The Influence of Women Empowerment on Child Nutrition in Rural Nigeria

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Abstract

In Nigeria, the low status of women and inflexible gender gaps contribute to weak dietary diversity and chronic child malnutrition. Child malnutrition is persistent, despite several interventions which fail to capture the need to empower women to improve the menace. In this study, the influence of women empowerment on child nutrition in rural Nigeria was therefore examined. Secondary data were sourced from General Household Survey Panel 2015-2016. Data were analyzed using the descriptive statistics, Modified Women Empowerment Index, Ordinary Least Square regression and Instrumental Variables techniques to correct for potential endogeneity. The result shows that majority (over 90%) of the households consumed cereals, vegetables, oils and fat, and spices, condiments and beverages while the least consumed food groups were milk and milk products (36%) and eggs (11%). It was also found that on average, women had less than two empowerment indicators implying low empowerment among women. Meanwhile, women empowerment significantly increased the household dietary diversity and consequently reduces the probability of child stunting. Therefore, the findings from this study lend support to the claims that woman empowerment remains a pathway out of cycle of weak dietary diversity and consistence child malnutrition in rural Nigeria.

Introduction

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 the reduction of poverty cannot be over-emphasized. Arimond et al. (2010) opined that agriculture has positive influences on nutrition. Inadequate nutrition has negative effects on health (Miese-Looy et al., 2008) as malnourished people become less productive and are unable to provide family needs. In extreme cases, malnutrition leads to deaths, 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 Demography and Health Survey (2013) showed that 37% of Nigerian children were stunted while 18% and 29% were wasted and underweight, respectively. It was further affirmed by the Nigeria Strategic Support Programme (NSSP) of the International Food Policy Research Institute (IFPRI) that malnutrition is more prevalent in rural areas where agricultural activities take place than in urban areas (NSSP, 2009). Additionally, World Development Indicators (2016) showed that the number of undernourished people in Nigeria has increased to 11.9 million, which is considerably higher than the 8.9 million recorded in 2008 thus increasing the prevalence of undernourishment from 5.7% to 7.3%. This implies that poor nutrition is still a major problem that can hinder the achievement of the Sustainable Development Goals in Nigeria.

Agriculture is the mainstay of the Nigerian economy, employing about 70% of the populace in rural communities. Women are important in Nigerian's agriculture especially in the different areas of the agricultural value chain namely production, processing and marketing (Okojie, 2013). Women make up about 43% of the agricultural labour force in developing countries (FAO, 2011). Despite the important role of women in agriculture/food production, family life and wage labour in Africa; their status remains low, because they are faced with various social, economic and political barriers (Anunobi, 2002).

Smith et al. (2003) associated the low status of women to factors such as less control over resources, lower decision-making power in the household and children's affairs, less access to health services, more mobility and time constraints. The poor level of empowerment among women and their subsequent low status could also affect their wellbeing as well as that of their family members in terms of outcomes such as the nutrition and health of household members, thus resulting in low economic growth

for the country. 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. The low status of women could therefore be linked with their disempowerment in any of the three dimensions of choices.

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 which were limited in scope, uncoordinated and ineffective in addressing the nutritional problems of the country comprehensively (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 aims to address the problem of food and nutrition across sectors and levels in Nigeria. Within this policy, there is a National Plan of Action on Food and Nutrition which caters to translating 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), Millennium Development Goals (2000) and research findings from the Nigeria Food and Nutrition Survey (2001) and Nigeria Nutrition Programme Review in the health sector (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 due to recent concerns in the science, practice and programming of food and nutrition activities such as nutrition in the first one thousand days of life, nutrition during emergencies and the prevalence of diet-related, non-communicable diseases and the conclusions from the International Conference on Nutrition (2014). Furthermore, the review was also done because of the realization 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 so as to come up with common nutritional objectives and ensure food sufficiency through the empowerment of women in 2011 (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 like the National Agricultural Policy (2000-2010) and 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 the growth of the agricultural sector due to the important roles they play in production, processing, marketing and the operation of 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 which was formulated in 2016 is the need for a 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).

