent to which impoverished households have become food insecure [24]. It can be stated numerically as;
The Food Insecurity Gap was calculated as:

$$FIG = 1/M \Sigma^{n}_{i=1} Gi \quad (2)$$

Where

M = number of food-insecure households.

G*i* = deficiency of consumed calorie for the ith household. G*i* is empirically written as:

$$Gi = \frac{Yi - Ri}{Ri} \quad (3)$$

The food surplus index (FSI) estimates the degree by which households that are considered food secure exceeded the food poverty line. The food surplus index (FSI) is expressed as:

$$FSI = 1/M\Sigma\, i=1 \quad \frac{(Ri - Yi)}{Ri} \quad (4)$$

Where the definitions of *Y* and *R* variables remain unchanged.

The headcount ratio (HCR) is an index that measures the proportion of the sampled population that is food (in) secure. The HCR is empirically written as:

$$HCR = M/N * 100 \quad (5)$$

Where
N = number of sampled households and M = the number of food (in) secure households

The study used the GSS [20][25] standard of 2,900 kcal as a baseline to assess the daily recommended calorie requirement of selected smallholder families. Because different age groups have discrete calorie requirements, the individual household members were grouped into three different age groups for assessing the homes' daily calorie requirement. Regardless, the daily calorie (energy) requirements for the various age groups in each household were transformed into their appropriate adult equivalences using the equivalent scales as established in literature and reported in Table 1.

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The total calorie need of adult household members was calculated by multiplying the daily calorie requirement of 2,900 kcal by the number of adults in the household (2,900 kcal*the number of adults in the household). To calculate the adult calorie requirement for children aged 6 to 18 yrs, the daily recommended calorie requirement of 2,900 kcal was multiplied by the sum of children aged 6 to 18 yrs and a conversion factor of 0.7 (2,900 kcal*sum of children aged 6-18y) *0.7). For children under the age of six, the procedure was repeated. The adult equivalence of food required was calculated by multiplying the daily recommended calorie requirement of 2,900 kcal by the sum of children under the age of six years and a conversion factor of 0.4 (2,900 kcal*sum of children under the age of six years*0.4).

Each smallholder household's real daily calorie need was calculated by adding the recommended calorie intake for the three age groups in the home.

The extensively nurtured food security crops (FASDEP) typically consumed by households in the research area came from food produced by the households as well as purchases to complement their own food production and gifts. Using bowls for grains and tubers of yam, data on various food crops (maize, rice, cowpea, sorghum, and yam) were collected, converted to kilogram equivalency, and multiplied by their respective energy contents. Table 2 shows the energy content of 1kg of each food (maize, rice, cowpea, sorghum, and yam) based on literature.

The logistic probability model adapted from [23] is empirically given as:

$$Pi = F(Zi) = 1 + \frac{1}{1 + e^{-(\alpha + \sum \beta i\, Xi)}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Pi is a parameter in the model that assesses the likelihood of a household being food secure given a collection of *Xi* (instructive variables). The model is abridged and expanded into log odds as:

$$\text{Log}\left(\frac{Pi}{1-Pi}\right) = Zi = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ B_k X_k + e \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where:
X_1 = Gender, X_2 = Age, X_3 = level of education, X_4 = Household size, X_5 =Monthly Income and X_7 = Age squared (k=11 and e = error term)

