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THE LINK BETWEEN MATERNAL HEALTH AND WOMEN'S FOOD SECURITY IN RURAL COMMUNITIES: CASE STUDY OF SMALLHOLDER FARMERS IN NIGERIA

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Abstract

The interaction between household food security, maternal health and child nutritional status is well documented but the empirical evidence seems to be limited. The study examined maternal health and household food security in Patigi Local Government Area of Kwara State, Nigeria. A multistage sampling technique was adopted in selecting total of 112 respondents. Data were analyzed using descriptive statistics and multinomial regression model. The result revealed that most of the households were male-headed. The mean age of household heads was 34 years. About 82 percent of the respondents were married; only 42 percent were educated up to secondary school level and 46 percent were farmers with an estimated average monthly income of less than N20,000.00. The food security index showed that 77 percent were moderately food secure and about 66 percent of households skip meals because of insufficient funds to buy food. The food security status of households worsened with increase in household size; women within the age range of 35-39 years experienced a high degree of food insecurity. The results from the multinomial regression analysis revealed that income ($p < 0.1$), education ($p < 0.01$) and household size ($p < 0.01$) are factors that determine the likelihood of being food insecure or secure. It also showed the effect of maternal health variables on households' food security status; the frequency of illness ($p < 0.01$) could decrease food security. The findings suggest that existing policies aimed at improving maternal health and ensuring food security should be monitored and evaluated for effective impact and should be more aggressively implemented. Also education, income generation and health policies specific to women are necessary to transform women's food security status.

Keywords: Maternal health, Food Security, Women, Rural communities, Access Scale, Multinomial regression.

Introduction

The spread of food security, hunger and malnutrition, in Nigeria and Sub-Saharan Africa (SSA) is high; pre-school age children, precisely a third, die yearly from nutrition related illnesses while at least a half of the population is food insecure (Bain et al. 2013 and FAO, 2017). This trend can be stemmed by a concerted action from stakeholders; but these actions need to be based on policy relevant evidence in order to prevent a continued deterioration of the situation in the future (Oniango, 2005, FAO 2019). Women, particularly in poor rural households, revolve in the cycle of poor health not only because of physical hard labour and reproductive responsibilities but also because of poor access to productive resources, medical services, food and special dietary needs (micro and macro-nutrients) such as iron supplement (Ayensu, 2020). In northern Nigeria, high maternal mortality of 1000 death per 100,000 live births is experienced among Hausa women due to seclusion related to socio-cultural factors (Wall, 1998, Meh et al 2019). Women's lives were traditionally seen to be situated within the complex of food production, food preparation, and bearing and raising of children (UNECA, 2000); the situation becomes more complex when their roles in multiple low income economic activities are included (Olajide and Doppler, 2013). This makes the comprehension of the interaction between reproductive health and household food security crucial (UNECA, 1999, 2000 and Moafi *et al.*, 2018). Although

women help to ensure adequate nutrition, health and cognitive development of their children in their formative years, they are over-represented among the resource poor (Saaka, 2015). Being resource poor implies that they do not own and control productive resources, a situation which fosters poverty and food insecurity (Ogunniyi *et al.*, 2021). Although an overwhelming amount of research (Olayemi, 2012; Otaha, 2013; Hasrris-Fry *et al.*, 2015; Saaka, 2015; Moafi, 2018; Oladapo and Olajide, 2015; Igwe *et al.*, 2017; FAO, 2017; FAO, 2019; Owoo 2018 & Owoo 2020) has been given to food security issues and to reproductive health, additional evidence with respect to overlaps in the nexus is still required. This research aims at contributing more empirical evidence to the relationship showing the direction and relationship between household food security (access component) and maternal health.

In 2000, the Food Security and Development Division of the United Nations. Economic Commission for Africa set an agenda for research which would link women's reproductive health with household food security. The agenda was premised on the hypothesis that the quality of life has a bi-causal relationship with maternal health and with food security within different social, cultural and environmental contexts. In other words, covariates of household food security and women's reproductive health can be similar and they can interact to influence both sides. It also suggests the need to isolate or better define the effects of particular factors and understand how they affect the twin concepts such that policy relevant evidence can be generated. In line with this, several attempts have been made to illuminate how several factors influence women's reproductive health status and household food security as well as examine the relationship between them (WHO, 1994; Powel. 2017; Gundersen and Zilliak, 2017 & FAO 2019). The results from these studies and many others indicate a significant relationship between the two but there is no standardized pathways that have been identified. The difference could be associated with varying social, cultural and environmental contexts but also to the difference in understanding and measurement of household food security and the level at which it is measured.