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 complements existing policies in agriculture and the National Gender Policy (2006). This policy was aimed at ensuring agricultural practices at all levels are gender responsive, as the role of agriculture cannot 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 into the agricultural policy in 2016, an existing medium-term plan that filled the gap created by the non-inclusion of gender-equality in most government documents is the National Economic Empowerment and Development Strategy (NEEDS). The strategy serves as a target instrument for protecting vulnerable groups, ensuring affirmative action for women in all programmes, 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 Convention to Eliminate all forms of Discrimination against Women –CEDAW (Kezie-Nwoha, 2006).

The main objective of the National Gender Policy of 2006 is to address women disempowerment, feminine poverty, gender inequality and underdevelopment in the country. Therefore, its goals are to eradicate poverty, achieve gender equality and encourage inclusiveness in the process of governance and development. The targets of the policy used in this study 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 enhancing 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 and reduce 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, among others.

From the aforementioned, women remain relevant in solving developmental problems such as child nutrition, and since one of the major goals of the National Gender Policy is to enhance women empowerment and encourage development, this study aims at examining how this policy on gender has influenced child under-nutrition that is rampant 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 agenda that need to be achieved and this can be achieved through empowering of women since they are in charge of cooking and taking care of children and other household members (Scaling up Nutrition in Practice, 2016).

2. 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 in Africa to bridging the gender gap (Damino and Nwakubo, 2013). Women remain dominant in the informal sector and the care economy. However, their marginalization through some socio-cultural beliefs, norms and practices result in discrimination and feminized 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, utilization 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 as well as training facilities, compared to their male counterpart (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 is equitable access to agricultural production resources such as capital, input and land among men and women, agricultural productivity will 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 are being disempowered with regards to education with the resource dimensions of empowerment contributing the highest percentages to their disempowerment. Most of the 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 the lack of empowerment among women in Nigeria (Oyediran and Odusola, 2006). Heaton and Forste (2007) affirmed that the lower empowerment among women affects their decision-making autonomy on the desired family size, health-care-seeking behavior, 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 Meinzen-Dick et al., 2013 where Meinzen-Dick et al., 2013 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). Women are critical to agricultural development in Nigeria. Palacios-Lopez et al. (2017) reported that 37% of agricultural labours in crop production in Nigeria were women, and variation exists 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, assessing women empowerment could impact positively on the agricultural productivity of the country as women are major players in the sector.

Although, available studies like Oyediran, 2006; Ogunlela, 2009 and Ayevbuoman et al. (2016) have assessed the determinants of women empowerment in Nigeria, 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 GHS panel data. However, this study distinguishes itself using household dietary diversity as a pathway to nutrition using stunting as the indicator of nutrition. It also makes valuable empirical contributions to the limited literature available on women empowerment in Nigeria especially in the rural area where agriculture predominates.

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 the household members. The outcome of this study would help in the development of effective gender-responsive policies that will enhance women empowerment, improve child and household care and reduce poverty and food insecurity in the country. This study is important because it provides empirical evidence that would guide the development of policies that will raise the status of women, improve nutrition, enhance and improve agricultural production and farm income. From the aforementioned, the central research question is Does women empowerment influenced child nutrition in rural Nigeria? While the objective is to examine whether women empowerment influences child nutrition in rural Nigeria