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RESULTS AND DISCUSSION

The socio-demographic outcomes of the survey conducted are presented in Table 3. Out of a total of 105 participants, a majority of 77% were females. The age group of ≥ 41 years constituted a majority of the study participants of (54.3%) of which many of them (41%) were married while only 4.8% were both separated and cohabited with their partners non-customarily. A family size of 4-7 persons was recorded as most dominant with 42.3%. The participants of this study were predominantly of an average level of education (44.3%) while an insignificant number (7.7%) had up to the tertiary level of education. This reflected in their occupation as many of them (37.1%) said they were traders and only 8.6% were employed in the formal sector. A monthly income range of 51-100 GH was earned by some (26.7%) of the respondents and did not significantly differ ($p>0.001$) from the other income earned. Many (40.4%) of them lived in their family houses which suggested they did not earn enough to either rent or build their own houses. The gender and head of their households were males (55.8%) and husbands (31.7%) respectively and were statistically insignificant ($p>0.05$).
Results for the anthropometric data collected from the respondents showed that a majority (59.6%) were in the normal BMI range, 21 (20.2%) were overweight, 12 (11.5%) were obese, while only 9 (8.7%) were found to be underweight. Regarding weight, many (38.1%) of them weighed below 55 kg and had a height range of 161-170cm. Waist to hip ratio and visceral fat were predominantly in the ranges of 0.7-0.9 and 4-6, 7-9 respectively (Table 4). Data on the frequency of food intake by the community (Table 5) revealed that a majority of 63.4% of the respondents ate three times a day. It was found that 77.2%, 68.7%, and 86.9% ate breakfast, lunch, and supper, respectively, daily in a week. A rather surprising number (31.7%) said they ate fruits daily while the rest ate 2-3, 4-6, once a week represented by 28.7%, 15.8% and 23.8%, respectively. The frequency of fruit consumption among the respondents was not significantly different ($p>0.05$). Almost half (48%) of the respondents ate from more than 4 food groups and this was comparable ($p>0.05$) to 46.9% who also ate from 4 food groups in the past 24h. When asked where they obtained their foods, staples, and vegetables from, an equivalent number of 69.6%, 68.6% and 92.2% respectively, said they obtained them from the market, those who obtained them directly from their farms were in the minority. Over two-thirds (68.6%) had some food stored to last for 2-4 days while the rest said they had storage that would last from 1 day up to 2 weeks and beyond. About half admitted sometimes they were worried that their households would run out of food (54%) or ate food they did not prefer to eat (48 %) while 60.8% said they never borrowed to feed their households, 52.9 % bought food on credit and 49.5% cut down or skipped meals because of insufficiency of food, respectively.
Over half of the respondents said adults in their families never went to bed hungry, never ate less than what they should have eaten and also their children never told them there wasn't enough to feed on or money to buy food respectively. Furthermore, about two-thirds never cut down on the quantity of food of their children's meals because there is not enough food or money to buy food and also never went to bed hungry.

Tests of associations conducted for socio-demographics and food frequency using the chi-square and Cramer's-V, revealed a moderately strong association ($p<0.05$) of 0.318 and 0.366 for age and number of meals eaten in a day as well as marital status and

frequency of fruit consumption in a week respectively (Table 6). All other associations tested, were not statistically significant ($p>0.05$). Furthermore, for socio-demographic and food frequency, monthly income, and educational level were found to be significant ($p<0.05$). Likewise, a positive correlation was established between the educational level and those who borrow food to feed their household and the same for educational level and the tendency to buy food on credit.

Lastly, always cutting down on one's family food quantity because there was not enough money was significantly correlated with borrowing food to feed one's household also for households buying food on credit. Households that ate foods they didn't prefer to eat were positively associated with the household that borrowed food to feed their households, likewise bought food on credit, and then cut down on the quantity of food because there was not enough money (Table 7). Food frequency and anthropometric data showed some significant positive associations between waist circumference and body composition, BMI and waist circumference, BMI and body composition, BMI and height, the number of meals eaten in a day and height and then lastly, frequency of breakfast in a week and BMI (Table 8).

Approximations of logistic regression of some factors of food security status of the households in the study area were significant (1% and 5%) and they included gender, age, educational level, household size and age squared with coefficients of 0.0002, 0.0001, 0.349, 0.0001 and $1x10^{-8}$ respectively. Occupation and monthly income were insignificant and recorded 0.154 and -0.132 respectively (Table 9). The food security position of the homes of the community was also recorded. The results from this study showed that a mainstream (71.5%) of the respondents were food secure and about 28.5% were food insecure. Indices of 1.31 and 0.73 were recorded for food secured and insecure respectively (Table 10).

In the general sense, food security is influenced by several factors. The estimation usually depicts that age, gender, monthly income, household size, dependency ratio, place of residence and education level among other factors have a momentous bearing on the food security status of a household. The results of the various tests used in this study revealed that the determinants of food security were all positive (ration seemed enough for all household members).

