The Influence of Women Empowerment on Child Nutrition in Rural Nigeria

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Abstract

Women empowerment is key to reducing weak dietary diversity and chronic child malnutrition. In Nigeria, child malnutrition is persistent, despite several interventions, which failed to factor in the need to empower women to eradicate the menace. In thisstudy, we examined the influence of women empowerment on child nutrition in rural Nigeria, using the five basic domains of empowerment, namely: production, resources, income, leadership and time. Data from General Household Survey Panel 2015-2016 were analysed using Poisson regression, Ordinary Least Square regression and Instrumental Variables techniques to correct for potential endogeneity. The results show that most (over 90%) of households consumed cereals, vegetables, oils and fat, spices, condiments and beverages. They also show that, on average, women had access to less than two empowerment indicators, implying low empowerment among them. Women empowerment significantly increased household dietary diversity and consequently reduced the probability of child stunting. These findings support the claim that women empowerment is a pathway out of the cycle of weak dietary diversity and consistent child malnutrition in rural Nigeria. It is, therefore, recommended that complementary and supportive policies on women empowerment, aimed at preventing and reducing severe child malnutrition in Nigeria, should be strengthened.

Key words: Child Nutrition, Empowerment, Rural Women

1.0 Introduction

1.1 Overview

Agriculture and nutrition are directly related, since agriculture provides food, which is essential for human survival. The roles of agriculture in the provision of steady income to farmers and reduction of poverty cannot be overemphasised. Gillespie and van den Bold(2017) opined that agriculture has positive influences on nutrition. Inadequate nutrition has negative effects on health (Khan et al.,2018) as malnourished people become less productive and are unable to provide for family needs. In extreme cases, malnutrition leads to death, especially among children under five years of age. Black et al. (2013) attributed about 45% of child deaths in the world to malnutrition. In Nigeria, the Demographic and Health Survey (Government of Nigeria, 2018) report showed that 37% of Nigerian children were stunted, while 22%, 7%, and 2% were underweight, wasted and overweight, respectively. The report further affirmed that malnutrition was more prevalent in rural areas where agricultural activities took place, than in urban areas. Additionally, the Food and Agricultural Organization - FAO (2017) showed that the number of undernourished people in Nigeria hasincreased to 25.58 million, considerably higher than the 13.76 million recorded in 2014, thus increasing the prevalence of undernourishment from 7.8% to 13.4%. This implies that poor nutrition is still a major problem that can hinder the achievement of the Sustainable Development Goals (SDGs) in Nigeria.

Women make up about 43% of the agricultural labour force in developing countries (FAO, 2011). In Nigeria, the agricultural sector employs about 70% of the populace in rural communities. Women are important in Nigerian agriculture especially in the different areas of the agricultural value chain, namely production, processing and marketing (Okojie, 2003). Despite the important role of women in agriculture/food production, family life and wage labour, they are faced with gender gaps in respect of access to economic resources due to various social, economic, and political barriers (Kangas et al., 2015; Quisumbing et al., 2014; FAO, 2011). These gaps result in less access to and control over productive resources, lower decision-making power in the household and children's affairs, less access to health services, and more mobility and time constraints, which are some of the catalysts and indicators of low empowerment (Peterman et al., 2015; Wouterse, 2016; Meierzu, 2016; Sell and Minot, 2018). Low-level empowerment among women could affect the well-being of women and that of their families in terms of outcomes such as the nutrition and health of household members,

thus resulting in low national economic growth and development for the country (Sraboniet al., 2014; Manfreet al., 2013). It is evident, as Kabeer (1999) explains, that empowerment expands people's ability to make strategic life choices, particularly in contexts in which this ability has been denied. The ability to make choices is made up of three dimensions, namely resources, agency and achievements.

1.2 Policies aimed at Improving Nutrition, Agriculture and Women Empowerment in Nigeria

Many policies in Nigeria have been geared towards improving the quality of nutrition among her populace, especially children, who are among the vulnerable groups. Prior to 1990, food and nutrition activities in Nigeria were carried out by the individual sector. Therefore, there were several policies that were limited in scope, uncoordinated and ineffective in comprehensively addressing the nutritional problems of the country (Nigeria National Plan of Action on Food and Nutrition, 2005). The National Committee on Food and Nutrition established by the Federal Government in 1990 formulated the National Food and Nutrition Policy in 1995. Launched in 2002, the policy aimed at addressing problems of food and nutrition across sectors and levels in Nigeria. Within it, there was a National Plan of Action on Food and Nutrition, to translate the goals, objectives and strategies of the National Food and Nutrition Policy into implementable projects and activities. The objectives of the National Plan were also to ensure the commitment of the country to achieving the goals of the World Summit for Children (1990), International Conference on Nutrition (1992), World Food Summit (1996), the Millennium Development Goals (2000), research findings from the Nigeria Food and Nutrition Survey (2001) and Nigeria Nutrition Programme Review (2001).

Inadequate implementation of policies and plans of action resulted in little or no improvement in the nutritional situation of the country, especially among the vulnerable groups, composed mostly of women and children. The policy was, therefore, reviewed in 2016. This also became necessary because of concerns in the science, practice and programming of food and nutrition activities, such as nutrition in the first 1,000 days of life, nutrition during emergencies and the prevalence of diet-related, non-communicable diseases as well as conclusions from the International Conference on Nutrition (2014). Furthermore, the review was also done following the realisation of the importance of nutrition in achieving the Sustainable Development Goals (2030) and the involvement of Nigeria in signing up for the Scaling-Up Nutrition (SUN) movement, which aimed at working with various partners to come up with common nutritional objectives and ensure food sufficiency through empowerment of women (Ministry of Budget and National Planning, 2016).

Nutrition is multi-sectoral and multi-disciplinary, involving several sectors of the economy such as agriculture, health, education and trade, among others. These sectors have developed policies and strategies to address the nutritional perspectives of their mandate. For instance, the agricultural sector of the country had policies such as the National Agricultural Policy (2000-2010), Agricultural Transformation Agenda

(2011-2015) and currently the Agricultural Promotion Policy (2016 to date). The major aim of the Agricultural Transformation Agenda was to develop an agricultural sector capable of reducing hunger by promoting income growth and accelerating reductions in nutrition and food insecurities (Federal Ministry of Agriculture and Rural Development, 2011). Women were part of the target group identified by the policy to drive growth of the agricultural sector due to the important roles they play in production, processing, marketing and operating small enterprises. Succeeding the Agricultural Transformation Agenda is the Agricultural Promotion Policy of the present administration of President Muhammad Buhari. An important guiding principle of the Agricultural Promotion Policy formulated in 2016 is the need for nutrition-sensitive agriculture, which aims at focusing policy instruments on stunting, wasting, being underweight and other manifestations of hunger and malnutrition, particularly among the vulnerable groups (Federal Ministry of Agriculture and Rural Development, 2016).

In order for the present administration to fill the gaps of gender integration and responsiveness identified in the Agricultural Transformation Agenda, a gender policy in agriculture was integrated in the Agricultural Promotion Policy of 2016. The policy complemented others in agriculture, and the National Gender Policy (2006). It was aimed at ensuring that agricultural practices at all levels were gender-responsive, as the role of agriculture could not be underestimated in the achievement of the sustainable development goals of eradicating poverty (SDG 1), ending hunger, achieving food security, improving nutrition and sustainable agriculture (SDG 2) and achieving gender equality and empowerment of women and girls (Federal Ministry of Agriculture and Rural Development, 2016).

Prior to the formulation of the National Gender Policy of 2006 and the inclusion of the gender issue in the 2016 agricultural policy, an existing medium-term plan that filled the gap created by the non-inclusion of gender-equality in most government documents was the National Economic Empowerment and Development Strategy (NEEDS). The strategy served as a target instrument for protecting vulnerable groups, ensuring affirmative action for women in all programmes, including education, access to credit and land, maternal and child care and specifically 30% affirmative action to increase women participation in decision-making and domestication of the Convention to Eliminate all forms of Discrimination against Women–CEDAW (Kezie-Nwoha, 2007).