Household food security, defined as does not lend itself to easy measurement. In most cases, proxies such as Dietary Diversity scores (Workicho *et al.*, 2016 and Powell, 2017); Coping Strategies Index (Olayemi, 2012 and Farzana *et al.*, 2017) have been used to measure it because of its multi-dimensional nature. This implies that the results of such studies need to be triangulated or interpreted in the context of other indicators such as food consumption and poverty measures at both household and individual levels (Owoo, 2020). Another perspective to the issue is the fact food security has four pillars (FAO, 2008) namely availability (that is having physical access to food); access (related to physical and economic access to it); utilization (considers the nutrient intake and the biological utilization of the food consumed); and stability (a situation where the other 3 pillars are always available irrespective of social, economic, political and environmental vagaries) but a single indicator which measures the 4 pillars is yet to be identified. This study takes a different approach by examining maternal health and household food security access in Nigeria using the Household Food Insecurity Access Scale (Coates *et al.*, 2006, 2007) for the fact that it measures only one pillar of food security, the consistency of its unit of measurement, and proven effectiveness at measuring household food access (Coates *et al.*, 2007 and Gebreyesus *et al.*, 2016). The findings suggest a significant relationship between household food access, maternal Body Mass Index, and frequency of illness; age, education, household size and income drive this relationship. Other sections of this paper present the methodology, detailed results, discussions and recommendations.

Methodology

Study Area, Data Collection and Sampling Technique:

The research was carried out in Patigi Local Government Area of Kwara State (consisting of three districts including Patigi, Lade and Kpada), which was created from Edu Local Government Area of Kwara State, Nigeria. The location shares common boundaries with Niger State, Kogi State as well as Edu and Irepodun Local Government Areas. According to Kwara State Agricultural Development Project, (KWADP, 2007), approximately 25% of the land area of the Local Government is used for farming activities. Crops grown include rice, melon millet etc. Primary data was obtained through the use of a well – structured questionnaire and personal interviews. A multi stage sampling was used; the

first stage involved a random selection of two villages from each district. Twenty households were randomly selected from each village depending on the size of the village, making a total of 120 correspondents, out of which 112 was used for the analysis.

Analytical Tools:

Descriptive statistics comprising frequency distribution, percentages and means were used in characterizing the rural households.

The extent to which households were food secure was measured using the Household Food Insecurity Access Scale (HFIAS). Several measures of food security exist: Coping Strategy Index (Maxwell 1996), Dietary Diversity Score (Wiesmann *et al.*, 2009), Food Consumption Scores WFP, 1996) and some proxies such as income and expenditure measures and calorie intake (Olayemi, 2012). The HFIAS, developed by the FANTA project between 2001 and 2006 (Coates *et al.*, 2007), was selected because it captures the access pillar of food security; it is simple but its measure of food security access has been proven to ‘distinguish between the food secure and food insecure across different cultural contexts. It is able to generate information on the prevalence of household food insecurity (access component) and to detect changes in the food insecurity situation of a population over time (Coates *et al.*, 2006 and 2007) The original purpose was to measure the impact of food aid programs in enhancing participants’ food security status, with a specific focus on the access component (Coates *et al.*, 2006 and 2007); hence it was developed to be a uni-dimensional measure. It examines this in 3 core domains: Anxiety and uncertainty, insufficient quality and insufficient food intake and its physical consequences. But its simplicity and efficiency enhanced its use in measuring household food security in research (Gebreyesus *et al.*, 2015 and Harris-Fry *et al.*, 2015). The HFIAS is a standardised questionnaire with a set of 9 questions on the occurrence of certain experiences related to food access and additional 9 questions to examine the frequency of occurrence of these experiences, if the respondents (person in charge of food preparation) answer in the affirmative. For example:

“In the past four weeks, did you worry that your household would not have enough food?

- 1. 0 = No (skip to Q2) 1 = Yes
- 1.a. How often did this happen?