A home is a group of people who live in the same compound or house [26] and eat from the same pot. Increases in household size, according to Tsegay [27], increase the burden on home spending rather than increasing household labor strength for production reasons. This suggests that the greater the household size, the greater the food need. As a result, home size is projected to have a negative impact on household food security.

In this survey, many homes in the Volta Region's district were led by males or spouses who frequently served as the family's "breadwinner." This is founded on the assumption that males have superior educational, employment, and financial standing than female partners. Conflicting duties such as childcare and work have been demonstrated in research to disadvantage female-headed families [28]. According to

the findings, the most common coping mechanisms described by the households, which were not rated in any order of importance or frequency, were borrowing food to feed the household, purchasing food on credit, and reducing the amount of food their children ate, among others.

This was in line with Namaa's published findings [23], who included reducing the number of daily meals, selling farm and household assets to buy food, shifting to less desired and cheaper cuisine, and the least popular approach of traveling to cities to look for work as other coping techniques. When there are acute food shortages or insecurity, households are forced to consume less desirable items such as roasted yam, roasted corn, and roasted groundnut as meals. They may sell part of the family's precious assets or sell their cattle to buy food for the family and to keep up with other household chores.

These findings countered the findings of Pobee *et al.* [19], who claimed that food insecurity affected 23% of Ghanaian households. It also contradicts previous research, which revealed that the majority (60%) of smallholder households in Ghana's central area were food insecure. Similarly, Babatunde *et al*. [24] reported that 64% of Nigerian smallholder households were food insecure. The findings further contradict Wiggins and Keats' [29] claim that smallholder farming households account for roughly 67% of the world's food insecure population since smallholder farmers are net buyers of food rather than sellers. Mutea *et al* [30,31] also found that 68% of rural households in South Western Kenya are food insecure.

The findings of this study, on the other hand, mirrored those of Sahu *et al.* [32], who reported a food secure status for a community (Nanga) in India, with all indicators showing positive. Because the majority of the households in the research region were mixed smallholder farmers who relied heavily on agriculture for their income, it's not unexpected that they have plenty to eat. Due to variables such as climate change, altered growing seasons, increased pest infestation, soil degradation, and lower agricultural potential, productive areas frequently become less productive, limiting households' adaptive capacity and making them vulnerable to food insecurity [33, 34].

The logit model variables have been deduced as follows: At a 1% significant level, household gender demonstrated a favorable link with food security. This indicates that households dominated by men are more likely to be food secure than households dominated by women. This could be due to the fact that, in most African cultures, males are typically viewed as family heads. Men are typically considered as heads of households, whilst women are frequently assigned with domestic duties such as cooking, washing, and childcare. The marginal effect score indicates that having a male-dominated home increases the likelihood of the household being food secure by around 0.05 when all other factors are held constant.

The age of the household members was positive and significant at the 1% level, according to the findings. By implication, the household's food security status improves when members of the household get older. This finding is consistent with the study's a priori expectations. As people get older, they have more experience turning to methods

that can diversify their income or food sources. According to the marginal impact, a year increase in the age of a family head increases food security by 0.031 while all other parameters remain constant. The educational status of the household was shown to be positive and significant at the 5% level.

As a result, homes with educated residents are more likely to be food secure than those with uneducated residents. Obtaining a higher education increases the household's food security status by about 0.2, assuming all other parameters remain constant. This result is consistent with Babatunde *et al.* [24], who found that household heads with higher education are more likely to provide food security in North Central Nigerian homes.

At P <0.01 significance, the results revealed a positive relationship between household size and food security factors. This means that families with a big number of members are more likely to be food secure than families with a small number of members. Large household sizes are likely to increase the labor force required to carry out farm activities, resulting in bumper harvests that will raise the household's food security status by about 0.4, assuming all other parameters remain constant. According to the study, monthly income has a negative link with food security that is significant at P <0.01. The negative sign indicates that higher household productivity levels did not always imply a higher likelihood of ensuring household security. The marginal effect suggests that increasing the quantity of a household's own produce (maize, rice, cowpea, sorghum, and yam) by a kilogram may not improve household food security. The findings of this study contradicted those of Babatunde *et al.* [24], who obtained dissimilar results among Nigerian rural households. The predictors of occupation and food security were likewise shown to be insignificant. At 5%, age squared was shown to be negative and significant. The marginal effect revealed that for every unit increase in age squared, a household's food security status decreased. This means that the ability of the home head to assure and maintain household food security status decreases as they get older.