The main objective of the National Gender Policy of 2006 was to address disempowerment among women, feminisation of poverty, gender inequality and underdevelopment in the country. Its goals were to eradicate poverty, achieve gender equality and encourage inclusiveness in governance and development. The targets of the policy used in this study are those closely related to women empowerment indicators. These are: (i) to remove all gender-based barriers, including tenure security, access to credit and inputs in agricultural production and to enhance the visibility, productivity, valuation and documentation of women's work in the agricultural sector by 2010; (ii) to ensure equal access of women and men to critical resources such as capital, labour, land, technology and entrepreneurial skills through

special initiatives, thereby reducing the number of citizens in core poverty groups, particularly women, by 2012; (iii) to guarantee equal access of women, men, girls and boys to both formal and informal education and skills development opportunities through special programmes and initiatives by 2015; and (iv) to institute the culture of respect for the rights of women and men, including freedom of expression and the elimination of all negative stereotypical representation of women and girls and the presentation of gender issues at various levels of the information dissemination and communication chain by 2010. Among the programmes/projects instituted to achieve these targets were: Growing Girls and Women Nigeria Initiatives (G-WIN); gender mainstreaming into all national, state and local government policies (NEEDS/ SEEDS /LEEDS) and Gender Action Plans for all MDAs.

From the aforementioned, women remain relevant in solving developmental problems such as child nutrition. Since one of the major goals of the National Gender Policy was to enhance women empowerment and encourage development, this study aims at examining how the policy on gender influenced the rampant child under-nutrition among under-five children in the country. It is believed that improving nutrition is not just a national agenda peculiar to Nigeria but a universal objective that must be achieved.This can be through empowering women, since they are in charge of cooking and taking care of children and other household members (Scaling up Nutrition in Practice, 2016).

1.3 Motivation

Understanding the influence of women empowerment on various sectors of the African economy is very important, as gender inequalities have been a major problem in Africa, despite various formal agreements in different conventions and commitments of different countries to bridging the gender gap (Damino and Nwakubo, 2013). Women remain dominant in the informal sector and the care economy. However, their marginalisation through some socio-cultural beliefs, norms and practices results in discrimination and feminised poverty as pointed out by the African Partnership Forum of 2007. The informal sector in which rural African women are highly prominent is agriculture. Women play an important role in the four pillars of food security: availability, accessibility, utilisation and stability (Garcia, 2013).However, they are constrained by limited access to productive resources, when compared to their male counterparts.

About 60-80% of African women are employed in agriculture, and they are responsible for 70-80% of food production (Africa Partnership Forum, 2007). In Nigeria, more than half of the agricultural labour force is also made up of women who produce about two-thirds of the food crops (Ogunlela and Muktar, 2009). Despite this important role performed by women, they have limited access to land, credit facilities, agricultural inputs, equipment, extension services, market for their produce, education and training facilities, compared to their male counterparts (Wekwete, 2014). Women empowerment is not only crucial in achieving gender equity but also in increasing

agricultural productivity and reducing hunger and poverty in Africa. The FAO (2011) affirmed that if there was equitable access to agricultural production resources such as capital, input and land among men and women, agricultural productivity would increase by 20-30%, thus reducing the number of the world's hungry people by 150 million.

Ayevbuoman et al.(2016) found that about 43% of women in rural Nigeria were being disempowered with regard to education, with the resource dimensions of empowerment contributing the highest percentages to their disempowerment. The majority of production and management decisions are carried out by men in the sector. The low decision-making power of women in agricultural production and management decisions could be attributed to lack of empowerment among women in Nigeria (Oyediran and Odusola, 2006). Heaton and Forste (2007) affirmed that the low empowerment among women affects their decision-making autonomy on the desired family size, healthcare-seeking behaviour, the amounts and types of food fed to children and themselves, and the amount of time to spend on child-rearing.

Assessing the impact of women empowerment on child nutrition is important as it gives insights into how developmental policies that would promote gender equity, increase productivity and reduce poverty and hunger can be formulated.This is in consonance with the view of Meinzen-Dick et al.,2012 where they affirmed that considering the role of gender and gender equity as important pathways in agricultural development is highly necessary if agriculture is to improve health and nutrition.

Women empowerment and nutrition are key developmental issues in the social and economic development of any nation. Assessing the impact of women empowerment on nutrition is very important at this critical period that Nigeria is experiencing food insecurity (Metu et al., 2016), high food prices (Okuneye, 2017), economic diversification from the oil sector to the agricultural sector (Uzonwanne, 2015), poor health outcomes (Onisanwa, 2014) and poverty (UN Report, 2016). The contribution of women is critical to agricultural development in Nigeria. Palacios-Lopez et al.(2017) reported that 37% of the agricultural labour force in crop production in Nigeria were women, with variations across regions in the country. Women constituted 51% and 32% of agricultural labour force in crop production in the southern and northern regions, respectively. Therefore, addressing women empowerment could impact positively on the agricultural productivity of the country.

Available studies such as those of Oyediran and Odusola(2006), Ogunlela and Muktar(2009) and Ayevbuoman et al.(2016) have assessed the determinants of women empowerment in Nigeria, and there is a dearth of information linking women empowerment to key development issues such as nutrition, especially in Nigeria. Tanankem et al. (2016) have assessed women empowerment and intra-household dietary diversity in Nigeria using the 2013-2014 General Household Survey (GHS) panel data. However, nutritionists have affirmed that dietary diversity is a measure of food security, and not a measure of nutrition. Therefore, this study distinguishes itself by its use of household dietary diversity (food security measure) as a pathway to nutrition using stunting as the indicator of nutrition. The household dietary diversity

pathway would provide more information on the linkage between food security and adequate nutrition. It would also make valuable empirical contributions to the limited literature available on the linkage between women empowerment and child nutrition in Nigeria, especially in the rural areas where agriculture predominates.The empirical evidence from the study would also show whether there is an improvement in women empowerment indicators such as accessibility to productive resources, decision-making power, and control over income and leadership roles among rural women in Nigeria.

The consideration of gender role and gender equity in agriculture could have a positive impact on the health and nutrition of women and of their household members, thus leading to agricultural development and economic growth (Meinzen-Dick et al., 2012). This study is also important as it unveils the role of women in decision making in agriculture. This is necessary because the decisions made by women often influence the possibility of translating income to improvement in the nutritional status of household members. The outcome of this study would help in the development of effective and holistic gender-responsive policies that will enhance women empowerment; improve child nutrition and food insecurity; improve agricultural production, productivity and farm income; and reduce poverty and inequality in the country.

Evidence from this study would enable the Nigerian government to understand how effective the National Gender Policy and the Integrated Gender Policy in the Agricultural Promotion Policy have been, and how they could be strengthened to enable the country achieve the Sustainable Development Goals of gender equity, zero hunger and wellness for all, come 2030. It would also aid the attainment of inclusive and sustainable growth and development as specified in the African Agenda 2063. From the aforementioned, the research question is "Does women empowerment influence child nutrition in rural Nigeria? The objective is to examine whether women empowerment influences child nutrition in rural Nigeria.

2.0 Literature Review

The ability to make choices in respect of empowerment has three dimensions, which are resource, agency and achievement. The resource and achievement domains, which are related to income and educational achievement,have been well documented in the literature on empowerment. The relative ability of women to generate income from agricultural activities has been limited by factors relating to their empowerment. Quisumbing and Maluccio (2003) identified the empowerment-related factors as limited use, ownership, and control of productive physical and human capital. However, there is only scanty literature on the agency domain of empowerment.

Literature on the resource domain of empowerment reveals that increasing women's control over the use of resources has positive effects on development indicators, such as their share of household budgetary expenditure (Doss, 2006; Duflo and Udry, 2004), child health outcomes (Skoufias, 2005;Quisumbing and Maluccio, 2003) and productivity (Kilic et al., 2013; Peterman et al., 2010). Also, literature on the achievement domain relates empowerment in terms of educational achievement and training to better child nutritional outcomes and access to knowledge and information on improved child health (Webb and Block, 2004; Babatunde et al., 2011, Abuya et al., 2012, Adekambi et al., 2013) and increased adoption of new technology (Awotide et al., 2016; Nwaobiala and Uchechi, 2016).