3. Literature review

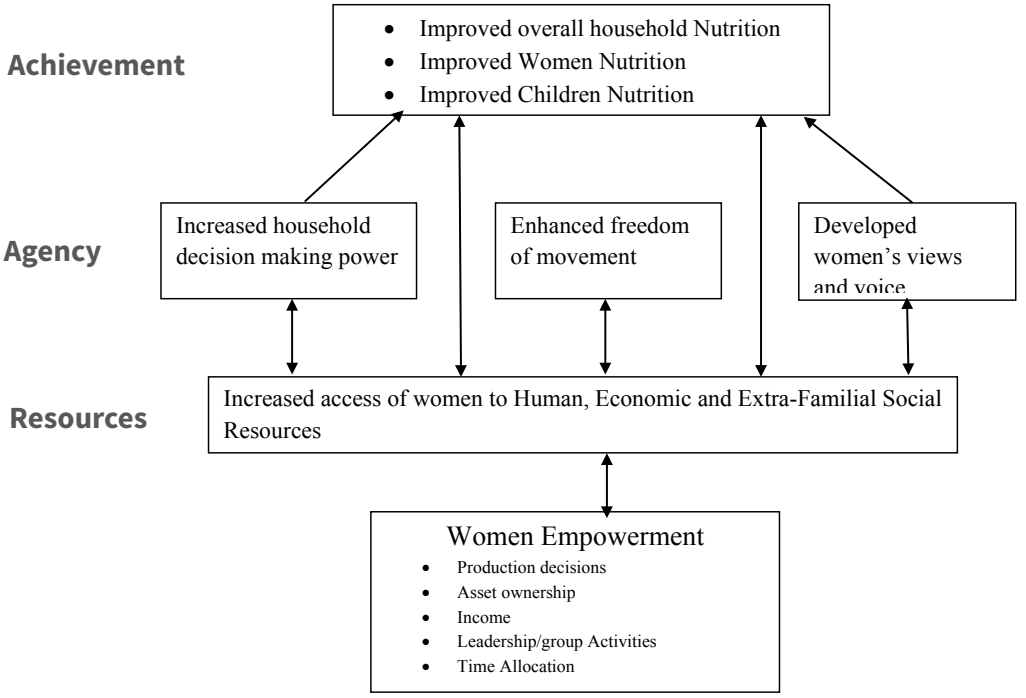
The ability to make choices in this definition of empowerment is made up of three dimensions which are resource, agency, and achievement. The resource and achievement domains which are related to income and educational achievement, have been well documented in literature on empowerment. However, scanty literature exists on the agency domain of 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.

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), among others. Also, literature on the achievement domain relates empowerment, interms of educational achievement and training, to better child nutritional outcomes and access to knowledge and information on improved child health (Web 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. (2016) found that the leadership domain of empowerment contributed highest percentage to women disempowerment in Nepal and Bangladesh. Sraboni et al., (2016) opined that increase in women's empowerment is positively associated with calorie availability and dietary diversity at the household level in Bangladesh. Factors that positively influenced women's empowerment in Nigeria as revealed in the study of Ayevbuoman et al., 2016 were age of the women, age of the household head and employment in skilled and unskilled sector while gender of household head, employment in agriculture and allied sector, 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 women's income but at the

same time, reduces the time allocated to childcare and domestic responsibilities. This may, in turn, lead to poor health outcomes for children who are the future leaders of the nation. The findings from literature thus reveal that the various domains of women's empowerment have both positive and negative effects on developmental indicators of any nation

Conceptual Framework



Adapted and modified by author from Yount (2017)

The framework shows that empowerment enables women to acquire resources to develop their voice, increase their decision-making capacity and fulfil their aspirations. These resources include human resources such as schooling attainment, skill development and self-efficacy; social resources such as participation in organizations, access to peer networks and role models outside their family and economic resources such as earnings, property and land. A woman's access to these resources will improve her decision making within the household, enhance her freedom of mobility and develop her views and voice. These will, in turn, improve her personal nutrition, children's nutrition and the overall nutrition of household members.

4. Methodology

Scope of the study: The scope of the study covered rural households in Nigeria, a West African country located in sub-Saharan Africa with a population of 195,875,237 persons in 2018 and land area of 923,768 km2. The country shares land borders with the Republic of Benin in the west, Chad Republic and Cameroun 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 populous in the world. The country is made up of six geo-political zones, thirty-six states and seven hundred and seventy-four 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 panel (GHS) 2015-2016, which is a secondary source. GHS is a nationally representative survey of approximately 5,000 households collected 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 is implemented as part of the Integrated Survey on Agriculture Programme which was revised in 2010 to include a panel component to enhance an innovative way of collecting agricultural data. The survey used a multistage, stratified sample selection process. The sample comprised 60 primary Enumeration Areas (EAs) selected from each of the 37 states, making a total of 2220EAs. Each EA contributed 10 households to the GHS sample thereby giving a sample size of 22,200 households. Out of the 22,200 households, 5000 households from 500EAs were selected. Due to movement of households from their locations only 4,581 households were interviewed in the third wave, compared with the 4,916 households interviewed in the first wave. The units of analysis used in the data were household, individual and community. The information collected includes household information (education, labour, health, child development, ICT, Credit, Food and non-food expenditure and aggregate food consumption, among others), agricultural information (land inventory, labour, input costs, fertilizer acquisition, land tenure, among others) and community information (Community infrastructure, community organization, community resource