CONCLUSION

The goal of this study was to determine the factors that influence household food security in Ghana's Dzodze District. The socio-economic and institutional aspects influencing food production and their impact on food security in the research area were highlighted. Our results show that factors such as age, gender, educational level, family size, and age squared were important in impacting food security in the peri-urban population. According to the computed food security index of 1.13 and a majority of participants having a normal range of BMI, smallholder households in the population studied are mostly and acceptably food secure.

The importance of education in ensuring food security cannot be overstated. Education has an important role in the modern household's food security situation since it boosts purchasing power, allowing food to be available at all times.

Agriculture can be profitably commercialized by using mechanized methods. Furthermore, increasing productivity as a governmental goal is one approach to boost

commercialization. Stakeholders should explore a large-scale effort into animal production and crop farming, since the findings of this study demonstrated that diversifying diets to offer the needed nutrients might improve food security. Ownership of commercial crop farms, poultry, and small ruminants promises to expand the food basket, having a significant impact on the community's food and nutrition security, as well as health.

Increasing the capacity of essential stakeholders to reduce post-harvest losses and improve storage and distribution systems.

Household size should also be kept high since more people have been demonstrated to be beneficial in terms of the labor force needed to work on farms-though the results backs it, this recommendation might raise some questions elsewhere, since it is being advocated to have small household sizes for the inhabitants to be better educated and have a better life in the future, having large household size might guarantee available labor for farming in the interim however, in the longterm if members are not educated or learn a trade food security will still be a problem, moreover, children of school going age are being prohibited by the state from being used for labor or in other types of employment to contribute to the household's pool of financial resources (income).

Maintaining a youthful population in the neighborhood and encouraging them to practice modern agriculture are strongly suggested, as both match well with Ghana's current strategy of planting for food and jobs.

Abbreviations

BMI-Body Mass Index, FIG-Food Insecurity Gap, FSI- Food Surplus Index, HCR-Head Count Ratio, GSS- Ghana Statistical Service, IFPRI- International Food Policy Research Institute, FAO- Food and Agriculture Organization, FSADEP- Food and Agriculture Sector Development Policy, WHO- World Health Organization, NGO-Non- Governmental Organization, RDCI- Recommended Daily Calorie Intake, GH-Ghana cedis.

AUTHORS' CONTRIBUTIONS

NKK, PE-A, CY and AK-D were involved in the conception of the research idea, design of the experiments, data analysis and also drafting of the paper. CT, EKE and PE-A participated in the design of the experiments and data collection. NKK, JN, EKE, EBN and CY provided guidance and supervision of the entire research and critically reviewed the manuscript. NKK, JN, EKE, CT, PTA, CY and EBN read, reviewed and amended manuscript. All authors read and approved the final manuscript.

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Table 1: Recommended Daily Calorie intake and Scale Equivalence

Age groups (years)	Average Daily Energy Allowance (kcal)	Scale Equivalence
Less than six (<6)	1150	0.4
Children (6-18)	2250	0.7
Adults (>18)	2900	1

Source: Ghana Statistical Service (2000)

Table 2: The energy content and Milling ratios of the various food crops

Food Crop	Energy Content (kcal)	Milling ratio
Maize	3590	0.85
Rice	3640	0.65
Cowpea	3380	0.90
Sorghum	3350	0.87
Yam	1190	-

Source: University of Ghana, Nutrition and Food Science Department, Legon, Ghana

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Table 3: Socio-demographics of the studied population

