Research Article

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Household Food and Nutrition Security Status Among Women of Reproductive Age (WRA) in Mombasa County, Kongowea Ward

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ABSTRACT

Food insecurity coupled with poor quality diets among women of reproductive age remain a challenge in Kenya today and undernutrition is a major risk factor for adverse health outcomes. Food nutrition and security is influenced by several multifaceted factors and therefore households ought to be equipped with knowledge to design practical solutions especially among those living in urban informal settlements. The study aimed at assessing the food and nutrition security status among women of reproductive age (15-49 years) within Kongowea's informal settlement in Mombasa County, Kenya. A cross-sectional study was carried out among 184 households across Kongowea ward in which semi-structured questionnaires were used to collect data on socio-demographic and dietary practices. The 24-hour dietary recalls, food frequency and diversity were used to assess the women's dietary intakes. The estimates used to measure food security were Food Consumption Score (FCS), Household Dietary Diversity Score (HDDS) and Nutrient Adequacy Ratio (NAR). The data was analyzed using Nutri-survey software and SPSS version 20 for descriptive, inferential, correlation and regression statistics. The results indicated that 97.3% of the respondents had a food consumption score (FCS) of above average (above 35.5). The average HDDS for the respondents was 5.7 and there was a moderate positive correlation ($r=0.18$, $p<0.05$) between household dietary diversity score (HDDS) and nutritional adequacy ratio of zinc. Likewise, there was as insignificant correlation ($r=0.13$, $p>0.05$) between household dietary diversity score (HDDS) and nutritional adequacy ratio of iron. The findings established that there exists a state of food security among the major population of women of reproductive age in Kongowea ward thus, fulfilling their nutritional requirements.

Keywords
Food security, Women of reproductive age, Diet, Household.

Introduction
Food and nutrition security is a global concern, particularly in Sub-Saharan Africa where 123 million people are acutely food insecure [1]. Latest projections indicate that approximately 600 million people worldwide will be chronically undernourished by the year 2030 FAO et al., [2], posing an immense challenge towards eradicating hunger and ensuring that the world's population has access to safe, nutritious and sufficient food at all times. Therefore, food and nutrition security remain critical global issues that impact human health, economic development and social stability. Food access is a major priority and therefore the concept of food security is majorly built on three pillars namely food accessibility, availability and utilization [3].

Kenya, like any other developing economy, is food and nutrition insecure where approximately 10 million of the population suffer from chronic food insecurity and poor nutrition [4]. According to national representative data from the year 2011, demographic and household survey demonstrate the association between food insecurity and anemia among women of reproductive age. There are gaps on the linkages between food security and nutrition that have not been fully explored and this is attributed to unreliable information on household food security compared to those needed for precise estimates of nutrition assessments. Several alternative ways to collect and analyze food consumption information using indicators that are proxy for actual caloric intake and diet quality have been proposed. Such proxies generally include information on dietary diversity, sometimes with the addition of food frequency [5]. World Food Program has adopted this data collection tool measuring dietary diversity and food frequency because several different indicators built on this sort of data have proven to be strong proxies for food intake and food security.

Chronic energy deficiency is caused by eating too little or having an unbalanced diet that lacks adequate nutrients. Women of reproductive age (age 15–49) are especially vulnerable to chronic energy deficiency and malnutrition due to low dietary intakes, inequitable distribution of food within the household, improper food storage and preparation, dietary taboos, infectious diseases, and inadequate care practices [6].

Therefore, this study sought to assess the food security status of women of reproductive age in Kongowea, Mombasa County to understand the nature, severity, and magnitude of food insecurity in order to inform, target, and monitor appropriate and timely development interventions.

Methodology

Research Design

A cross-sectional nutrition survey was conducted in May-August 2023 targeting a random sample of 184 households with women of reproductive age (15 – 49 years) in Kongowea ward Mombasa County. A Semi-structured questionnaire was used to collect socio-demographic and dietary practices data. The 24-hour dietary recalls, dietary diversity and food frequency questionnaire (FFQ) were used to assess the women's dietary intakes. Food security was estimated using Food Consumption Score (FCS), Household Dietary Diversity Score (HDDS) calculated as indicator for dietary diversity and Nutrient Adequacy Ratio (NAR).

