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Women Empowerment and Intra-household Dietary Diversity in Nigeria

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Abstract

This study used a nationally representative survey from the 2012-2013 World Bank's General Household Survey for Nigeria, to examine the relationship between empowerment, measured using a modification of the Alkire et al. (2013) empowerment index, and household dietary diversity, based on the FAO groupings of food intake within the household. Accounting for potential endogeneity of empowerment, as well as using both the non-parametric regression and the traditional least square regression, we find that increases in empowerment are positively associated with household dietary diversity. Overall, household that are female biased in terms of share of female within the household, and those that favour female leadership tend to have higher significant improvement in their dietary intake with empowerment. On the contrary, empowerment generates a small proportion of male dietary diversity.

Keywords: Agriculture; Food Diversity; Food Security; Gender; Household; Nigeria; Rural Development

JEL Code: Q01; Q18; R14

1. Introduction

Empowering women is among the key objectives of development policy: the United Nations Sustainable Development Goals (SDG5) emphasized on the need to achieve gender equality and empower all women and girls. Achieving these goals has been shown to have a broader economic development impact. For instance, Alkire et al. (2013) traced female empowerment to improving household productivity and efficiency. Likewise, female empowerment in the agricultural sector is seen as essential to achieving food security and reducing hunger, as well as improving the efficiency of policy interventions (FAO, 2011; World Bank, 2011). More so, gender equality could be achieved through women empowerment, and which can lead to poverty reduction, huger eradication and even improvement in food security (Malapit et al., 2015). These outcomes from empowering women are hinged on the fact that women play important roles in household and care services that affect a larger proportion of individuals within the society.

Focusing on Nigeria and many other developing countries, one important role of women in households is their ability to ensure and enhance an efficient dietary intake among household members. Most women in Nigeria are largely involved in food production[1], distribution and consumption. This implies that within households, women are primary decision makers in relation to food (Diego and Quentin, 2010; Efobi, 2016). Meanwhile, the growing demand for food has drastically increased, especially because of the growth of Nigeria's population from about 159 million in 2010 to 182.2 million in 2015. Nigeria is in food-deficit and depends on imports of grains, livestock products and even fish (IFAD, 2012). More so, the extent of nutrition[2] diversity may shrink as food cost becomes expensive, while consumption remains on the increase.

To tackle this situation, there is a renewed interest in furthering women's empowerment status through interventions and development programs[3]. Despite these actions, the need to develop scientific indicators for measuring empowerment and to examine the relationship between these

[1] Nigerian women contribute 70 percent of the total agricultural workforce, 50% of animal husbandry related activities and 60% of food processing activities (National Coallition on Affirmative Action, 2009).
[2] Nutrition and dietary diversity will be used interchangeably. They mean the same thing for this study.
[3] Such as National Gender Strategic Framework, Information, Communication and Value Re-orientation, Capacity Building and Skill Development, and some other Women Empowerment Programmes that have been initiated by Federal Ministries that support women and agricultural development in Nigeria.

measures and food related outcomes will provide relevant policy options that can be used to monitor the interventions to empower women. This paper, therefore, investigates the linkages between empowerment and the nutritional diversity of households using the 2012-2013 World Bank's General Household Survey for Nigerian households. We also use the components of the empowerment variable to identify how specific domains and indicators are associated with nutrition diversity. We pay particular interest on how the estimated linkage differs across gender of the household. We use an empowerment index that is similar in construction to the survey-based approach empowerment index of Alkire et al. (2013), which directly assesses empowerment based on five domains such as agricultural production, access to and control over productive resources, control over the use of income, leadership in the community, and time allocation.

Our modification of Alkire et al. (2013) measure of empowerment considers domains that pragmatically reflect empowerment indices within Nigeria, such as access to and control over productive resources, leadership in the community, education, information and connection, and insurance. The inclusion of completion of a post-secondary education, ability to use and own technology that can enhance information and connection, and ability to own an/a insurance/savings scheme in our measure of empowerment is motivated by three reasons: (i) the consideration of this study goes beyond households in the agricultural sector and therefore, the need to develop an index that considers other measures of empowerment outcome that, though relates to agriculture, but can fit beyond the agricultural sector; (ii) some of the development programs that are initiated in Nigeria and directed at the empowerment of women have considered outcomes such as ensuring the completion of education and human capacity development, as well as been able to own and use connection and information gadgets in order to bridge the gap of globalization and social connectivity; (iii) considering insurance as an important outcome for empowerment is beginning to receive considerable attention since it reflects the individual's ability to invest in the future and escape the poverty trap – or out-of-pocket expenditure that weighs much on the household's income (Grown, 2006; World Health Organization, 2012; International Fund for Agricultural Development – IFAD, 2012; African Development Bank, 2015), especially for countries with high income inequality like Nigeria.

To the best of our knowledge, this study is the first attempt to examine dietary diversity for all household members in Nigeria and using a modified Alkire et al. (2013) empowerment index. This is important considering the ongoing policy interventions that are targeted at empowering different gender classifications in Nigeria. More so, our approach adds to the limited literature on measuring empowerment and advances the Alkire et al. (2013) methodology by including other components that can directly define the extent of empowerment based on specific peculiarity of the context of study. Since empowerment is endogenous, we used instrumental variable, alongside the local polynomial and the ordinary least square regression, to arrive at the following results: overall empowerment index of all household members and across gender are significantly and positively associated with dietary diversities. The dietary intake of households that are female-biased tend to respond positively and significantly to a change in the extent of empowerment. These results explain the differing needs of individuals and household composition across gender; the quality of response from an empowerment intervention for one group of individuals or household may not be the same for the others. Thus, gender should be seriously taken into consideration when considering empowerment, alongside improved dietary diversity. The remainder of the paper is distributed as follows: the next section considers a background to the study that discusses the stylized facts on Nigeria. The third section considers conceptual and review of literature on the relationship between empowerment and dietary diversity, and also explains the concept and measurement of empowerment. The fourth section focuses on data, empirical specification and variables. The results and discussions are included in the fifth section, while the sixth section concludes the study with some policy recommendations and suggestions for further studies.