The agency domain of empowerment has received attention in recent times. However, a large proportion of women are still disempowered (Sraboni et al.,2014; Ayevbuoman et al., 2016). Malapit et al. (2013) and Sraboni et al.(2014) found that the leadership domain of empowerment contributed the highest percentage to women disempowerment in Nepal and Bangladesh. Sraboni et al. (2014) opined that increase in women's empowerment is positively associated with calorie availability and dietary diversity at the household level in Bangladesh. The factors that positively influenced women's empowerment in Nigeria,as revealed in the study of Ayevbuoman et al.(2016), were the age of the woman, age of the household head, and employment in skilled and unskilled sectors while gender of household head, employment in agriculture and allied sectors, household size and location of rural women in the northern region of Nigeria were the factors that influenced women's empowerment negatively. However, the effect of empowerment may be positive or negative. For instance, women's empowerment with respect to employment increases their income but at the same time reduces the time allocated to child care and domestic

responsibilities. This may, in turn, lead to poor health outcomes for children.

Yaya et al. (2020) used the Demographic and Health Survey data for 30 countries to establish the association between women's empowerment and child malnutrition in Sub-Saharan Africa. The indicators of women's empowerment used in the study were decision-making and attitude towards domestic violence, while stunting and underweight were used to capture child nutrition. The data were analysed at bivariate and multivariate levels using chi-square and regression models. The results revealed that attitudes towards violence and experience of violence showed positive association with childhood nutritional status, while women's decision-making showed negative association with childhood nutritional status.

Jones et al. (2019) analysed women's empowerment and child nutrition using Demography and Health Survey data of 2011-2016 for five African countries, namely Ethiopia, Kenya, Rwanda, Tanzania and Uganda. Child nutrition was captured using anaemia, stunting and underweight, while woman empowerment was captured using three latent domains, namely, social/human assets, intrinsic agency and instrumental agency. Data were analysed using the Structural Equation Models. The results revealed that the domains of women empowerment were directly and positively associated with maternal Body Mass Index (BMI). Maternal BMI was also directly and positively associated with child stunting and child underweight. Shafiq et al. (2019) examined the effect of women's empowerment on child nutritional status in Pakistan using the 2012-2013 Pakistan Demography and Health Survey data. Child nutritional status was measured using the composite index of anthropometric failure, while women empowerment was captured using their education, employment status and household decision-making. Data were analysed using binary logistic regression. The results revealed that women's empowerment indicators, namely education and employment status, had negative relationship with child malnutrition while women decision-making power about visits to family had insignificant effect on child malnutrition in Pakistan.

A systematic review of the role of women's empowerment in child nutrition outcomes by Santoso et al. (2019) yielded evidence of 62 quantitative studies that used 200 indicators of women's empowerment with various child nutrition outcomes. It was concluded that there was an inconclusive relationship between women empowerment and child nutrition, as a larger percentage of association with stunting and wasting outcomes were not significant. Despite the large number of unique women's empowerment indicators used by the studies, indicators such as time resource allocation, reproductive decision and indicators for men's engagement in child care and nutrition were omitted. Also, a synthesis of the literature review on women's empowerment and child nutritional status in South Asia using three domains of women's empowerment, namely control of resources and autonomy, workload and time, and social support was done by Cunningham et al. (2015). Evidence revealed that women empowerment was associated with child nutrition, but the findings were mixed, given the inter-study differences in population characteristics, methodologies, conceptualisation of women empowerment and child nutrition indicators.

Van der bold et al. (2013) reviewed the effects of three interventions, namely: cash transfer programmes, agricultural intervention and microfinance programmes on women's empowerment, nutrition and both. The conditional cash transfer programmes produced mixed impact on long-term nutrition status and a positive impact on women empowerment, while the unconditional cash transfer programme indicates mixed impacts on women empowerment and positive impact on nutrition. Agricultural interventions such as home gardening and dairy projects showed very little impact on nutrition and a mixed impact on women empowerment. Evidence of microfinance programme on both women empowerment and nutrition were mixed. The review of literature reveals that there is mixed effect of women's empowerment on child nutrition. The variations range from population characteristics, data used, indicators of women's empowerment, and nutrition utilised by different studies, among others. The review also reveals that there are limited studies associating women's empowerment with child nutrition in the Nigerian context, thus re-emphasising the need for this study.

Figure 1: Relationship between women's empowerment and child nutrition
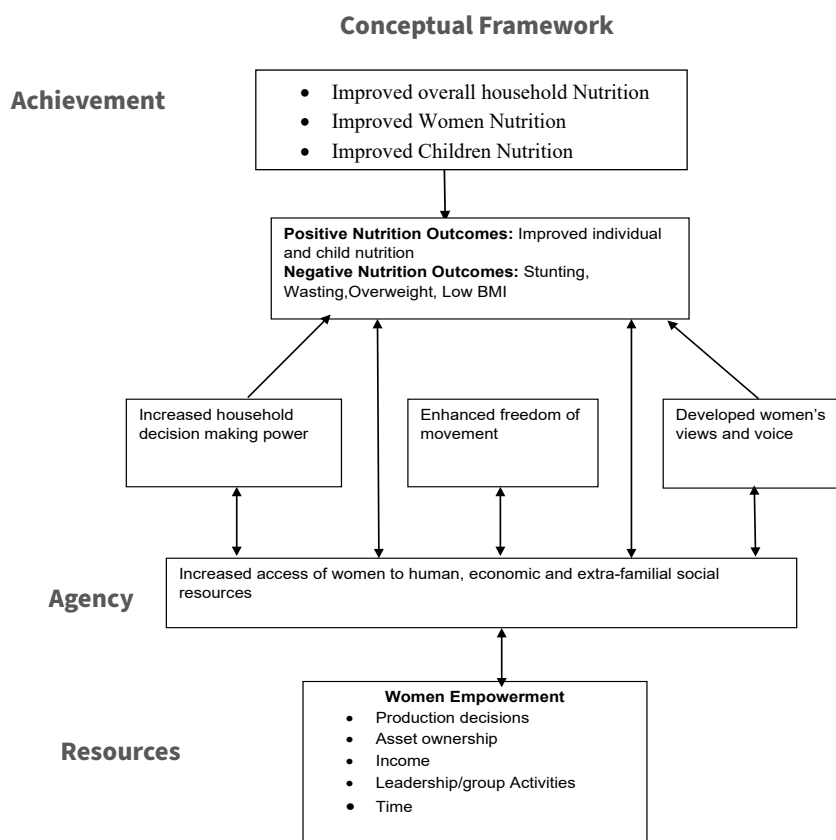
Source: Adapted and modified by authors' from Yount (2017)

The framework in Figure 1 shows the relationship between women empowerment and child nutrition. Women accessibility to empowerment indicators such as production decisions, asset ownership, income, leadership/group activities and time could enable them to acquire resources to develop their views and voice, increase their decision-making capacity and fulfil their aspirations. This can also be vice-versa as women's access to resources to develop their views and voice, increase their decision-making capacity, and fulfil their aspirations, could also empower them. The resources that could be acquired by women include human resources such as schooling, skills development and self-efficacy; social resources such as participation in organisations, access to peer networks and role models outside their family; and economic resources such as earnings, property and land. Women's access to these resources will improve their decision-making within the household, enhance their freedom of mobility, and also develop their views and voice. Also, improvement in women's decision-making, freedom of mobility and development of views and voice could enhance their access to resources. Access to human, economic and extra-familial social resources could lead to positive or negative nutrition achievements, thus re-emphasising the mixed effects reported by previous literature. Positive nutrition outcomes, that is improved nutrition for adults and children within the household, would be achieved if economic gains as a result of women's empowerment are used to provide household members, especially children, with nutritious diets while negative nutrition outcomes such as stunting, wasting, overweight and low BMI could occur due to limited time for child care and preparation of nutritious meals, thereby making household members, especially children, to rely on alternative child care options, consumption of fast foods and other junks that may be detrimental to their health.

3.0 Methodology

Scope of the study: The study covered rural households in Nigeria, a West African country with a population of 195,875,237 persons in 2018 and a land area of 923,768 km^2. The country shares land borders with the Republic of Benin in the west, Chad Republic and Cameroon in the east, Niger Republic in the north and the Gulf of Guinea in the south. Nigeria is the most populous country in Africa and the 9th most populousin the world. The country is made up of six geo-political zones, 36 states and 774 local governments. The capital city of Nigeria is Abuja. Besides oil, agriculture is the most significant contributor to the Nigerian economy. Agricultural activities that take place in Nigeria include crop and livestock production.