1 = Rarely (once or twice in the past four weeks)

2 = Sometimes (three to ten times in the past four weeks)

3 = Often (more than ten times in the past four weeks)

The nine questions believed to capture all three core domains that reflect a household’s inadequate access to food were asked. The data analyzed for this study were based on the answers following Coates et al 2007, “The HFIA category variable was calculated for each household by assigning a code for the food insecurity (access) category in which it falls. The frequency-of-occurrence was coded as 0 for all cases where the answer to the corresponding occurrence question was “no” (i.e., if Q1=0 then Q1a=0, if Q2=0 then Q2a =0, etc.) prior to assigning the food insecurity (access) category codes. The four food security categories are created sequentially, to ensure that households are classified according to their most severe response. These are:

- 1 = Food Secure,
- 2=Mildly Food Insecure Access,
- 3=Moderately Food Insecure Access,
- 4=Severely Food Insecure Access

HFIA category = 1 if [(Q1a=0 or Q1a=1) and Q2=0 and Q3=0 and Q4=0 and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0];

HFIA category = 2 if [(Q1a=2 or Q1a=3 or Q2a=1 or Q2a=2 or Q2a=3 or Q3a=1 or Q4a=1) and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0];

HFIA category = 3 if [(Q3a=2 or Q3a=3 or Q4a=2 or Q4a=3 or Q5a=1 or Q5a=2 or Q6a=1 or Q6a=2) and Q7=0 and Q8=0 and Q9=0]; and

HFIA category = 4 if [Q5a=3 or Q6a=3 or Q7a=1 or Q7a=2 or Q7a=3 or Q8a=1 or Q8a=2 or Q8a=3 or Q9a=1 or Q9a=2 or Q9a=3]'

Only 3 categories could be assigned for this study: The food secure, the severely food secure and the moderately food secure.

Multinomial Logistic Regression Model:

The relationship between socioeconomic characteristics and food security; as well as the link between maternal health characteristics and food security were examined using Multinomial Logistic Regression models (MLR), after Harris-Fry et al (2015), given that there are three possible food security status. The choice of the model is based on the fact that it is efficient where we have polychotomous categorical dependent variable (Hosmer and Lemeshow, 2000). In the model, parameter estimates are identified and compared to a baseline category of the dependent variable (Long, 1997). The logit model for the base line category is given as:

$$\log\left(\frac{\pi_j}{\pi_1}\right) = \alpha_j + \beta_j x, j = 1, 2, \dots, j - 1 \quad \text{equation} \quad (1)$$

Separate parameters are defined for each logit model and the number of equation is j-1. The different categories of the dependent variable will be paired with the baseline as such the effects observed will differ because it will depend on the category paired with it; the effects of each independent variable on the dependent variable when there are j categories are predicted by the model which are fit simultaneously (Agresti, 2007). The dependent variable in this study is food security. Mothers can be food secure, severely food insecure or moderately food insecure based on HFIAS; there are three unordered categorical form of food security status represented by

f=1: Food secure

f=2: Severely food insecure

f=3: Moderately food insecure (base category)

Let P_{ij} = the probability that a mother will have a j^{th} food security status.

Where $i = 1, 2, 3, \dots, 12$ and $j = 1, 2, 3$

The empirical model used to estimate the multinomial regression relating socio-economic characteristics to food security is given as:

$$\log\left(\frac{p(F_1=1 | x_i AGE + \dots + HHSize)}{p(F_1=3 | x_i AGE + \dots + HHSize)}\right) = \beta_o + \beta_1 x_i AGE + \dots \beta_6 x_i HHSize \quad \text{equation 2}$$

$$\log\left(\frac{p(F_1=2 | x_i AGE + \dots + HHSize)}{p(F_1=3 | x_i AGE + \dots + HHSize)}\right) = \beta_{10} + \beta_{12} x_i AGE + \dots \beta_{16} x_i HHSize \quad \text{equation 3}$$

The empirical model used to estimate the multinomial regression relating maternal health characteristics to food security is given as:

$$\log\left(\frac{p(F_1=1 | x_i Illness + \dots + VacStatus)}{p(F_1=3 | x_i Illness + \dots + VacStatus)}\right) = \beta_o + \beta_1 x_i Illness + \dots \beta_3 x_i VacStatus \quad \text{equation 4}$$

$$\log\left(\frac{p(F_1=2 | x_i Illness + \dots + VacStatus)}{p(F_1=3 | x_i Illness + \dots + VacStatus)}\right) = \beta_{10} + \beta_{12} x_i Illness + \dots \beta_{13} x_i VacStatus \quad \text{equation 5}$$