management, conflict, food prices, among others)[1]. For the purpose of this study, the individual and household unit of analysis was used; data for individual women in the productive age of 15 to 60 years with under-five children as well as their household characteristics and agricultural information were sorted from the GHS panel of 2015-2016. A total of 2,346 women in households with under-five children were used for the study.

Choice of Women Empowerment Indicators: Women empowerment indicators for this study were chosen following Alkire et al., (2013) and Tanankem et al. (2016). Due to the limitations of data on empowerment indicators in the GHS, five indicators were utilized from five domains of empowerment. The domains and indicators that really reflect the empowerment indices within the Nigerian context were also considered. The domain 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 the extensive evidence which shows that women have limited roles in decision making on farming activities in Nigeria, especially in rural areas where they constituted 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 many rural women in Nigeria owned physical assets such as mobile phone and radio while less than 10% of the women owned natural assets such as land. The authors further affirmed that majority of women in rural Nigeria have no control over the assets they owned. 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 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 (Salawu, 2019; 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 counterpart. 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 member	Respondent participates in cooperative in the last six months.	Yes, No
Time	Workload	Women use time to engage in non-farming activities	Yes, No

Source: Authors' Compilation from the GHS 2015/2016 data.

Analytical techniques

Polychoric principal components analysis (PPCA)

In order to generate the women empowerment index, the Polychoric Principal Component Analysis (PPCA) was used. Generally, the classical PPCA was conceptualized for the analysis of quantitative data and 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 fails 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 possibilities of categorical dummies produced for the same variables being negatively correlated. This, therefore, requires that the PPCA needs to consider 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 analyzing 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.

Household dietary diversity score (HDDS)

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. HDDS shows the economic capability of the household to access different food types which was also used to get the HDDS for individual households. 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 rootsor 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 fruitsother 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

Ordinary least square (OLS) regression

The OLS model was used to identify the drivers of the number of food groups consumed in rural households. The determinants of the HDDS was examined with the equation

$$HDDS_i = \beta_0 + x_i\beta_i + v_i \quad (1)$$

where x represents independent variables and $HDDS_i$ the dependent variable

The explanatory variables x are specified as:

Household and Demographic Characteristics
x1=Household size (log)
x2 =Resident in the North (1 if yes; 0 if otherwise)
Women Characteristics
x3= Mother's age (years)
x4= Mother's primary education
x5= Mother's secondary education
x6= Mother's tertiary education
Farm Characteristics
x7= Land size cultivated (ha)
x8= Proportion of crop value sold (₦)
x9 = Extension service access (1 if yes; 0 if otherwise)
x10= Use of improved seed (1 if yes; 0 if otherwise)
Women Empowerment
x11= Women empowerment index
x12= Women empowerment index * North
x13= Women empowerment index* Educated women

IV-Probit regression model

In order to examine the relationship between women empowerment and child stunting, the regression model below was utilized:

$$CS_i = \beta_0 + V_i\beta_i + w_i \quad (2)$$

where CS_i is represented as 1/0; CS is 1 when child is stunted and 0 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 and 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 was 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 CSi. Therefore, in the IV-Probit model the residual of the HDDS was inserted into the child stunting equation. Equation 2 is then represented as

$$CS_i = \beta_0 + V_i\beta_i + R_i\beta_i v_i \quad (3)$$

where R is the HDDS residual

Household and Demographic Characteristics
V1=Household size (log)
V2 =Resident in the North (1 if yes; 0 if otherwise)
Women Characteristics
V3= Mother's age (years)
V4 = Mother's primary education
V5= Mother's secondary education
V6= Mother's tertiary education
Child Characteristics
V7= Child's sex (1 if male; 0 if otherwise)
V8 = Child's age (months)
Farm Characteristics
V9= Land size cultivated (ha)
V10= Proportion of crop value sold (₦)
Women Empowerment
V11= Women empowerment index
V12= Women empowerment index * North
V13= Women empowerment index * Educated women