Parameter	Characteristics	Frequency	Percent (%)	P-value
Gender	Male	23	21.9	<0.001
	Female	81	77.1	
Age	6-12	2	1.9	<0.001
	20-26	1	1.0	
	27-33	7	6.7	
	34-40	38	36.2	
	>41	57	54.3	
Marital Status	Married	43	41.0	<0.001
	Single	30	28.6	
	Cohabitation	5	4.8	
	Separated	5	4.8	
	Widowed	22	21.0	
Household size	1	10	9.6	<0.001
	2-3	31	29.8	
	4-7	44	42.3	
	8-10	10	9.6	
	>10	9	8.7	
Educational level	No formal education	12	11.5	<0.001
	Primary	28	26.9	
	JHS	46	44.2	
	SHS/Vocational	10	9.6	
	Tertiary	8	7.7	
Occupation	Farmer	19	18.1	<0.001
	Trader	39	37.1	
	Formal employment	9	8.6	
	Artisan	15	14.3	
	Unemployed	13	12.4	
	Other	10	9.5	
Monthly Income	<50	20	19.0	0.501
	51-100	28	26.7	
	101-200	22	21.0	
	201-500	15	14.3	
	501-1000	14	13.3	
	>1000	6	5.7	
Housing Type	Own	26	25	<0.001
	Rented	32	30.8	
	Family House	42	40.4	
	Living with non-relatives	4	3.8	
Gender of Head of Household	Male	58	55.8	0.86
	Female	46	44.2	
Head of Household	Husband	33	31.7	0.29
	Wife	10	9.6	
	Father	24	23.1	
	Mother	16	15.4	
	Other	21	20.2	

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Table 4: Anthropometric data of the studied population

Parameter	Characteristics	Frequency (n=105)	Percent (%)	P-value
BMI (kg/m^3)	< 18.5	9	8.7	0.001
	18.5-24.9	62	59.6	
	25-29.9	21	20.2	
	≥ 30	12	11.5	
Weight (kg)	<55	40	38.1	0.043
	56-60	13	12.4	
	61-66	17	16.2	
	67-77	18	17.1	
	78-83	5	4.8	
	>84	12	11.4	
Height (cm)	<150	9	8.7	0.009
	151-160	42	40.0	
	161-170	40	38.1	
	171-180	10	9.5	
	181-190	3	2.9	
Waist to Hip ratio	<0.3	1.0	1.0	0.01
	0.4-0.6	2	2.0	
	0.7-0.9	84	82.4	
	1-1.2	14	13.7	
	1.3-1.5	1	1.0	
Body Composition (% visceral fat)	1-3	24	24.0	<0.001
	4-6	30	30.0	
	7-9	30	30.0	
	10-12	9	9.0	
	13-15	7	7.0	

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Table 5: Dietary patterns and frequency of the studied population

Parameter	Characteristics	Frequency	Percentage (%)	P-value
No. of meals eaten in a day	1	1	1.0	<0.001
	2	26	25.7	
	3	64	63.4	
	4-5	10	9.9	
Frequency of Breakfast in a week	Daily	78	77.2	<0.001
	4-6	16	15.8	
	2-3	6	5.9	
	Once a week	1	1.0	
Frequency of lunch in a week	Daily	68	68.7	<0.001
	4-6	14	14.1	
	2-3	9	9.1	
	Once a week	8	8.1	
Frequency of Supper in a week	Daily	86	86.9	<0.001
	4-6	8	8.1	
	2-3	4	4.0	
	Once a week	1	1.0	
Frequency of fruit Consumption in a week	Daily	32	31.7	0.121
	4-6	16	15.8	
	2-3	29	28.7	
	Once a week	24	23.8	
No. of food groups Adult ate from in the Past 24 h dietary recall	<4	46	46.9	
	4-5	47	48.0	<0.001
	6	4	4.1	
	4	1	1.0	
Where do you obtain food from?	Farm	29	28.4	0.7601
	Buy from market	71	69.6	
	Borrow from family members	2	2.0	
Where do you obtain the main staple from?	Farm	31	30.4	<0.201
	Buy from market	70	68.6	
	Borrow from family members	1	1.0	
Where do you obtain fish/meat and vegetables from?	Farm	7	6.9	<0.001
	Buy from market	94	92.2	
	Borrow from family members	1	1.0	
Have you ever been on food support from the NACS program	Yes	33	32.4	<0.001
	No	69	67.6	
Do you have any food in-store in your household?	Yes	70	68.6	<0.001
	No	31	30.4	
How long will the food last in the household?	A day	19	18.6	0.32
	2-4 days	38	37.3	
	5-7 days	22	21.6	