The equations 2 through 5 give the odds ratio of a mother being food secure or food insecure relative to being moderately being food secure. The corresponding probabilities are:

$$P_i, \text{ Food secure} = \frac{e^{\beta_1 x_i}}{1 + \sum_{j=1}^3 e^{\beta_j x_i}} \quad \text{equation 6}$$

$$P_i, \text{ Severely food insecure} = \frac{e^{\beta_2 x_i}}{1 + \sum_{j=1}^3 e^{\beta_j x_i}} \quad \text{equation 7}$$

$$P_i, \text{ Moderately food secure} = \frac{e^{\beta_3 x_i}}{1 + \sum_{j=1}^3 e^{\beta_j x_i}} \quad \text{equation 8}$$

The independent variables for the relationship between socioeconomic status and food security include: age (Years), education, income (Naira), farming experience (Years), type of marriage, and household size (Number or count) while those for the relationship between maternal health and food security were maternal health characteristics such as: frequency of illness (Number or count), Body Mass Index, and vaccination status (Yes or No).

Results and Discussion

Household Socio-Economic Characteristics:

The result (see table 1) shows that in over 80 percent of the households were male headed while 11 percent were female headed. Although most were married, the percentage of the separated or divorced appears to be relatively high; 10 and 4 percent respectively. The households tend to have large family sizes, over 60 percent have a minimum of 6 members while the average household size is 7. Several studies (Igwe *et al.*, 2014; Workicho *et al.*, 2016; Powel *et al.*, 2017; and Farzana *et al.*, 2017) have linked food security status to large household sizes. Over 80 percent were in their productive and reproductive years and the mean age being approximately 34 years. Exposure to formal education was very low, about 26 percent had no formal education; while only 42 percent had secondary level education. The respondents were involved in different income generating activities ranging from farming (67 percent) to trading while some were involved in full time employment as civil servants. While being economically viable could contribute to a better food security status, low levels of education and high fertility can interact with it to give a negative effect (Owoo, 2020). The income earned particularly in trading and civil service jobs showed that they were at the lower rung of the ladder. Almost 50 percent of them earned less than ₦20, 000 (\$100) per month, while only 4.5 percent earned more than ₦ 100, 000 (\$500) per month. This suggests that a high percentage earn less than the minimum wage of ₦ 30, 000 (\$150) per month. Poverty measures (Income and expenditure) have been used to validate nutrition and food security indices such as the Dietary Diversity Score; or used as proxies to measure food security as such low incomes suggest poor food and nutrition security status (Oladapo and Olajide, 2015 and Owoo, 2020).

Household Food Security Status and Its Drivers:

Fears and worries dominated the thoughts of most women when it came to food. Results presented in Table 2 show that 71 percent of the respondent were worried because food would run out before they could get money to buy more. The extent and nature of food insecurity observed in the study is similar to Gebreyesus, 2015, Saaka, 2016 and Owoo 2020, who observed that rural households had lower food security status; and that food insecurity was associated with low maternal health in Ethiopia, Ghana and Nigeria respectively. Other self-reported indicators showed that members lost weight because there wasn't enough food to eat (75.0 percent), some did not eat for a whole day because there was no money to buy food (83.9 percent). Also, more than two-thirds of the respondents said that members of household could not afford balanced diet because there was not enough food at home (67.1 percent), household relied on low cost food because there was no money to buy expensive food (69.6 percent) and they skipped meals because of lack of money (66.1 percent). These reports suggest a low quality of life among mothers which has been associated with low food security status in different contexts (Moafi, 2018 and Owoo, 2020). Table 3 is the summary of the Household Food Security Status, it reveals that

most of the households were food insecure; 77.7 percent were moderately food insecure while 10.7 percent were severely food insecure, only 11.6 were food secure. A comparison of household food security status by socio-economic characteristics (Table 4) shows that 88.4% of the 112 households investigated were food insecure. The frequency of insecurity was highest among mothers of 35 – 39 years; 30 of them were moderately food insecure while 4 were severely food insecure. In the education category, mothers with low level education (no education to secondary level) were the most food insecure. Harris-Fry et al (2015), in their study amongst rural women in Bangladesh, found that women's literacy level could significantly reduce the risk of food insecurity; Ogunniyi et al (2021) found similar results among maize farmers in Nigeria. Married women were more food insecure in the marital status group but large households appeared to be more food insecure while those who earned less than the minimum wage were severely insecure. Owoo (2020) found similar results while examining food security status across rural and urban regions of Nigeria.