In this model, the women empowerment index was instrumented, since literature has established that empowerment is endogenous. Following Lupine and Strobl (2012), 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 households since different ethnic groups have different social norms that serve as threat points in intra-house bargaining power.

In order 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 the 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) from Burkina Faso revealed that there is a disparity in the labour allocation and autonomy for women empowerment dimensions among different ethnic group. Similar findings were recorded by Lépine and Strobl, (2013) in Senegal. The strong correlation between ethnicity and women empowerment in sub-Saharan African countries is widely reported in literature (Kevane and Wydick, 2001; Nikièma et al., 2008; Kasturirangan, 2008; Kasturirangan et al., 2004; Lépine and Strobl, 2013). 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 Salawu (2019). They are more conservative due to 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. In order 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, of 2 if the woman is Hausa or Fulani and lives in the northern region and of 3 if the woman is an Igbo or Yoruba and lives in the southern part of the country. As can be seen from Appendix 1, 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 instrument. More specifically, the identifying assumption is that there are no other factors correlated with women empowerment that will not be controlled for, but are correlated with child nutrition status (Stunting using HAZ).

5. Results and discussions

Descriptive statistics of some selected variables

The average age of the household heads was 31±10.10 years and about 77% of them were male. Table 3 shows that most of the women are from large households (5.62±1.75 members). Studies (Malapit et al., 2013; Kappmair et al., 2016; Tanankem et al., 2016) have asserted that larger households are likely to diversify diets due to increased non-food expenditures. The average age of the women in the study was 30.64±10.10 years and only about 6% had post-secondary education while over 30% had no formal education. This shows that the women are likely to be low in human capital development in relation to educational attainment. Only about 16% of women lived in farming households that used improved seeds for cultivation. The average land size cultivated was 1.1hectares. The average income generated from farming activities was ₦125,560.10 with a maximum of ₦1,051,867. 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	287966.1	8011.4	26680	2000000	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
Women's' 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

continued next page

Table 3 Continued

	Variable	Observations	Mean	Std. Dev.	Min	Max	
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	125560.1	10133.1	23700	1051867	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

Food groups consumed by households

Food consumed by the household is reported in Table 4. An average of 8.47 food groups were consumed by each household (see 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 proteins sources like 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 source of protein, can be very detrimental to the health of the household members especially the children. It is pertinent to state that the intake of adequate nutritional foods in the early stage 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

Household dietary diversity (HDD) score

The dietary diversity was used as a proxy for household food security. As contained in Table 5, result 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 that the adequacy of a healthy diet is still low in rural Nigeria.

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

Score	Frequency	Percentage
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

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 at least one type of income. Engagement in non-farm enterprises among women is a livelihood diversification strategy has increase wellbeing, reduce vulnerability to risk and shocks, improve food and nutrition security and ensure a 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 continues to have the potential and wherewithal to meet the immediate needs of the people while its ability to meet future needs is not jeopardized. Additionally, less than 18% made decisions about agricultural production or had control over assets or credits while only 3% of them 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 will enhance their visibility, productivity, 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 of 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 (see 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

Women empowerment score

The average empowerment score for each woman was 1.68 (Table 3). This implies that, on the average each woman had less than two empowerment indicators. This is an indication of weak empowerment among rural women in Nigeria. This finding is typical of women in sub-Saharan African (SSA) countries. African Development Bank Group (2015) reported that women in Africa have low bargaining power and are less empowered. While many of these women work (mostly microenterprises), they still face economic exclusion, as their jobs are underpaid and undervalued and most are found in the informal sector. This affirmation was also supported in this study as represented in the distribution of the scores on 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 score

Empowerment score	Freq.	Percent
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

Determinants of household food diversity

In examining how women empowerment influences nutrition outcomes among children, the drivers of dietary diversity within households with under-five children were assessed.