	2 weeks	3	2.9	
	>2 weeks	20	19.6	
Do you worry your household will run out of food	Never	32	31.4	0.21
	Always	14	13.7	
	Sometimes	49	54.9	
Does your household eat food they don't prefer to eat?	Never	39	38.2	0.33
	Always	24	13.3	
	Sometimes	49	48.0	
Do you borrow food to feed your household?	Never	62	60.8	0.002
	Always	5	4.9	
	Sometimes	35	34.3	
Does your household buy food on credit?	Never	54	52.9	0.17
	Always	3	2.9	
	Sometimes	45	44.1	
Do the adults in your household cut down on the number of meals or skip meals?	Never	52	49.5	0.08
	Always	6	5.7	
	Sometimes	44	41.9	
Do the adults in your family ever go to bed hungry because there is not enough food or money to buy food?	Never	56	51.0	0.45
	Always	4	5.9	
	Sometimes	42	43.1	
Do your children eat less than you feel they should because there is not sufficient food or money to buy food?	Never	61	59.8	0.34
	Always	6	5.9	
	Sometimes	35	34.3	
Do your children say they are hungry because there is not enough food or money to buy food?	Never	56	54.9	0.09
	Always	4	3.9	
	Sometimes	42	41.2	
Do you always cut down on the number of your children's meals because there is not enough food or money to buy food	Never	62	60.8	0.11
	Always	3	2.9	
	Sometimes	37	36.3	
Do you ever go to bed hungry because there is not enough food or money?	Never	65	63.7	0.001
	Always	4	3.9	
	Sometimes	33	32.4	

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Table 6: Associations of socio-demographics and food frequency

Associations n=105	Chi-square (X^2)	Likeli-hood Ratio	Phi	Cramer's V	Contingency coefficient	P-value
Age vs No. of meals eaten in a day	30.655	20.847	0.551	0.318	0.483	0.002
Age vs frequency of breakfast in a week	12.032	11.533	0.345	0.199	0.326	0.443
Age vs. frequency of fruit consumption in a week	9.081	10.308	0.300	0.173	0.287	0.696
Age vs No. of food groups adult ate from the past 24hrs	7.018	7.013	0.268	0.155	0.259	0.856
Gender vs no. of meals eaten in a day	6.634	8.780	0.256	0.181	0.248	0.356
Gender vs. frequency of breakfast in a week	7.593	7.451	0.274	0.194	0.264	0.269
Gender vs frequency of fruit consumption in a week	6.358	6.381	0.251	0.177	0.243	0.384
Gender vs No. of food groups adult ate from in the past 24hrs	1.659	2.251	0.130	0.092	0.129	0.948
Marital status vs No. of meals eaten in a day	15.582	16.234	0.393	0.227	0.366	0.211
Marital status vs frequency of breakfast in a week	35.870	20.718	0.596	0.344	0.512	<0.001
Marital status vs frequency of fruit consumption in a week	13.062	13.472	0.360	0.208	0.338	0.365
Marital status vs No. of food groups adult ate from in the past 24h based on the 24h dietary recall	3.959	4.225	0.201	0.116	0.197	0.984

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Table 7: Pearson's correlation matrix of some socio-demographical factors and food security determinants

	1	2	3	4	5	6	7
1.Monthly income	-						
2.Occupation	0.154	-					
3.Educational Level	0.349**	0.156	-				
4. Do you Borrow food to feed your household?	-0.090	0.013	-0.219*	-			
5. Does your household buy food on credit?	-0.132	-0.059	0.298**	0.816**	-		
6. Do you always cut down on your children's food quantity because there is not enough money?	-0.133	-0.026	-0.009	0.508**	0.553**	-	
7. Does your household eat foods they don't prefer to eat?	-0.088	-0.164	-0.044	0.584**	0.637**	0.494**	-

** Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

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Table 8: Pearson's correlation matrix of some anthropometric measurements and food security determinants