The drivers of food security status were examined using multinomial logistic regression model. The results (Table 5) show that age, household size and income have significant effects on the food security status of households. The fact that these factors are statistically significant implies a high degree of vulnerability which could be related to the resource base and economic viability of the households (Saaka, 2016). It is important to note that the type of marriage relationship (monogamous or polygamous) has an effect on whether a household is food secure or not (Owoo, 2018). Education, income and farm experience are particularly relevant for food secure households; that is an additional year of formal education attained by mothers could change (reduce) the likelihood of being severely food insecure by 5%, while the chances that the household will be food secure increases by 1.5%. Also, a naira increase in household monthly income, could reduce the chances that the household will be severely food insecure by 2.5% (Gebreyesus, 2015; Saaka, 2016; Owoo 2020 and Ogunniyi 2021).

Women's Health and Food Security Status:

Maternal health and child birth history: A summary of the women's pregnancy history and response to general health issue is given in Table 6. It indicates that many of the women have had multiple pregnancies and births; the respondents had carried 3 (7.1 percent) to 8 pregnancies 26.8 percent more than seven times. They however reported healthy children who were still living but the results show that about 20 percent had lost at least a child. The history of miscarriage or stillbirth during pregnancy and delivery was related by approximately 21 percent of the women. In line with Olonade et al (2019), the high level of pregnancies and mortality may be associated with poor health, food security status and health care system among other factors. Body Mass Index of the mothers was used to measure maternal health, also information on where respondent received treatment when ill and when giving birth, number of pregnancy and children alive, and how often they fall sick were used as maternal health variables. The result shows that majority of the mothers in the household surveyed have a normal BMI (87.5 percent), while others had unhealthy status, like underweight (3.6 percent), overweight (7.1 percent) and obesity (1.8 percent). These health characteristics were examined by food security status (Table 7). From the table, highest frequency of food insecurity of 76 was recorded among mothers with normal BMI range and among those who had been pregnant for more than seven times (20). Also, those mothers who had more than 5 pregnancies were more food insecure compared with those who had 3 or 4 pregnancies. Gundersen and Ziliak (2015) suggest that there is a consistent inverse relationship between health and food security status. Johnson et al (2018) observed that women with low nutrition intake or whose diets were based on few food groups were generally less food secure compared with those with a varied intake.

Relationship between Maternal Health and Food Security:

Being severely food insecure or moderately food insecure increases the chance of a mother being ill. Also, an increase in the number of times of illness reduces the chance of that household being food secure because of the implications for work productivity. This implies that money spent in buying drugs and other treatment can be used to purchase more quality food (Table 8). The results have implications for a child's health according to Shammah-Levy *et al.*, (2017) who in a study on household food security and maternal child nutritional status in Mexico, found that the interaction between household food (in

security and maternal obesity could have a significant impact on stunting in preschool children and that severe household food insecurity could increase the risk of stunting in children depending on the health or nutritional status of the mother. Senbanjo *et al.*, (2013) in their study on maternal and child under nutrition in Lagos, indicated that poor food security status as indicated by maternal under nutrition could perpetuate a cycle of stunted children in the household.

Conclusion and Recommendations

The research has shown that there is high prevalence of food insecurity among the women investigated. A high percentage could not afford balanced diet and had to skip meals because there was not much food at home. The fact that most of the respondents are polygamists and have large family size also revealed that there are more people to feed in the family which invariably means that each mother has to fend for her children; thereby having to do more work or income generating activities to make them more food secure. The educational attainment of the respondents is also crucial in this study because majority of them have a form of formal education which is good for sound nutritional and health status information of mothers. A significant relationship between maternal health variables and food security status was established. The Body Mass Index which is one measure of maternal health status shows that 87.5 percent of most mothers are normal, this result cannot be conclusive bearing in mind that there are some diseases that have hidden symptoms which could manifest later on in life. Majority of the mothers have been pregnant more than seven times, and being food insecure will make pregnancy risky. Mothers should be enlightened on family planning methods and sensitized on general health issues so that they can take very good care of themselves. A State-private sector partnership in conjunction with the rural populace on maternal health and nutrition will help improve the delivery of the above recommendation.