Calculation of Food Consumption Score (FCS)

The Food Consumption Score (FCS) is a more complex indicator of a household's food security status because it considers not only the dietary diversity and food frequency but also the relative nutritional importance of the different food groups. Food consumption score was calculated using the frequency of consumption of eight different food groups consumed by a household. Using standard food frequency data, all the food items were grouped into specific food groups as indicated in Table 1 below. The consumption frequencies of food items of the same group were summed up and the value of each group recorded above 7 truncated to 7. The value obtained for each food group was then multiplied by its weight and a column of a new weighted food group scores was created. The weighted food group scores were summed up thus creating the food consumption score (FCS). Using the appropriate thresholds, the variable food consumption scores were recorded as a categorical variable. Below are the standard food groups and current standard weights that were used in allanalyses.

Table 1: Specific food group and its weight used in analysis of food frequency.

S.NO	FOOD ITEMS (examples)	Food groups (definitive)	Weight (definitive)
1	Maize, maize porridge, rice, sorghum,millet pasta, bread and other cereals Cassava, potatoes and sweet potatoes,other tubers, plantains	Main staples	2
2.	Beans. Peas, groundnuts and cashew nuts	Pulses	3
3.	Vegetables, leaves	Vegetables	1
4.	Fruits	Fruit	1
5.	Beef, goat, poultry, pork, eggs and fish	Meat and fish	4
6.	Milk yogurt and other diary	Milk	4
7.	Sugar and sugar products, honey	Sugar	0.5
8.	Oils, fats and butter	Oil	0.5
9.	spices, tea, coffee, salt, fish power, small amounts of milk for tea.	Condiments	0

Source: Modified from draft 'CFSVA Guidelines'. Missing data for individual food items could be interpreted as 0 consumptions days, or as missing

Upon calculation of food consumption score, the thresholds for the food consumption groups (FCGs) were determined based on the frequency of the scores and the knowledge of the consumption behavior in the household.

Table 2: Typical thresholds of food consumption score.

Food consumption score (FCS)	Profiles
0 - 21	Poor
21.5 - 35	Borderline
> 35	Acceptable

Calculation of Household Dietary Diversity Score (HDDS)

The Household Dietary Diversity Score is the sum of the indices assigned to each of the twelve food groups which were grouped as cereals, root and tubers, vegetables, Fruits, (meat, poultry, offal), eggs, (Fish and Seafood), (pulses, legumes, nuts), oils /fats, sugar/ honey and miscellaneous. Table 3 below summarizes these twelve food groups.

The value is calculated by taking the sum of the categories of the various food groups of food eating score and dividing by all the households. Setting the appropriate targets involved, the assumption that poor household would have a less diverse dietary score than the rich and this as their income increase then they would be a higher diverse dietary score because of access to food variety. This study provided data for income of the families investigated which was subsequently used to establish that a HDDS greater than 5.75 was labelled as Diverse while that below this value was labelled as uniform.

Table 3: Categories of the various food groups of food consumption score.

Food category	Specific Foods
A	Cereals
B	Roots and tubers
C	Vegetables
D	Fruits
E	Meat, poultry and Offal's
F	Eggs
G	Fish and seafood
H	Pulses, legumes, nuts
I	Milk and milk products
J	Oils/Fats
K	Sugar / honey
L	Miscellaneous

$$\boldsymbol{HDDS} = Sum(\ A + B + C + D + E + F + G + H + I + J + K +$$

$$\boldsymbol{AVERAGE\ HDDS} = \frac{SUM(HDDS)}{TOTAL\ NUMBER\ OF\ HOUSEHOLDS}$$

Nutrient Adequacy Ratio and Mean Adequacy Ratio

Nutrient Adequacy Ratio (NAR) and Mean Adequacy Ratio (MAR) are effective, commonly used indicators in the assessment of food security, particularly in measuring the "utilization" pillar of diet quality and micronutrient intake. The nutrient adequacy ratio is computed as the ratio of daily individual nutrient intake to the standard recommended amount for the respondent's age category.

$$\boldsymbol{NAR} = {Daily\ Nutrient\ Intake}\Big/{Recommended\ amount\ of\ N}$$

$$\boldsymbol{MAR} = {Sum\ (NAR(truncated\ at\ 1)}\Big/{Number\ of\ Nutrients}$$

The number of nutrients investigated by the research was protein, Fats, Vitamin A, Vitamin E, Vitamin B_1, Vitamin B_2, Vitamin B_6, Vitamin C, Potassium, Sodium, Phosphorous, Calcium, Magnesium, Zinc and Iron.