	1	2	3	4	5	6	7
1.Waist Circumference (cm)	-						
2. Body composition (% visceral fat)	734**	-					
3.BMI (Kg/m2)	0.717**	0.669**	-				
4.Height (cm)	0.054	0.095	0.195*	-			
5. No. of meals eaten in a day	-0.102	0.018	-0.152	-0.217*	-		
6. Frequency of breakfast in a week	0.137	-0.011	0.209*	-0.044	-0.144	-	
7. No. of food groups adult ate from in the past 24hrs based on the 24hrs dietary recall	-0.117	-0.069	-0.002	0.109	-0.026	0.059	-

** Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

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Table 9: Estimates of the Logistic regression of some determinants of food security status of the households in the study area (Adapted from [23])

Variables	Coefficients	Std. Error	P> x^2	Marginal Effects
1. Gender	0.0002**	0.04214	0.029	0.0533
2. Age	0.0001**	0.08810	0.000	0.0308
3. Educational level	0.349*	0.10202	0.0137	0.074
4. Occupation	0.154	0.15772	0.164	-0.01168
5. Household Size	0.0001**	0.10221	0.001	0.3786
6. Monthly Income	-0.132	0.14593	0.159	0.178
7. Age Squared	$-1x10^{-8}$ *	$8.81x10^{-6}$	0.0009	$-1.0x10^{-12}$

**1% significance * 5% significance

Number of observations = 105

Pearson Chi square(x^2) = 3.959

Log likelihood = 0.625

Prob>chi ^{2} = 0.000

R^2 = 0.452

Table 10: Food Security status of the community of the study area

Item	Food Secure	Food Insecure
% of Households	71.5	28.5
Total Households	75	30
Mean (FSI)	1.31	0.73
SD	0.17	0.16
Food Insecurity Gap/surplus	0.341	0.252
Headcount ratio	0.369	0.631

REFERENCES

1. **Fawole WO, Ozkan B and FA Ayanrinde** Measuring food security status among households in Osun State, Nigeria. *British Food Journal* 2016; 118(7):1554-1567. https://doi.org/10.1108/BFJ-11-2015-0425

2. **Seligman HK, Laraia BA and MB Kushel** Food insecurity is associated with chronic disease among low-income NHANES participants. *The Journal of nutrition* 2010; **140(2)**:304-310.

3. **Keino S, Plasqui G and B van den Borne** Household food insecurity access: a predictor of overweight and underweight among Kenyan women. *Agriculture & Food Security* 2014; **3(1)**:2.

4. **Willows N, Veugelers P, Raine K and S Kuhle** Associations between household food insecurity and health outcomes in the Aboriginal population (excluding reserves). *Health reports* 2011; **22(2)**:15.

5. **Furness BW, Simon PA, Wold CM and J Asarian-Anderson** Prevalence and predictors of food insecurity among low-income households in Los Angeles County. *Public health nutrition* 2004; **7(6)**:791-794.

6. **Food and Agriculture Organization**. *The State of Food Insecurity in the World: The Multiple Dimensions of Food Security*. Rome: FAO; 2013.

7. **Chakona G and CM Shackleton** Food insecurity in South Africa: To what extent can social grants and consumption of wild foods eradicate hunger? *World Development Perspectives* 2019; **13**:87-94.

8. **Shisanya SO and SL Hendriks** The contribution of community gardens to food security in the Maphephetheni uplands. *Development Southern Africa* 2011; **28(4)**:509-526.

9. **Ngidi MS and SL Hendriks** Coping with food insecurity in rural South Africa: the case of Jozini, KwaZulu-Natal. *Mediterranean Journal of Social Sciences* 2014; **5(25)**:278.

10. **Pérez-Escamilla R, Villalpando S, Shamah-Levy T and I Méndez-Gómez Humarán**. Household food insecurity, diabetes and hypertension among Mexican adults: Results from Ensanut 2012. *salud pública de méxico* 2014; **56**:s62-s70.

11. **FAO I. WFP**. The State of Food Insecurity in the World The Multiple Dimensions of Food Security by FAO, IFAD and WFP. In.: Rome: FAO. 2013.

12. **Biederlack I and J Rivers** Comprehensive Food Security and Vulnerability Analysis (CFSVA). Republic of Ghana. *VAM Food Security Analysis, United Nations World Food Programme* 2009.