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Table 1: Socio-economic characteristics of respondents

Variables	Frequency	Percentage
Household Head		
Father	100	89.3
Mother	12	10.7
Total	112	100.0
Household Size		
1 - 5	44	39.3
6 - 10	54	48.2
11 -15	14	12.5
Total	112	100.0
Age group(Years)		
25 - 29	27	24.1
30 - 34	30	26.8
35 - 39	39	34.8
40 - 45	16	14.3
Total	112	100.0
Educational Attainment		
No Formal Education	29	25.90
Primary Education	29	25.90
Secondary Education	47	42.0
Tertiary Education	7	6.20
Total	112	100.0
Marital status		
Married	92	82.1
Divorced	4	3.6
Separated	12	10.7
Widowed	4	3.6
Total	112	100.0
Primary Occupation		
Civil Servant	12	10.7
Farmer	75	67.0
Artisan	15	13.4
Business	10	8.9
Total	112	100.0
Estimated Monthly Income		
<N20, 000	52	46.4
N20,000 - 50,000	45	40.2
N51,000 - 99,000	10	8.9
N100,000 -199,999	5	4.5
Total	112	100.0

Source: Field Survey, 2013.

Table 2: Self-reported of household food security status

Item	Yes	No
Worried because food will run out before getting money to buy more food	80 (71.4)	32 (28.6)
Food bought didn't last and there was no money to buy more in the last 30days	54 (48.2)	58 (51.8)
Members couldn't afford balanced diet because there wasn't much food at home	76 (67.9)	36 (32.1)
Relied on low cost food because there was no money to buy expensive food	34 (30.4)	78 (69.6)
Members weren't eating enough because there isn't money to buy more	57 (50.9)	55 (49.1)
Members were hungry but didn't eat because there was no money to buy food	63 (56.3)	49 (43.7)
Members of household lost weight because there wasn't enough food to eat	28 (25.0)	84 (75.0)
Some members did not eat for a whole day because there was no money to buy food	18 (16.1)	94 (83.9)
We cut the size of meal because of lack of money to buy enough food		
We skip meals because of lack of money to buy food	67 (59.8)	45 (40.2)
	74 (66.1)	38 (33.9)

Source: Generated by Author with data from field survey 2013. **Note:** Percentages are in parenthesis

Table 3: Severity of food security status

Items	Frequency	Percentage
Food Security Status		
Food Secured	13	11.6
Moderately Food Insecure	87	77.7
Severely Food Insecure	12	10.7
Total	112	100.00

Source: Generated by Author with data from field survey 2013.

Table 4: Distribution of household food security status by socio economic characteristics

Socio Demographic Characteristics	Food Security Status			Total
	Food Secured	Moderately Insecure	Severely Insecure	
Age				
25 – 29	4 (3.6)	21 (18.8)	2 (1.8)	27 (24.1)
30 – 34	2 (1.8)	26 (23.2)	2 (1.8)	30 (26.8)
35 – 39	5 (4.5)	30 (26.8)	4 (3.6)	39 (34.8)
40 – 45	2 (1.8)	10 (8.9)	4 (3.6)	16 (14.3)
Education				
No Formal Education	4 (3.6)	18 (16.1)	4 (3.6)	24 (21.4)
Pry Education	2 (1.8)	24 (21.4)	1 (0.9)	27 (24.1)
Secondary Education	4 (3.6)	30 (26.8)	2 (1.8)	39 (34.8)
Tertiary	3 (2.7)	10 (8.9)	4 (3.6)	17 (15.2)
Other	0 (0)	5 (5.7)	0 (0)	5 (4.5)
Marital Status				
Married	10 (8.9)	74 (66.1)	8 (7.1)	92 (82.1)
Divorced	1 (0.9)	3 (2.7)	0 (0)	4 (3.6)
Separated	2 (1.8)	6 (5.4)	4 (3.6)	12 (10.7)
Widowed	0 (0)	4 (3.6)	0 (0)	4 (3.6)
Estimated Monthly Income				
< ₦20, 000				
₦20,000 - 50,000	6 (5.4)	43 (38.4)	3 (2.7)	52 (46.4)
₦51,000 - 99,000	5 (4.5)	34 (30.4)	6 (5.4)	45 (40.2)
> ₦100,000	2 (1.8)	5 (4.5)	3 (2.7)	10 (8.9)
	0 (0)	5 (4.5)	0 (0)	5 (4.5)
Occupation of Household Head				
Civil Servant				
Farmer	4 (3.6)	16 (14.3)	2 (1.8)	22 (19.6)
Artisan	4 (3.6)	48 (42.9)	4 (3.6)	56 (50.0)
Business	5 (4.5)	18 (16.1)	5 (4.5)	28 (25.0)
	0 (0)	5 (4.5)	1 (0.9)	6 (5.4)
Household Size				
1 - 5	6 (5.4)	35 (31.2)	3 (2.7)	44 (39.3)
6 - 10	6 (5.4)	42 (37.5)	6 (5.4)	54 (48.2)
11 – 15	1 (0.9)	10 (8.9)	3 (2.7)	14 (12.5)
	13 (11.6)	87 (77.7)	12 (10.7)	