Household characteristics

The results revealed that household size had 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 less 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. Being in 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 the higher level of poverty and insecurity in northern Nigeria. The northern zones of Nigeria have a higher poverty incidence in Nigeria compared to the southern zones (Oyekale et al., 2011; Ajakaiye et al., 2014).

Farm enterprise characteristics

For household per capita income, the regression reveals that an increase in income of rural household raised the number of food groups they consume. Hussein et al. (2016) revealed that despite the availability of diverse food products in the markets, most farming households depend on the food they produce as they cannot afford to buy from the markets. Higher household income therefore translates to higher purchasing power to buy items from other food groups. Theil and Fink, (1983) revealed that increases in the 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 markets, most farming households depend on food produced by the household, which is often insufficient to meet their nutrition need, as they cannot afford to buy from the markets. The coefficient of farming households that have access to extension agents also had a positive relationship with household food diversity (Table 8). This implies that when households have access to extension agents, they are more likely to improve their nutritional status by adding items from a variety of food groups to their meals. 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.

Women's characteristics

The presence of empowered women in rural households significantly increased the HDDS of rural households. This implies that households with women that are empowered were more likely to have variety in their diets. Several studies affirmed

that an increase in the level of women empowerment does not only increase food security but also reduce household hunger, of which HDDS is a component (Tanankem et al., 2017; FAO, 2011 and World Bank, 2011). The HDDS of households improved with mothers' education. This is evident, compared to those without education. The coefficients for mothers with primary, secondary and tertiary education were positive in all the models and the magnitude of the coefficients increased as the level of education increased.

Women empowerment and child stunting

The relationship between women empowerment and child stunting was examined using IV-Probit regressions. In the model, the residual of the DD model was inserted into the IV-probit regression and the women empowerment variable was also instrumented for. Table 8 shows the ordinary least squares (OLS) and 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) results 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). Additionally, the F-statistic exceeded the critical value of 4.79, which is associated with a bias relative to OLS of less than 30% (Stock and Yogo, 2005). This suggests that the instruments used for women empowerment on child nutrition were strong for the model.

Household characteristics

The results revealed that household size had 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 households with less 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 the malnutrition effects of conflict and social crises in the northern region which have significantly increased food shortages and subsequently, child stunting.

Women's characteristics

The result of the relationship between women empowerment and child nutrition shows a negative association. The result suggests 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 activities, with the focus on increasing productivity and income thus getting more autonomy to control income generated such income can be directed towards the need 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 strengthening of capacity of the mothers towards child nutrition. In principle, women's autonomy contributes in a very significant way to enhancing quality of life for the household and specifically for the children (Cunningham et al., 2015; Prately, 2016). This relationship suggests the importance of women empowerment as a veritable tool by which women 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. Our cross-sectional reach conclusions that 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. Hence, these findings have programmatic and policy implications. They emphasized on the importance of including women's empowerment as an explicit component of programmes that aim to reduce child stunting (and possibly other nutrition outcomes like wasting, 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 of several studies (Richards et al, 2013; Zereyesus et al., 2015; Carlson et al., 2015; Cunningham et al., 2015) 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. Also, the role of women empowerment through actively participating in more social group and possibly engaging in non-farm enterprises plays critical role in reducing child stunting. Studies (De Silva and Harpham 2007; Anderson et al. 2004; Martin and Rogers 2004) suggest that the mechanisms linking mothers' actively participating

in social group and their children's nutrition status are particularly connected through the enhancement in mothers' knowledge, which in turn, affects the mother's parenting behavior This further suggests that households with empowered women were less likely to have stunted children. Ibrahim and Pandey (2015) found that the empowerment of women in terms of decision making has significant positive impacts on the health outcomes 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 immunization for their children thus maximizing their survival potentiality compared to children of those that are not empowered.