Source and type of data: Data for this study were sourced from the General Household Survey (GHS) panel of 2015-2016, which is a secondary source. GHS is a nationally representative survey of approximately 5,000 households sampled by the Nigeria Bureau of Statistics (NBS), in collaboration with the Federal Ministry of Agriculture and Rural Development, National Food Reserve Agency, Bill and Melinda Gates Foundation and the World Bank. The 2015-2016 GHS panel data is the third wave.The survey was carried out as part of the Integrated Survey on Agriculture Programme, which was revised in 2010 to include a panel component to enhance the collection of agricultural data. The survey used a multistage, stratified sample selection process. Sixty primary Enumeration Areas (EAs) were selected from each of the 37 states, making a total of 2,220 EAs. Each EA contributed 10 households to the GHS sample, thereby giving a sample size of 22,200 households. Out of the 22,200 households, 5,000 from 500 EAs were selected. Due to the movement of households from their locations, only 4,581 households were interviewed in the third wave compared with 4,916 in the first wave. The units of analysis used in the data were the household, individual and community. Information on the household (education, labour, health, child development, ICT, credit, food and non-food expenditure and aggregate food consumption, among others),agriculture (land inventory, labour, input costs, fertilizer acquisition and land tenure, among others), and the community information (community infrastructure, community organisation, community resource management, conflict and food prices, among others)[1] were collected. For the purpose of this study, the individual and household units of analysis were used.

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1 This data can be accessed at www.microdata.worldbank.org.

Data from the 2015-2016 GHS panel on 2,346 women between 15 and 60 years old and from households with under-5 children were used for the study.

Choice of women empowerment indicators: Women e mpowerment indicators for this study were chosen following Alkire et al.(2013) andTanankem et al. (2016). Due to the limitations of data on empowerment indicators in the GHS, five indicators were used from five domains of empowerment. The domains and indicators that really reflect the empowerment indices within the Nigerian context were also considered. The domains of empowerment used were production, resources, income, leadership and time, while the indicators were inputs in production decisions, ownership of assets, control over use of income, group membership and workload. The choice of these indicators was informed by extensive evidence, which shows that women have limited roles in decision-making on farming activities in Nigeria, especially in rural areas where they constitute the majority of those involved in farm labour (Rahman, 2008; Ogunlela and Muktar, 2009; Ngodoo and Idisi, 2014).

The study of Oladokun and Adenegan (2017) confirmed that the majority of rural women in Nigeria owned physical assets such as mobile phones and radios while less than 10% of the women owned natural assets such as land. The authors further affirmed that the majority of women in rural Nigeria have no control over the assets they own.George et al. (2015) opined that lack of access to land and ownership of land rights among women tend to compromise their access to credit facilities. In terms of the ownership of livestock, women generally own poultry and small ruminants such as sheep and goats, unlike cattle ownership that is male-dominated, especially in the northern part of the country (Kelleher, 2018). Empirical evidence has also shown that women in Nigeria have greater control over their income (Salman et al., 2020; Kelleher, 2018). It has been confirmed that a higher percentage of women in Nigeria participate in different categories of cooperatives, and the activities of these societies have contributed positively to entrepreneurship and rural development (Awotide, 2012; Umeh et al., 2017; Beshel and Okeme, 2018). Adeyonu (2012) affirmed that women in rural southwestern Nigeria allocate more time to work (farming, non-farming and household activities) than their male counterparts. These women also allocate lesser time to leisure activities than their male counterparts. Table 1 shows the domains and indicators of women empowerment used in this study.

Table 1: Domains and indicators of women empowerment used in the study

Domain	Indicator	GHS variable to be used	Modalities
Production	Input in productive decisions	Woman decides on agricultural production activities	Yes, No
Resources	Ownership of assets	Individual owns an asset (land or livestock)	Yes, No
Income	Control over use of income	Individual has control over at least one type of income	Yes, No
Leadership/ Group Activities	Group membership	Respondent participates in cooperatives in the last six months	Yes, No
Time	Workload	Woman uses time to engage in non-farming activities	Yes, No

Source: Authors' compilation from the GHS 2015/2016 data

4.0 Analytical Techniques

4.1   Polychoric Principal Component Analysis

To generate the women empowerment index, the Polychoric Principal Component Analysis (PPCA) was used. Generally, the classical PPCA was conceptualised for the analysis of quantitative data. It comes with the assumption that input variables to be used in the aggregation procedure are normal on the multivariate scale (Qian et al., 1994; Kolenikov and Angeles, 2009). But most of the variables required for assessing women empowerment are discrete (in nature). Discrete data fail to retain the multivariate normality assumption. Therefore, it will be inappropriate to apply classical PPCA to categorical data[2]. Over and above this deficiency, Kolenikov and Angeles(2009)noted that discrete data tend to have high skewness and kurtosis.[3] However, Kolenikov and Angeles (2009) noted that the use of dummies in the PPCA can produce specious and spurious correlations among the variables of interest. This is due to the possibility of categorical dummies produced for the same variables being negatively correlated. This, therefore, requires that the PPCA considers both the (habitually) positive correlations among observed variables and the negative correlations among the dummies for the same variable. Consequently, the PPCA may not be able to generate correct results because the greater variability observed could be from the spurious correlations.

In overcoming the above problems, Kolenikov and Angeles (2009) introduced the Polychoric Principal Component Analysis (PPCA) for analysing the discrete variables. They proposed a polychoric correlation matrix for discrete variables. The matrix would then be used for the PCA. The maximum likelihood estimation is applied for generating the polychoric correlation matrix.

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2 Application of discrete data for factor analysis generates wrong conclusions and biased estimates for the factor loadings (Olson, 1979).

3 Various studies (see Bollen and Barb, 1981; Johnson and Creech, 1983; Babkus et al., 1987; Dolan, 1994; DiStefano, 2002) have discussed in detail the major concerns regarding the use of discrete data in multivariate analysis.

4.2   Household Dietary Diversity Score

Household Dietary Diversity Score (HDDS)was used to assess how farming households diversify their diets. It is the simple count of food groups that a household has consumed, using a seven-day memory recall. The HDDS shows the economic capability of the household to access different food types. HDDS for individual households was used in the study. Table 2 shows the food groups and their examples, as used in this study.

Table 2: Food group and examples of food groups used in the study

	Food Group	Examples
1	Cereals	Corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) plus other local foods e.g. *ugali, nshima*, porridge or paste
2	Roots and tubers	White potatoes, white yam, white cassava, or other foods made from roots or sweet potato
3	Vegetables	Dark green leafy vegetables, including wild forms + locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach, pumpkin, carrot, squash, other locally available vitamin-A-rich vegetables (e.g. red sweet pepper)other vegetables (e.g. tomato, onion, eggplant) + other locally available vegetables
4	Fruits	Ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + other locally available vitamin A rich fruits, other fruits, including wild fruits and 100% fruit juice made from these
5	Flesh and organ meats	Liver, kidney, heart or other organ meats or blood-based foods, beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects
6	Eggs	Eggs from chicken, duck, guinea fowl or any other egg
7	Fish and sea foods	Fresh or dried fish or shellfish
8	Legumes, nuts and seeds	Dried beans, dried peas, lentils, nuts, seeds or foods made from these (e.g. hummus, peanut butter)
9	Milk and milk products	Milk, cheese, yogurt or other milk products
10	Oils and fats	Oil, fats or butter added to food or used for cooking
11	Sweets	Sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes
12	Spices, Condiments and Beverages	Spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages

Source: Authors' compilation

Poission Regression

In modelling the determinants of household food security, we used the Poisson regression model. The dependent variable used was the Household Dietary Diversity Score (HDDS), which is the number of different food groups consumed. Since it is a discrete variable, it is appropriate to use a model for count data based on a Poisson distribution. Following previous studies (Ochienget al.,2017; Cheteni et al.,2020), the study defines as the number of food groups consumed by the household using seven-days memory recall. The variable Y_i is assumed to be distributed as a Poisson distribution with parameter $\delta_i \delta_i$ given as:

$$P(Y_i = y_i) = \frac{e^{-\delta} \delta_i^{y_1}}{y_1!} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$

Where can be specified by a vector of covariates X_i that includes the variables in Table 2. More often than not, is log linear function which assumes the form:

$$In(\delta_i = B_i x_i) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(2)$$