Results

Food consumption score (FCS) of the women of reproductive age

The Figure 1 below indicates a summary of the findings on food security status among the women of reproductive age which was determined using the food consumption score categorized as either poor, on the borderline or acceptable.

The results indicate that those households which had an acceptable food consumption score (above 35.5) were 97.3% while those that were on the borderline (21 - 35.5) were 2.7%. In addition, there was no household that recorded a poor food consumption score (0 - 21). The analysis supports the theory that more households are likely in the acceptable range and are thus considered to be food secure. In contrast to the hypothesized association between food security status and dietary intake, the results suggest that there is indeed a relationship between dietary intake and food security. The high percentage of acceptable food consumption score could be attributed to economic empowerment of the respondents thus, translating to food availability, accessibility and the subsequent utilization of these foods.

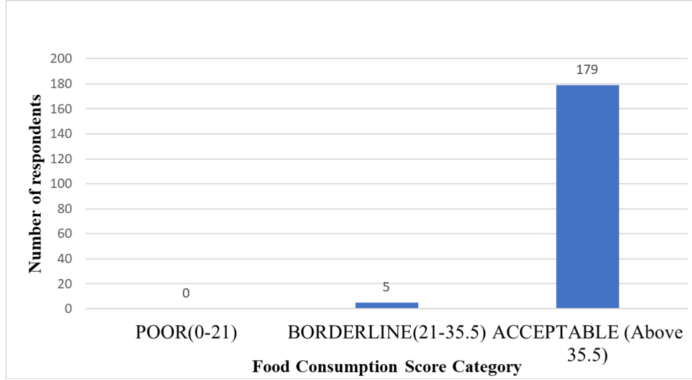

Figure 1: Food consumption score of women of reproductive age.

These findings are in tandem with the food frequency results (Figure 2) below, which indicated that the most frequently consumed foods on daily basis were starch cereals (maize, rice, wheat and Oats) at 94.0%, followed by vegetables (kales spinach, *mchicha* (*Amaranthus*), cowpeas) at 93.4% and milk (fresh and fermented) at 59.7%. The least consumed foods were meat and fish (4.9%), eggs (5.9%) and non-starch cereals (7.1%). Legumes and fruits were consumed on daily basis at 14.1% and 21.7% respectively. Based on this, various foods were both accessible and were utilized thus contributing towards meeting the nutritional needs of the respondents.

The consumption of animals as a source of food, due to its superior nutritional quality could also have been a contributor towards the outcome. According to the findings, the minority (2.7%) who were on the borderline could be attributed to a possible lower level of economic empowerment (as indicated by socio-demographic results) thus affecting food availability and diet utilization at household level. The results contribute to the existing knowledge of Fite et al. [7] whose findings established that approximately (54.7%) of pregnant women had acceptable food consumption score (FCS) which was positively influenced by wealth and the consumption of animals as a source of food amongst other factors.

Household dietary diversity score (HDDS)

Household food access is the ability of a household to acquire a sufficient quantity and quality of food to meet the nutritional requirements of all the household members in order to promote productive lives. The Household Dietary Diversity Score is the sum of the indices assigned to each of the twelve food groups as indicated in Table 3 above. The Figure 3 below gives a summary of the findings on the household dietary diversity score whose adequacy is at 5.7.

The results indicate that the highest HDDS was 7.2 corresponding to an income of greater than 80,000 while the lowest HDDS stood at 4.2 corresponding to an income of between KES 30,000 - 40,000. The lowest income earning category of between KES

5,000 – 10,000 recorded a HDDS of 5.6 while the next two levels of KES 10,000 - 20,000 and 20,000 - 30,000 had a HDDS of 5.2 and 5.3 respectively. There was an increase in the HDDS from 4.2 for the category earning between 30,000 – 40,000 to 5.6 for the category earning between KES 40,000 – 50,000. The results also indicate that there was a slight increase in the HDDS of up to 5.8 from 5.6 for those earning up to KES 60,000. The data also indicates a slight decrease in the HDDS from 5.8 to 5.1 between the groups of households earning up to KES 60,000 and those earning up to KES 80,000. Subsequently, there was a sharp increase in HDDS from 5.1 up to 7.2 in the households earning between KES 70,000 – 80,000 and those earning over KES 80,000.