13. **National Archives of Ghana.** Report on the food supply in Frafra. May 31, 1911, by Captain H. Wheeler, Acting Provincial Commissioner, North Eastern Province, Zuarungu [ADM 56/1/28]. 1911.

14. **National Archives of Ghana.** Human nutrition report on diet and nutrition in Mamprusi December 12, 1939 [ADM 11/1/1294] 1939.

15. **Shariff ZM and GL Khor** Household food insecurity and coping strategies in a poor rural community in Malaysia. *Nutrition research and practice* 2008; **2(1)**:26-34.

16. **World Bank.** *Niger Food Security and Safety Nets*; Report No. 44072-NE; World Bank: Washington, DC, USA, 2009. Available online: https://reliefweb.int/attachments/7f9c3876-5780-3905-9bde-ceebed270109/fullreport.pdf *Accessed 19th September 2012.*

17. **Molini V and P Paci** Poverty Reduction in Ghana. 2015.

18. **Cooke E, Hague S and A McKay** The Ghana poverty and inequality report: Using the 6th Ghana living standards survey. *University of Sussex* 2016.

19. **Pobee RA, Aguree S, Colecraft EK, Gernand AD and L.E Murray-Kolb**. Food insecurity and micronutrient status among Ghanaian women planning to become pregnant. *Nutrients* 2020: **12**: 470.

20. **Service GS** Population & Housing Census of Ghana. NA-ZU, vol. 3: Ghana Statistical Service; 2005; 2000.

21. **Moffat T** The "childhood obesity epidemic": Health crisis or social construction? *Medical anthropology quarterly* 2010; **24(1)**:1-21.

22. **Demi SM and J Kuwornu**. Assessing the Degree of Food Insecurity among Farming Households: Evidence from the Central Region of Ghana. *Research on Humanities and Social Sciences* 2013; **3(3)**:51-61.

23. **Namaa BHT** Determinants of Food Security Status of Smallholder Farming Households in the Wa West and Sissala West Disricts of the Upper West Region Of Ghana. University Of Ghana; 2017.

24. **Babatunde R, Omotesho O and O Sholotan** Socio-economic characteristics and food security status of farming households in Kwara State, North-Central Nigeria. *Pakistan Journal of Nutrition* 2007; **6(1):**49-58.

25. **Quisimbing A, Brown L, Feldstein H, Haddad L and C Peña** Women: the key to food security. Looking into the household. In.: Washington, DC: IFPRI; 2000.

26. **Apwah F** Emerging Threats to Food Security among Rural Households in the Kassena-Nankana Municipality. 2015.

27. **Tsegay G** Determinants of food security in rural households of the Tigray Region. *Unpublished Master Thesis, Faculty of Applied Statistics, Addis Ababa University, Ethiopia* 2009.

28. **Levin CE, Ruel MT, Morris SS, Maxwell DG, Armar-Klemesu M and C Ahiadeke**. Working women in an urban setting: traders, vendors and food security in Accra. *World Development* 1999; **27(11)**:1977-1991.

29. **Wiggins S and S Keats**. Smallholder agriculture's contribution to better nutrition. *ODI, London* 2013.

30. **Mutea E, Rist S and J Jacobi**. Applying the Theory of Access to Food Security among Smallholder Family Farmers around North-West Mount Kenya. *Sustainability* 2020; **12(5)**:1751.

31. **Mutea EN, Bottazzi P, Jacobi J, Kiteme B, Ifejika Speranza C and S Rist** Livelihoods and Food Security Among Rural Households in the North-Western Mount Kenya Region. *Frontiers in sustainable food systems* 2019, **3**.

32. **Sahu AK, Chüzho Z and S Das** Measuring household food security index for high hill tribal community of Nagaland, India. *Food Secur* 2017; **5**:155-161.

33. **Connolly-Boutin L and B Smit** Climate change, food security, and livelihoods in sub-Saharan Africa. *Regional Environmental Change* 2016; **16(2):**385-399.

34. **Martin-Shields CP and W Stojetz**. Food security and conflict: Empirical challenges and future opportunities for research and policy making on food security and conflict. *World Development* 2019; **119**:150-164.