The log linear model guarantees that the number of food groups consumed by the household is a non-negative integer and is given as:

$$E(y_i|x_i) = \delta_i = e^{B_i x_i} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (3)$$

The empirical model is given as:

$$\delta_i = E(y_i|x_i) = \beta_0 \delta_i = E(y_i|x_i) = \beta_0 + x_i \beta_i x_i \beta_i + w_i w_i \dots\dots\dots\dots\dots\dots(4)$$

Where yi is the household dietary diversity score (HDDS);i.e.number of food groups consumed by household i over the reference period. β_0 is the constant term, βi are the coefficients, x_i is the set of explanatory variables and ε is the error term.The explanatory variables x are specified as:

Household and Demographic Characteristics
$x_{1=}$ Household size (log)

x_2 =Resident in the North (1 if yes; 0 if otherwise)

Women Characteristics
x_3= Mother's age (years)
x_4= Mother's primary education

x_5= Mother's secondary education

x_6= Mother's tertiary education

Farm Characteristics

x_7= Land size cultivated (ha)

x_8= Proportion of crop value sold (₦)

x_9 = Extension service access (1 if yes; 0 if otherwise)

x_{10}= Use of improved seed (1 if yes; 0 if otherwise)

Institutional variables

x_{11}= Access to credit

x_{12}= Access to extension services

x_{13}= Membership of social group

IV-Probit Regression Model

To examine the relationship between women empowerment and child stunting, the regression model below was used:

$$CS_i = \beta_0 + V_i\beta_i + w_i \quad\quad \text{...(5)}$$

where CS_i is represented as 1/0;CS is 1 when child is stunted and 0 if otherwise.V_i is women empowerment score in farming household *i*. A positive and significant estimate for β_i implies that a higher women empowerment index is associated with higher household dietary diversity, as is commonly assumed. A negative but significant estimate for β_2 implies that the strength of the association is diminishing at higher levels of women empowerment. Lastly, ω_i represents the random error term in the model.

In the model, the relationship among child stunting, the number of food groups consumed in households (HDDS) and women empowerment were established. The endogenous nature of the women empowerment index implies that if the equation is estimated by OLS, the point estimates would be biased and inconsistent since the error terms will be correlated with CS_i. Therefore, in the IV-Probit model,the residual of the HDDS was inserted into the child stunting equation. Equation 2 is then represented as:

$$CS_i = \beta_0 + V_i\beta_i + R_i\beta_i v_i \quad\quad \text{...(6)}$$

where R is the HDDS residual

Household and Demographic Characteristics

$V_1 =$ Household size (log)

$V_2 =$ Resident in the North (1 if yes; 0 if otherwise)

Women Characteristics

$V_3 =$ Mother's age (years)

$V_4 =$ Mother's primary education

$V_5 =$ Mother's secondary education

$V_6 =$ Mother's tertiary education

Child Characteristics

$V_7 =$ Child's sex (1 if male; 0 if otherwise)

$V_8 =$ Child's age (months)

Farm Characteristics

$V_9 =$ Land size cultivated (ha)

$V_{10} =$ Proportion of crop value sold (₦)

Women Empowerment

$V_{11} =$ Women empowerment index

$V_{12} =$ Women empowerment index * North

$V_{13} =$ Women empowerment index * Educated women

In this model, the women empowerment index was instrumented, since literature has established that empowerment is endogenous. In congruence, in this study, we acknowledge that women's empowerment status is potentially endogenous to child nutritional outcomes (such as stunting). A possible source of endogeneity is unobserved heterogeneity, which is more likely in our context as it cannot be ruled out that unobserved factors influence women empowerment and child nutrition outcomes simultaneously. For example, unobserved characteristics such as women's leadership or control over the use of household income could potentially affect both child stunting and their empowerment status. Endogeneity may also arise from reverse causation between women's empowerment and child nutrition outcomes. Women's empowerment may improve child nutrition by encouraging a more optimal allocation and organisation of productive resources, while poor child health (stunting) increases the burden and time women dedicate to child-rearing or caregiving, which may likely increase some of the constraints placed on them and open opportunities for active participation in productive activities.

Following Lépine and Strobl (2013), the instrument that was used for the empowerment index is ethnicity. The authors submitted that the ethnicity of a woman may influence her bargaining power within the household, since different ethnic groups

have different social norms that serve as threat points in intra-house bargaining power. To obtain a consistent estimator, the assumption of the existence of an Instrumental Variable (IV) that satisfies the assumption for correcting the endogeneity problem was maintained. Thus, the instrument needs to be strongly correlated with women empowerment (index generated) but not with other unobservable characteristics represented in children's nutritional status error term. The approach of presenting a "reasonable" instrumental variable stemmed from the role and dynamics of the ethnicity of the mother of the child in terms of her connection to the empowerment dimensions. More specifically, McElroy(1990) submitted that social norms may differ across ethnic groups, with the potential to place threat sockets in intra-household bargaining and decision making on the indicators of women empowerment. For instance, studies (Kevane and Wydick, 2001; Nikièma et al., 2008) revealed that there is a disparity in labour allocation and autonomy for women empowerment dimensions among different ethnic groups. Similar findings were recorded by Lépine and Strobl (2013). The strong correlation between ethnicity and women empowerment in Sub-Saharan African countries is widely reported in the literature (Kevane and Wydick, 2001; Nikièma et al., 2008; Kasturirangan, 2008; Kasturirangan et al., 2004; Lépine and Strobl, 2013). Interestingly, aside from the validity test for the variable, ethnicity plays an important role in the level of women empowerment in Nigeria, which makes it a suitable instrument for women empowerment.

In this study, it was also operationalised that women in the northern region of Nigeria, especially the Hausas and Fulanis, are less autonomous than women in the southern region (the Yorubas and Igbos)as established in Salman et al. (2020). They are more conservative due to their culture and religion. Their southern counterparts have always played more economic and political roles, since their society gives room for women to be productively engaged. To properly capture the relationship between ethnicity and empowerment, conditional on the ethnicity of the community of residence of the woman, a variable called relational ethnicity was constructed. The variable takes the value of 1 if the woman is Hausa or Fulani and lives in the southern region, 2 if the woman is Hausa or Fulani and lives in the northern region, and 3 if the woman is Igbo or Yoruba and lives in the southern part of the country. We used category 1 (woman is Hausa or Fulani and lives in the southern region) as the reference point while focusing on the other two categories (reconstructed to dummies), which are the ethnicity of the majority of women living in the community. As can be seen from Appendix 2, this variable is a significant predictor of women's empowerment and takes on the expected negative sign. It is important to state the underlying identifying assumption of using relational ethnicity as an instrument. More specifically, the identifying assumption is that there are no other factors correlated with women's empowerment that will not be controlled for but are correlated with the status of child nutrition (Child stunting, that is, height-for-age z-score HAZ).

5.0 Results and Discussions

5.1 Descriptive Statistics of Selected Variables

The average age of the household heads was 31 years and about 77% of them were male. Table 3 shows that most of the women are from large households (5.62 members). Studies (Malapit et al., 2013; Kappmair et al., 2016; Tanankem et al., 2016) have asserted that larger households are likely to diversify diets. The average age of the women in the study was 30.64 years and only about 6% had post-secondary education, while over 30% had no formal education. This shows that women had low educational attainment. Only about 16% of women in farming households used improved seeds for cultivation. The average land size cultivated was 1.1hectares. The average annual income generated from farming activities was ₦125,560.10. The results also show that about 38% of the children were stunted.