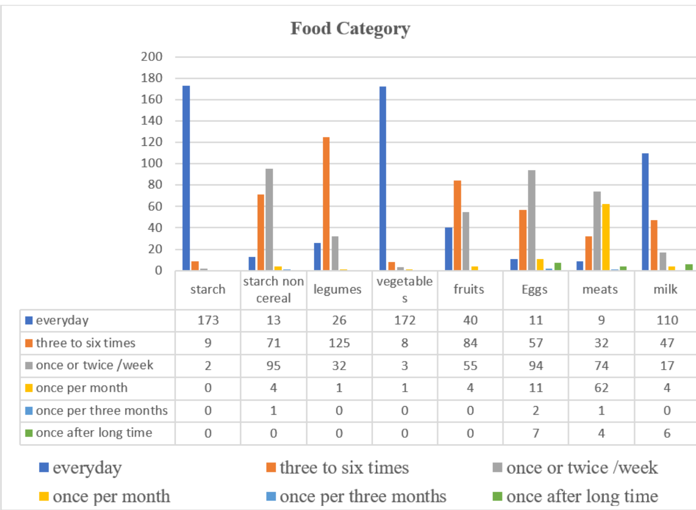

Figure 2: Food frequency for the various food categories.

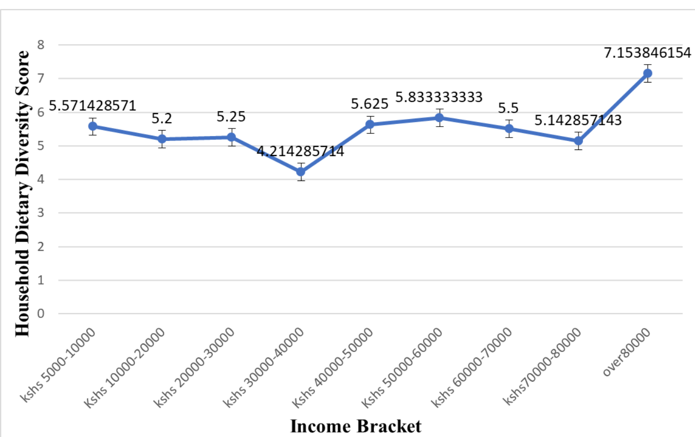

Figure 3: Household dietary diversity score (HDDS) based on income bracket.

In general, the data also suggests that households with an income higher than KES 50,000 had a more than average HDDS (>5.6). Previous studies have revealed that a higher HDDS is associated with socio-economic status and household food security Huluka et al. [8], meaning food access is highly dependent on the income bracket. A diet of at least 4.0 HDDS is valid as nutritionally adequate because it is an indicator of dietary diversity normally used to measure the state of food security of a population. It is simple to implement and easy to administrate at both individual and household levels. The findings are in agreement with Cordero-Ahiman et al. [9] whose results showed that the average HDDS of food consumption was 10.8, of which most of the analyzed food groups consumed were cereals, roots and tubers, fruits and sugar. The determinants that best explain this HDDS were the household size, food expenditure, the level of education and marital status of the household head amongst others.

The relationship between household dietary diversity score (HDDS) and Nutrient adequacy ratio (NAR)

The relationship between household dietary diversity score (HDDS) and nutrient adequacy ratio (NAR) was effectively ascertained through correlation and regression analysis. Correlation analysis implies the direction and regression informs whether there is any causal link between the two phenomena. Table 4 below indicates the output of the Pearson correlation matrix.

Table 4: Output on Pearson correlation matrix.

Variable	1	2	3	4
1. MAR	—	.023	.286**	.266**
2. HDDS	—	—	.131	.180*
3. IRONNAR	—	—	—	.917**
4. ZINCNAR	—	—	—	—

MAR = Mean Nutrient Adequate Ratio; **HDDS** = Household Dietary Diversity Score; **IRONNAR** = Iron Nutrient Adequacy Ratio; **ZINCNAR** = Zinc Nutrient Adequacy Ratio. * p < .05. ** p < .01.