Source: Generated by author from field survey data 2013 **Note:** Figures in parenthesis are percentages

Table 5: Multinomial regression model relating socio-economic characteristics and household food security

Dependent Variable:		Base Outcome: Moderately food insecure			
Food Security		Coefficient	Std. Err.	P> z 	Marginal effect
Severely Food Insecure	Age	-0.0091317	0.057983	0.07522*	0.0231
	Household size	0.0210133	0.531811	0.00132***	0.0431
	Education	-0.1107560	0.713827	0.08788	0.0491
	Single	0.4336632	1.553276	0.4721	0.0001
	Farm experience	-0.8230390	1.017510	0.41911	0.0321
	Monogamous	-7.5992323	2.450213	0.25545	0.5331
	Income	-0.0029377	0.000105	0.07109*	0.010
	_cons	2.3206911	2.025820	0.25221	0.066
	Age	0.21450	1.56210	0.231	0.0011
	Household size	-1.41690	0.31981	0.047**	0.0248
Food Secure	Education	0.31285	0.89412	0.013***	0.0442
	Single	0.33451	3.69123	0.898	0.3221
	Farm experience	0.00340	1.44167	0.046**	0.0220
	Monogamous	-0.32342	2.51890	0.823	0.0021
	Income	0.64101	0.24556	0.051*	0.0566
	_cons	1.4560	1.34189	0.199	0.0031

Source: Generated from field survey data 2013

Note: *, **, and *** indicate p-values significant at 10%, 5%, and 1%

Table 6: Women's health status

Variables	Frequency	Percentage
No. of Pregnancies		
1 - 4	28	25.0
5 - 8	84	75.
Total	1	100.00
No. of Children Alive and dead		
1-2	20	2.7
More than 2	2	0.3
Alive	90	97.0
Total	112	100.0
No. of Stillbirth/Miscarriage		
1-2	24	3.3
More than 2	1	0.1
Total	23	100.0
Body Mass Index		
Underweight	4	3.6
Normal	98	87.5
Overweight	8	7.1
Obese	2	1.8
Total	112	100.0

Anthropometric indices were calculated using WHO ANHTRO 2007

Table 7: Distribution of maternal health characteristics by food security status

Socio Demographic Characteristics	Food Security Status			Total
	Food Secured	Moderately Insecure	Severely Insecure	
Body Mass Index				
Underweight	0 (0)	3 (2.7)	1 (0.9)	4 (3.6)
Normal	13 (11.6)	76 (67.9)	9 (8.0)	98 (87.5)
Overweight	0 (0)	6 (5.4)	2 (1.8)	8 (7.1)
Obese	0 (0)	2 (1.8)	0 (0)	2 (1.8)
No of Pregnancies				
3	0 (0)	7 (6.2)	1 (0.9)	8 (7.1)
4	4 (3.6)	15 (13.4)	1 (0.9)	20 (17.9)
5	2 (1.8)	15 (13.4)	1 (0.9)	18 (16.1)
6	0 (0)	13 (11.6)	1 (0.9)	14 (12.5)
7	3 (2.7)	17 (19.5)	2 (1.8)	22 (19.8)
>7	4 (3.6)	20 (17.9)	6 (5.4)	30 (26.8)

Source: Generated from field survey data 2013

Table 8: Relationship between maternal health and household food security

Dependent variable:		Base Outcome: Moderately food insecure		
Food security				
Severely food insecure				
		Coefficient	Std. Err.	P> z
	Vaccination status	-0.009131	0.057983	0.7522
	Frequency of illness	0.433111	0.34211	0.0021***
	Body mass index	-0.110756	0.713827	0.8788
Food secured				
	Vaccination status	0.2145011	0.52212	0.23102
	Frequency of illness	-1.282985	0.40845	0.0111***
	Body mass index	0.3128539	0.894121	0.01302***

Source: Generated from field survey data 2013

Note: *, **, and *** indicate p-values significant at 10%, 5%, and 1%