Table 3: Summary statistics of selected variables

	Variable	Observations	Mean	Std. Dev.	Min	Max	
Household Characteristics	Age of HH	2,346	30.6440	10.1009	15	60	Age of household head in completed years
	Sex of HH	2,346	0.7749	0.4177	0	1	1 if household head is male, 0 otherwise
	HH size	2,346	5.6210	1.7583	2	29	Number of household members
	Nonfarm_income	2,346	287,966.1	8011.4	26,680	2,000,000	Non-farm income (local currency)
	Number of food groups consumed	2,346	8.5336	1.8179	1	12	Number of food groups individual consumed last week HDDS - PH
Childs' Characteristics	HAZ_Dummy: Stunting (HAZ <-2SD)	2,346	0.3751	0.4842	0	1	1= if a child is classified as stunted based on HAZ less than two standard deviations below the median
	Height-for-age z-scores (index)	2,346	-1.2344	2.1732	-6.78	5.96	Height-for-age z-scores (HAZ)
	child_age (months)	2,346	30.8222	7.5421	0.13	60.95	Age of the child in months
	child_sex (male)	2,346	0.9279	0.2586	0	1	1 if the sex of the child is male
Womens' Characteristics	No formal education	2,346	0.3145	0.4644	0	1	Dummy for education if obtain no formal education
	Primary	2,346	0.2762	0.4472	0	1	Dummy for education primary education
	Secondary	2,346	0.1756	0.3805	0	1	Dummy for education secondary education
	Post –Secondary	2,346	0.0626	0.2424	0	1	Dummy for education post-secondary (not tertiary)
	Age women	2,346	30.6441	10.1009	15	60	Age of the women
	Extension reach	2,346	0.1376	0.3446	0	1	1= Household reached by extension services
	Emp. Index	2,346	0.3347	0.2551	0.00479	1	Modified Women empowerment index generated
	Emp. Score	2,346	1.6837	1.0752	0	5	Modified Women empowerment score generated
Farm Characteristics	imprv_seed~e	2,346	0.1577	0.3645	0	1	1= Household uses improved seed
	Land size cultivated	2,031	1.1056	0.2759	0.1113	6.2976	Area Planted in Hectares
	farm_income	2,346	125,560.1	10,133.1	23,700	105,1867	Farm income (local currency)
Geopolitical Zones	n_central	2,346	0.1474	0.3546	0	1	1=woman is from north central geopolitical zone
	n_east	2,346	0.2438	0.4294	0	1	1=woman is from north east geopolitical zone
	n_west	2,346	0.3427	0.4747	0	1	1=woman is from north west geopolitical zone
	s_east	2,346	0.1116	0.3150	0	1	1=woman is from south east geopolitical zone
	s_south	2,346	0.1219	0.3272	0	1	1=woman is from south south geopolitical zone
	s_west	2,346	0.0323	0.1770	0	1	1=woman is from south west geopolitical zone
Ethnicity (Instruments)	Hausa	2,346	0.4718	0.4993	0	1	1 if ethnicity is Hausa
	Igbo	2,346	0.1253	0.3311	0	1	1 if ethnicity is Igbo
	Yoruba	2,346	0.0298	0.1701	0	1	1 if ethnicity is Yoruba
	Fulani	2,346	0.0605	0.2385	0	1	1 if ethnicity is Fulani
	Others	2,346	0.2531	0.4349	0	1	1 if ethnicity is otherwise

Source: Data analysis from GHS 2015/2016

5.2 Food Groups Consumed by Households

The foods consumed by households are reported in Table 4. An average of 8.47 food groups were consumed by each household (Table 5). The majority (over 90%) of the households consumed cereals, vegetables, oils and fat, spices, condiments and beverages. Also, about half of the households consumed protein sources, such as

meat and fish, while the least consumed food groups were milk and milk products (36%) and eggs (11%). The household's high consumption of carbohydrates and low consumption of livestock and poultry-related products such as milk and eggs, which are good sources of protein, can be very detrimental to the health of members, especially children. It is pertinent to state that the intake of adequate nutritional foods in the early stages of a child's development is very instrumental to the proper maintenance of the child's current body mass and facilitates the child's normal growth and development.

Table 4: Summary statistics for food group consumption

Variable	Observation	Proportion	Std. Dev.	Min	Max
Cereals	2,346	0.9953	0.0683	0	1
Root and tubers	2,346	0.7489	0.4337	0	1
Vegetables	2,346	0.9829	0.1294	0	1
Fruits	2,346	0.5119	0.4999	0	1
Meat	2,346	0.6381	0.4806	0	1
Eggs	2,346	0.1146	0.3186	0	1
Fish	2,346	0.5861	0.4926	0	1
Legumes and seed	2,346	0.9023	0.2968	0	1
Milk and milk products	2,346	0.3614	0.4805	0	1
Oil and fats	2,346	0.9820	0.1326	0	1
Sweets	2,346	0.7557	0.4297	0	1
Spices, condiment and beverages	2,346	0.9539	0.2096	0	1

Source: Data Analysis from GHS 2015/2016

5.3 Household Dietary Diversity Score

Dietary diversity was used as a proxy for household food security. Table 5 shows that more than half of the households had dietary diversity scores ranging between 7 and 9. This implies that about 50% of the households consumed items at least from 7 food groups out of the 12 considered. About 5% consumed all items in the 12 food groups. This is an indication of gross absence of a healthy diet in rural Nigeria.

Table 5: Household score based on number of food groups consumed

Score	Frequency	%
1	2	0.09
2	0	0.00
3	6	0.26
4	16	0.68
5	97	4.13
6	177	7.54
7	371	15.81
8	504	21.48
9	450	19.18
10	353	15.05
11	260	11.08
12	110	4.69
Total	2,346	100.00

Source: Data analysis from GHS 2015/2016

5.4 Indicators of Women Empowerment Index

Table 6 contains the summary statistics of the variables used for generating the Women Empowerment Index. More than half of the women used part of their time engaging in non-farm enterprises and had control over a t least one type of income. Engagement in non-farm enterprises among women as a livelihood diversification strategy increases well-being, reduces vulnerability to risks and shocks, improves food and nutrition security, and ensures more sustainable use of natural resources (Eneyew and Bekele, 2012; Uzonwanne, 2015; Ajayi et al., 2016). Engaging in non-farm enterprises will remain relevant if it has the potential and wherewithal to meet the immediate needs of the people, while its ability to meet future needs is not jeopardised.

Additionally, less than 18% made decisions about agricultural production or had control over assets or credits while only 3% were members of social groups in their communities. This implies that women in rural Nigeria are still faced with gender-based barriers in tenure security, access to credit, and inputs that would enhance their visibility, productivity and valuation, and the documentation of their work in the agricultural sector. These findings also show that the low autonomy associated with women in rural Nigeria, which can be traced to cultural and social norms in most parts of the country, results in the inability to eradicate gender-based barriers in resource access as part of the target slated to be achieved in 2010 in the National Gender Policy of Nigeria. The women had an average empowerment index of 0.3347 (Table 3).

Table 6: Summary statistics for indicators of women empowerment

Variable	Observation	Proportion	Std.Dev.	Min	Max
Used time engaging in non-farm enterprises	2,346	0.7655	0.4237	0	1
Makes decision about agricultural (crop or livestock) production	2,346	0.1683	0.3742	0	1
Control over resources (assets and credits)	2,346	0.1756	0.3805	0	1
Member of social group	2,346	0.0332	0.1793	0	1
Control over at least one type of income	2,346	0.5409	0.4984	0	1

Source: Data analysis from GHS 2015/2016

5.5 Women Empowerment Score

The average empowerment score for each woman was 1.68 (Table 3). This implies that, on average, each woman had less than two empowerment indicators. This is an indication of low empowerment among rural women in Nigeria. This finding is typical of women in Sub-Saharan African (SSA) countries. The African Development Bank Group (2015) reported that women in Africa had low bargaining power and were less empowered. While the majority of these women work (mostly in micro-enterprises), they still face economic exclusion as they are underpaid and most of their jobs are found in the informal sector. This affirmation was also supported in this study as represented in the distribution of the scores in Table 7, which shows that over 70% of the women have empowerment scores below 4. Almost 14% of the women did not have any of the indicators of empowerment, while less than 1% had all the indicators of empowerment.

Table 7: Distribution of women empowerment scores

Empowerment score	Freq.	%
0	321	13.68
1	710	30.26
2	864	36.83
3	304	12.96
4	135	5.75
5	12	0.51
Total	2,346	100.00

Source: Data analysis from GHS 2015/2016

5.6 Determinants of Household Food Security

In examining how women empowerment influences nutrition outcomes among children, the drivers of household food security within households with under-five children were assessed. The results of the econometric estimation are summarised in Table 10. The factors determining household food security were modelled using the Poisson regression model. Poisson regression allows for the estimation of models with count data such as the household dietary diversity score (which ranges from 0 to 12) in this study. In addition, when estimating the count data, the model assumes that the results are Poisson-distributed. We also estimated Ordinary Least Squares (OLS) to validate the study findings. Comparing results based on the two models is important because, originally, Poisson regression model was used when modeling count data. We reported the Poisson result based diagonistic indicators showing goodness-of-fit of the model. The coefficients were more significant in the Poisson model, and this model was selected according to the likelihood test and the Wald test. However, as the significant factors did not change that much compared to the OLS model, the Poisson results are reliable, robust, and estimated with robust standard errors.