The interaction of the empowerment score with regions 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, irrespective of growth in women empowerment in the northern zones. This could be associated with the high level of insecurity and poverty in the region that prevent households from getting access to resources they need. The interaction of the empowerment score and 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. Ajao et al., (2010) revealed that less educated mothers were more likely to have malnourished children

Child characteristics

Male children had a significant growth relationship with child stunting. This indicates that child stunting increased with male children in rural Nigeria. This is consistent with the findings of authors like 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 intake than girls and are thus considered less likely to be satisfied by breastfeeding alone but are further in need of complementary food. Additionally, as boys develops, they require a large amount 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 culturally known to engage themselves in low intensity physical activities (Akombi et al. 2017). Besides this, most African countries developmental projects/ interventions on children tend to favour female children than male children thus giving them an edge over their male counterparts.

Table 8: Relationship among Women empowerment, Household Dietary Diversity and Child Stunting

	VARIABLES	HDDS	Stunting (IV – Probit)
Household and Demographic	Household size (log)	0.138	0.125***
characteristics		(0.0898)	(0.0407)
	Household Dietary diversity (Residual)	-	-0.305***
		-	(0.0701)
	Resident in the North	-1.651***	0.201***
		(0.0898)	(0.0724)
Women's Characteristics	Mother's age	-0.00608*	0.00699***
		(0.00366)	(0.00228)
	Mother's primary education	0.276***	-0.346***
		(0.0842)	(0.0763)
	Mother's secondary education	0.366***	-0.314***
		(0.0937)	(0.0678)
	Mother's tertiary education	1.058***	-0.540***
		(0.142)	(0.121)
Child Characteristics	Child sex (male)	-	0.120*
		-	(0.0678)
	Child age (months)	-	0.000641
		-	(0.000638)
Farm Characteristics	Land size cultivated (ha)	-0.0151	-0.00968
		(0.0303)	(0.0108)
	Proportioncropvaluesold	0.302**	-0.0381
		(0.135)	(0.0514)
	Extension service access (1/0)	0.989***	-
		(0.100)	-
	Use of improved seed (1/0)	0.221**	-
		(0.0920)	-
Women empowerment	Women empowerment Index	1.056***	-2.859***
		(0.249)	(0.816)
	Women empowerment index * north	-	1.032***
		-	(0.320)
	Women empowerment index* educated women	-	-0.794***
			(0.254)
	Constant	8.491***	-1.734***
		(0.267)	(0.462)
	Observations	2,346	2,346
	R-squared	0.251	

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

6. Conclusion and policy options

Women's empowerment is extensively perceived to be a key factor in closing gender gaps in improving livelihood outcomes. In this study, we explored and investigated 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 utilized. To estimate the relationship, the instrumental variable Probit strategy, which corrects for the potential endogeneity of women empowerment and nutrition outcomes was used. Central findings are summarized in the following paragraphs.

Cereals, vegetables and fats and oils were the most consumed staples in rural households in Nigeria while eggs are the least consumed among the 12 food groups considered. The women empowerment descriptive statistics reveal that time and income were the major domains that contributed most to the empowerment of rural women while playing a leadership role contributed the least. It was also found that women empowerment is positively associated with dietary diversity in Nigeria, the lack of which has been identified as a key driver of the 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 consider 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 while age of the women and women living in the northern region were negatively associated with child stunting in rural Nigeria. In order to further explore the effect of women empowerment, 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 therefore suggested based on our findings that; the widespread child stunting in rural household in Nigeria needs to be addressed. However, 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 for nutrition and enlightenment about the adverse effects of large households while also giving them the opportunity to engage in productive employment. Results of the study also corroborates the evidence that mothers' education and avoiding conflict zones are significant determinants of a household's long-term and short-term nutritional status.

Finally, since women's empowerment is assumed to affect household nutrition through diet diversification, efforts should still be deployed to make policies aimed at preventing and reducing severe malnutrition in Nigeria. 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 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 main limitation is that our data set only included information on the food groups to measure dietary diversity. So, it was not possible to test if women's empowerment also influences calorie intake and other measures of nutrition. Additionally, though we provided proxies, some indicators of the domains are not available in the data.

Notes

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

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.

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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

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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