The correlation matrix revealed several notable findings. A moderate positive correlation was found between Household Dietary Diversity Score (HDDS) and zinc nutrient adequacy ratio (r = 0.18, p< 0.05), suggesting a positive relationship between household dietary diversity score and nutrient adequacy ratio for Zinc. The findings suggest that households with greater dietary diversity are likely to have higher zinc nutrient adequacy. Although the correlation is moderate, the significant p-value underscores the importance of promoting diverse diets as a means of improving zinc intake adequacy. There was a positive insignificant correlation between Household Dietary Diversity Score (HDDS) and iron nutrient adequacy ratio (r=0.13, p>0.05) suggesting that a positive relationship may exists between Household dietary diversity score and Nutrient adequacy ratio for Iron at a relaxed significant level of 1%. There was no correlation between mean nutritional adequacy ratio (MAR) and Household Dietary Diversity Score.

Using stepwise regression, the findings showed that there was a causal link between zinc nutrient adequacy ratio and both HDDS and iron nutrient adequacy ratio. These signifies that Household diversity score can be used to predict the nutrient adequacy ratio for zinc. The findings concur with Kumar & Gautam [10] in which, after fixing the minimum intake quantity of the food groups, the relationship between the dietary diversity score and the nutritional accuracy was strengthened.

Table 5: Regression analysis between zinc nutrient adequacy ratio (ZINCNAR) and household dietary diversity score.

Model	R	R^2	Adj R^2	Std. Error	R^2 Change	F Change	df1	df2	Sig. F Change
1	.180[a]	.032	.027	1.21070	.032	6.063	1	182	.015
2	.919[b]	.844	.842	.48789	.811	939.720	1	181	< .001

Table 6: Coefficients of Regression analysis.

Model	B	SE	Beta	t	p	95% CI Lower	95% CI Upper
1 (Constant)	.841	.262	—	3.213	.002	.324	1.357
HDDS	.109	.044	.180	2.462	.015	.022	.196
2 (Constant)	-1.149	.110	—	-1.354	.178	-.367	.068
HDDS	.037	.018	.060	2.036	.043	.001	.072
IRONNAR	.626	.020	.909	30.655	< .001	.586	.666

SE = Standard Error; **CI** = Confidence Interval; **HDDS** = Household Dietary Diversity Score; **IRONNAR** = Iron Nutrient Adequacy Ratio. **Dependent variable**: ZINCNAR.

Regression analysis between zinc and household dietary diversity score

The Table 5 below indicates the results of regression analysis between the nutrient zinc and the household dietary diversity score.

a. Predictors: (Constant), HDDS
b. Predictors: (Constant), HDDS, IRONNAR
c. Dependent Variable: ZINCNAR

The hierarchical regression analysis evaluated the contributions of HDDS and IRONNAR in predicting ZINCNAR. Model 1, which included only HDDS, accounted for a modest but statistically significant portion of variance in ZINCNAR ($R^2 = .032$, $p = .015$). The unstandardized coefficient ($B = .109$, $p = .015$) indicates that each unit increase in HDDS is associated with a 0.109 unit increase in ZINCNAR. However, the predictive power of HDDS alone is limited. The corresponding table of coefficients was as indicated in the table below.

Model 2 added IRONNAR and led to a dramatic increase in explanatory power ($R^2 = .844$, $p < .001$), with an R^2 change of .811. The coefficient for IRONNAR ($B = .626$, $p < .001$) shows it is a highly significant and strong predictor of ZINCNAR. Even after controlling for IRONNAR, HDDS remained a small but significant predictor ($B = .037$, $p = .043$), suggesting a marginal independent effect. In regression equation form the relationship would be condensed as follows;

$$zincnar = -1.149 + 0.037HDDS + 0.626IRONNAR$$

These findings suggest that while dietary diversity influences zinc adequacy to a degree, iron adequacy is by far the dominant predictor. This likely reflects the shared absorption pathways and physiological interactions between zinc and iron. Nutrition interventions should therefore target iron intake as a lever for improving zinc adequacy.

Conclusion

The findings established that there exists a state of food security among majority of the population of women of reproductive age in Kongowea ward. This means that they are capable of affording, accessing and utilizing food thus fulfilling their nutritional requirements. However, it was also evidenced that there was a minority of a population who were food insecure meaning they are unable to access quality food, making them vulnerable to micronutrient deficiencies especially iron and zinc.

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