5.6 Household Characteristics

The results revealed that household size had positive and significant growth effects on the HDD of rural households. This implies that households with more members are more likely to consume items from more food groups than households with fewer members. This result could be associated with a larger supply of family labour for agricultural activities, which could result in increased agricultural output, farm income and access to different food groups. The result is congruent on the role of high household size (Olagunju et al.,2019;Ogunniyi et al., 2018). Being in the northern zones (north-east, north-west and north-central) had significant negative relationships with the dietary diversity of rural households in Nigeria. This implies that farming households in the northern zones were less likely to have a variety of foods in their diets. This could be associated with higher level of poverty and insecurity in northern Nigeria. The northern zones of Nigeria have a higher poverty incidence compared to the southern zones (Oyekale et al., 2011; Ajakaiye et al., 2014; Ogunniyi et al., 2016). Household income was also found to positively and significantly influence food security of the households. The probable reason for the result may be that as household income increases, the budget allocation for food expenditure may increase, which may increase the diversity of diet consumed in the households. The result is consistent with the previous studies (Cordero-Ahiman, 2021; Agrawal et al., 2019; Ritzema et al., 2019) suggesting that as household income increases, dietary diversity expands.

5.7 Farm Enterprise Characteristics

For household per capita income, the regression reveals that an increase in the income of rural households raised the number of food groups they consumed. Hussein et al. (2016) revealed that despite the availability of diverse food products in the markets, most farming households depended on the food they produced as they could not afford to buy from the markets. Higher household income, therefore, translates to higher purchasing power to buy items from other food groups. Ogunniyi et al. (2021) revealed that increases in per capita income of farming households could significantly raise their dietary diversity. Hussein et al. (2016) revealed that despite the availability of diverse food products in the market, most farming households depend on food produced, which was often insufficient to meet their nutritional need as they could not afford to buy from the market. HDDS was also more likely to increase among households that used improved seed varieties. This could be associated with the higher level of productivity that may result from the use of improved inputs (Babu et al., 2020; Ogunniyi et al., 2021; Balana et al., 2021).

5.8 Women's Characteristics

The HDDS of households improved with mothers' education. This is evident when compared to households without educated mothers. The coefficients for mothers with secondary and tertiary education were both positive and the magnitude of the coefficients increased with the level of education. The result is consistent with the findings of Tanankem et al.(2016), FAO (2011) and World Bank (2011).

5.9 Institutional Characteristics

Studies (Ogundipe et al., 2017; Olagunju et al.,2019; Ogunniyi et al., 2020;Balana et al., 2021) have shown that institutional variables are key to enhancing household food security. The coefficient of farming households that have access to extension agents also had a positive relationship with household food security. This implies that when households have access to extension agents, they are more likely to improve their dietary diversity by adding items from a variety of food groups to their meals. The results show that access to credit significantly and positively influences household dietary diversity. Studies (Ogunniyi et al., 2017; Olagunjuet al., 2019) have shown that access to credit is very important for rural housholds in order to increase productivity, which may translate to having improved food expenditure and enhanced dietary diveristy.

Table 8: Results of the poisson regression estimating factors that determine the HDDS in rural households

HDDS	Coefficient	Robust Standard error	P-value
Household size	0.102***	0.001	0.000
Northern resident (1=yes)	-0.183***	0.011	0.000
Age	0.000	0.000	0.606
Primary education (1=yes)	0.011	0.012	0.344
Secondary education (1=yes)	0.033**	0.015	0.028
Tertiary education (1=yes)	0.074***	0.021	0.000
Landsize	-0.001	0.002	0.375
Proportion crop value sold	0.035*	0.019	0.068
Extension reach (1=yes)	0.077***	0.016	0.000
Improved seed_use (1=yes)	0.056***	0.014	0.000
Total livestock unit	0.000	0.001	0.775
Ownasset (1=yes)	0.002	0.011	0.846
Member of cooperative (1=yes)	-0.031	0.028	0.257
Credit access (1=yes)	0.086***	0.012	0.000
Income	0.005***	0.001	0.001
Constant	2.122	0.025	0.000
Log likelihood	-11036.553		
LR chi^2(15)	614.86		
Prob > chi^2	0.0000		
Pseudo R^2	0.0271		

5.10 Women Empowerment and Child Stunting

The relationship between women empowerment and child stunting was examined using IV-Probit regression. In the model, the residual of the dietary diversity (DD) model was inserted into the IV-probit regression and the women empowerment variable was also instrumented for. Table 9 shows the IV-Probit regression results for the effects of women empowerment on a child nutrition outcome (stunting). The IV diagnostic results are presented in Appendix 1. The Anderson-Rubin test results imply that the endogenous variable is relevant. The identification test (over-identification and under-identification test) confirm that the instruments were valid and the models were rightly identified. The Kleibergen-Paap F-statistics show that the null hypothesis for weak instruments is rejected at the 5% level threshold (see Appendix 1). This suggests that the instruments used for women empowerment on child nutrition were strong for the model.

5.11 Household Characteristics

The results revealed that household size had positive growth effects on child stunting in rural households. This implies that households with more members are more likely to have children that are stunted than those with fewer members. The dietary diversity of households had a negative relationship with child stunting. This indicates that households that include more food groups in their diets are less likely to have stunted

children. This is consistent with the findings of Ajao et al., (2010) that households with food insecurity were more likely to have malnourished children. Being in the northern zones (north-east, north-west and north-central) has significant positive relationships with child stunting among rural households in Nigeria. This could be related to the results of household dietary diversity, which revealed that farming households in the northern zones were less likely to have food variety in their diets. Additionally, studies (Ogunniyi et al., 2016; Amare et al.,2018) have also reported malnutrition as one of the effects of conflict and social crises in the northern region that have significantly increased food shortages, and subsequently, child stunting.

5.12 Women's Characteristics

The results of the relationship between women empowerment and child nutrition show a negative association.They suggest that child stunting will reduce if the primary female decision-maker is more empowered through being given more rights to make decisions about agricultural (crop or livestock) production, with the focus on increasing productivity and income, thus getting more autonomy to control the income generated. Such income can be directed towards the nutritional needs of the child in the household. Additionally, child stunting will reduce if the mother's control over resources (assets and credits) is not restrained, because this is instrumental to strong empowerment and ability of mothers to spend more on the nutritional needs of their children. In principle, women's autonomy contributes in a very significant way to enhancing the quality of life in the household, specifically for the children (Cunningham et al., 2015; Prately, 2016). This relationship suggests the importance of women empowerment as a veritable tool by which they leverage available resources in favour of their children's health.

These findings should be interpreted in the context of Nigeria, a developing country in Sub-Saharan Africa where most households (especially rural) lack basic resources, and childhood undernutrition is prominent. It is possible that different conclusions would be reached in better-off contexts. Findings from our study are consistent with the theory postulated by Kabeer (2005), which states that empowering women can have instrumental value and spillover effects when it facilitates and enhances the use of resources (either limited or abundant). In this case, women's empowerment, even in conjunction with household economic status, is linked with lower levels of child stunting. Taken together, these findings lend credence to the broader theory that empowering women operates, in part, through enabling women to take advantage of resources. Therefore, these findings have programmatic and policy implications. They emphasise the importance of including women's empowerment as an explicit component of programmes that aim to reduce child stunting (and possibly other nutritional outcomes such as wasting and obesity. But in resource-constrained environments, programmes also need to provide the minimum level of resources necessary to enable women to adopt practices that promote better child nutrition and health outcomes.

Additionally, our findings are consistent with those from several studies (Zereyesus et al., 2017 Carlson et al., 2015; Cunningham et al., 2015; Richards et al, 2013) which showed that in families where mothers play an important role in decision-making as a measure of women empowerment, the proportion of family resources devoted to children is greater than in families in which mothers play a less decisive role. Active participation of women in more social groups and possibly engaging in non-farm enterprises plays a critical role in reducing child stunting. Some studies (De Silva and Harpham 2007; Anderson and Damio, 2004; Martin and Rogers, 2004) suggest that active participation of mothers in social groups enhances their knowledge, which in turn affects parenting behaviour. This further suggests that households with empowered women were less likely to have stunted children. Ibrahim and Pandey (2015) found that empowerment of women in terms of decision-making has significant positive impacts on the health of children. Oyafara (2014) inferred that mothers who are empowered were more likely to use their resources to procure good health services such as full immunisation for their children, thus maximising the children's survival potential, compared to children of those that are not empowered.

The interaction of the empowerment score with regions of residence and mothers' level of education further reveals the impact of women empowerment, given some of the characteristics of women and their households. The coefficient of the interaction between the empowerment score and the dummy variable for the northern zones had a positive relationship with child stunting. This implies that child stunting remained high in northern zones, irrespective of growth in women empowerment. This could be associated with the high level of insecurity and poverty in the region that prevent households from getting access to the resources they need. The interaction of the empowerment score and mother's level of education revealed a negative relationship, which implies that women empowerment could reduce the number of stunted children even when women in the household had no formal education. The nutritional outcomes of children in rural households improved with mother's education. This is evident when compared to those without any education. The coefficients for mothers with primary, secondary and tertiary education was positive in the IV model, and the magnitude of the coefficients increased as the level of education increased. However, Ajao et al. (2010)reported that less educated mothers were more likely to have malnourished children.

5.13 Child Characteristics

Being male had a significant relationship with child stunting. Male children were more stunted than female children in rural Nigeria. This is consistent with the findings of authors such as Cruz et al.(2017) and Mzumara et al.(2018), who found that male children were more likely to be stunted than female children. The higher prevalence of stunting among male children in Nigeria has been attributed to the fact that boys require greater energy than girls, and are thus considered less likely to be satisfied by breastfeeding. Additionally, as boys develop, they require large amounts of energy for

higher intensity physical activities (such as crawling or running within the household). This energy will be used by their female counterparts for growth and development, as they are known to engage themselves in lower-intensity physical activities (Akombi et al., 2017). Besides this, developmental projects/ interventions of most African countries on children tend to favour female children than male children, thus giving them an edge over their male counterparts.

Table 9: Relationship among women empowerment, household dietary diversity and child stunting

	Variables	Stunting (IV – Probit)
Household and Demographic characteristics	Household size (log)	0.125***
		(0.0407)
	Household dietary diversity (Residual)	-0.305***
		(0.0701)
	Resident in the North	0.201***
		(0.0724)
Women's Characteristics	Mother's age	0.00699***
		(0.00228)
	Mother's primary education	-0.346***
		(0.0763)
	Mother's secondary education	-0.314***
		(0.0678)
	Mother's tertiary education	-0.540***
		(0.121)
Child Characteristics	Child's sex (male)	0.120*
		(0.0678)
	Child's age (months)	0.000641
		(0.000638)
Farm Characteristics	Land size cultivated (ha)	-0.00968
		(0.0108)
	Value of proportion of crop sold	-0.0381
		(0.0514)
	Access to extension service (1/0)	-
		-
	Use of improved seed (1/0)	-
		-

	Women empowerment Index	-2.859***
		(0.816)
Women Empowerment	Women empowerment index * north	1.032***
		(0.320)
	Women empowerment index* educated women	-0.794***
		(0.254)
	Constant	-1.734***
		(0.462)
	Observations	2,346

Source: Data analysis from GHS 2015/2016
Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

6.0 Summary, Conclusion and Policy Options

Women's empowerment is extensively perceived to be a key factor in closing gender gaps to improve livelihood outcomes. This study was aimed at finding out whether women empowerment measured by five (5) basic domains (production, resources, income, leadership, time) has any relationship with child nutrition. The Household Dietary Diversity Score (HDDS) was used as a proxy for the nutritional status of households, while child stunting was used as the indicator of child nutrition. The 2015/2016 Living Standard Measurement Survey data (LSMS-ISA) for rural Nigeria was used. To estimate the relationship, the Instrumental Variable Probitstrategy, which corrects for the potential endogeneity of women empowerment and nutrition outcomes, was used. The main findings are summarised in the following paragraphs.

Cereals, vegetables and fats and oils were the most consumed staples in rural households in Nigeria, while eggs were the least consumed among the 12 food groups considered. Time and income were the major domains that contributed the most to the empowerment of rural women, while playing a leadership role contributed the least. It was also found that women empowerment was positively associated with dietary diversity in Nigeria, the lack of which had been identified as a major reason for poor nutritional status of household members. Nevertheless, the estimation of the relationship between women empowerment and nutrition is usually challenged by the fact that women empowerment does not necessarily take into account possible unobserved household and cultural norms that are likely to stimulate intra-household food allocation and household food preferences. It was also found that education, access to extension services and the proportion of crop sold were key factors that positively and significantly influenced the nutrition outcomes of children in rural households. The age of the women and being resident in the northern region were negatively associated with child stunting in rural Nigeria. To further explore the effect of women empowerment education and northern geopolitical zones were interacted. It was found that despite empowerment, living in the northern region increased child stunting.

Since adequate nutrition is a prerequisite to good health and good health is a prerequisite for active and productive human resources, it is suggested that the widespread child stunting in rural households in Nigeria needs to be addressed. This can be efficiently and effectively done if public policies are envisioned to improve women empowerment through education. This is because education is likely to

provide women with the knowledge and skills that are vital for appropriate nutrition and enlightenment about the adverse effects of large households, while also giving them the opportunity to engage in productive employment. The results of the study also corroborate the evidence that educating mothers and avoiding conflict zones are significant determinants of a households' long-term and short-term nutritional status.

Finally, since women's empowerment is assumed to affect household nutrition through diet diversification, policies aimed at preventing and reducing severe malnutrition in Nigeria are needed. The increase in women's empowerment as a strategy to fight malnutrition in Nigeria should not take the place of nutrition policies but rather should be seen as a complementary and supporting approach, especially among women in rural households. Although our results are robust to the use of different measures of women empowerment and instruments, our paper suffers from a limitation. The policy implication of this study is that absolute empowerment, and the relative empowerment of women within households, can positively affect child nutritional well-being. Therefore, there is need for additional support policies to narrow the gender gap in Nigeria.

The limitation is that our data set only included information on the food groups to measure dietary diversity. Therefore, it was not possible to test if women's empowerment also had an effect on calorie intake and other measures of nutrition. Additionally, though we provided proxies, some indicators of the domains were not available in the data. Thus, an interesting improvement would be to construct a more general indicator of female empowerment for all adult women using a larger sample. Also, conducting randomised controlled experiments can reveal important insights on the role of women empowerment and child nutritional outcomes in Nigeria and elsewhere in Sub-Saharan Africa. Future research should carry out rigorous evaluations of policy interventions in terms of whether they affect women empowerment and thus reduce the prevalence of child malnutrition in developing countries such as Nigeria.

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Appendix

Appendix 1: IV diagnostics results

Hansen J p, Ho: instruments valid	0.345
Under ID test p, Ho: under identified	0.000
Weak ID test stat (Kleibergen-Paaprk Wald F)	10.650
Anderson-Rubin, Ho: endogvars irrelevant	
A-R Wald test, p-value	0.000
A-R Wald chi2 test, p-value	0.000

Appendix 2: First stage for the IV-Probit

	Variables	First Stage
Household and Demographic Characteristics	Household size (log)	0.138***
		(0.0098)
	Resident in the North	-0.190***
		(0.001)
Women's Characteristics	Mother's age	-0.608***
		(0.006)
	Mother's primary education	0.116***
		(0.002)
	Mother's secondary education	0.463***
		(0.090)
	Mother's tertiary education	1.058***
		(0.202)
Child Characteristics	Child's sex (male)	0.600***
		(0.007)
	Child's age (months)	0.333***
		0.044
Farm Characteristics	Land size cultivated (ha)	0.003
		(0.031)
	Value of proportion of crop sold	0.302**
		(0.135)
	Access to extension service (1/0)	0.989***
		(0.100)
	Use of improved seed (1/0)	0.690**
		(0.001)

Mission

To strengthen local capacity for conducting independent,
rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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