2. Background and Stylized Facts

Apart from the important role of women in food production and quality of consumption, the need to study the impact of empowerment across gender and its impact on dietary intake is motivated by the following stylized facts. First, some challenges that confront women in patriarchal societies, like Nigeria[4] are enormous. Distant from economic disadvantages is the fact that women face higher inequality in school enrolment than their male counterparts. Table 2.1 presents the primary, secondary and tertiary enrolment status across the gender of household

[4] Nigeria is a lower-middle-income country in West Africa with a per capita income of about 1280 US$ and a poverty rate of about 62.6 percent.

members. There is a consistent gender dimension to the pattern of education enrolment across the years and across the different levels of education. The gender gap for education widens when considering tertiary education. The poor enrolment of women in tertiary education may be caused by poverty and cultural stereotypes. At this level of enrolment, the decision to further education almost entirely rest on the individuals because the average age for this level of enrolment is 18 years, and legally, individuals of this age are considered as adult and responsible for their actions. Therefore the ability to further education to the university level, despite the odds that confront the individual, can be traced to some level of empowerment that intrinsically motivates the individual for this level of achievement.

Table 2.1: School Enrolment in Nigeria (2010-2013)

	Primary enrol.		Secondary enrol.		Tertiary enrol.	
	Female	Male	Female	Male	Female	Male
2010	45.715	54.285	45.341	54.659	41.106	58.894
2011	45.888	54.112	45.088	54.912	42.728	57.272
2012	47.770	52.230	44.278	55.722	42.555	57.445
2013	47.921	52.079	47.359	52.641	43.906	56.094

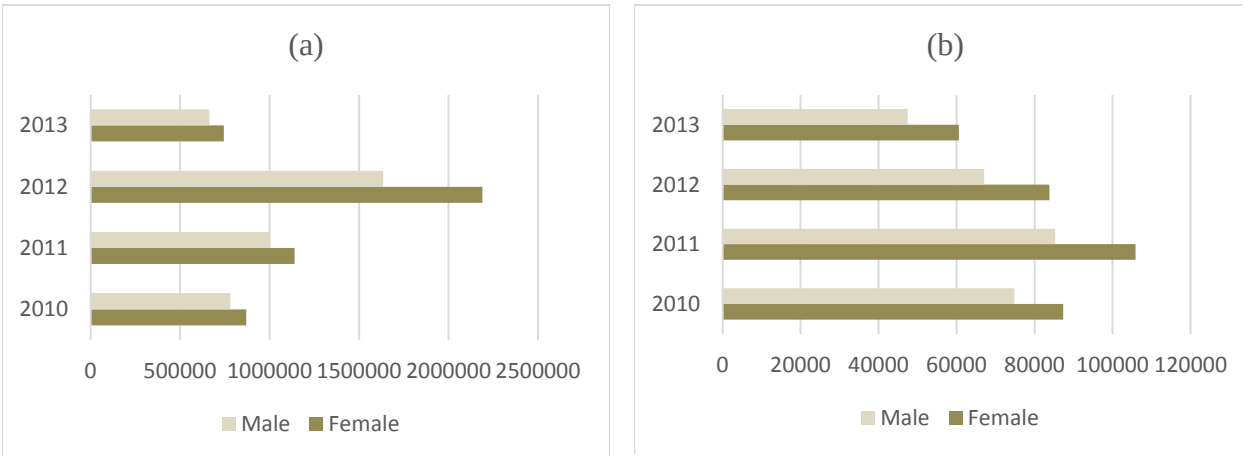
Source: Nigerian Bureau of Statistics (2014)

Second, the unequal representation of women and men in school enrolment in Nigeria may have some health effect on the household and children. According to UNICEF (2011), the relationship between women's level of education and children's malnutrition rate is positive. Smith et al. (2003) and Von Grebmer et al. (2009) observe that in South Asia, the low status of women in education (among others) contributes to chronic child malnutrition and food insecurity, while Asongu and De Moor (2015) and Asongu and Nwachukwu (2016ab) note that the bulk of inclusiveness in development agenda must include women empowerment. In Nigeria, we can also associate the poor educational status of women to their overall health and cause of death. Luchuo et al. (2013) associated the educational status of mothers in Sub Saharan African countries to nutrition, sanitation and common disease prevention strategies that logically reduce malnutrition-related mortality and morbidity.

Figure 2.1a shows a trend of the notifiable diseases across gender of individuals in Nigeria and as reported by the state ministries of health. The female individuals are more prone to diseases than the male individuals. More so, they die from these diseases at a higher rate than their male counterparts. Figure 2.1b confirms this trend: over the years, the female individuals tend to have

a higher death rate from notifiable diseases than the male. Among the causes of these deaths include the inability of some women to pay for health care cost, compared to the male individuals and poor nutrition associated with unequal representation of women in school enrolment. Therefore, when considering health and wellbeing, the male individuals in Nigeria tend to outperform the female, which raises concern as to the intensity of the challenges that confront women.

Figure 2.1 Number of Notifiable Diseases and Death from the Disease across Gender (2010-2013)

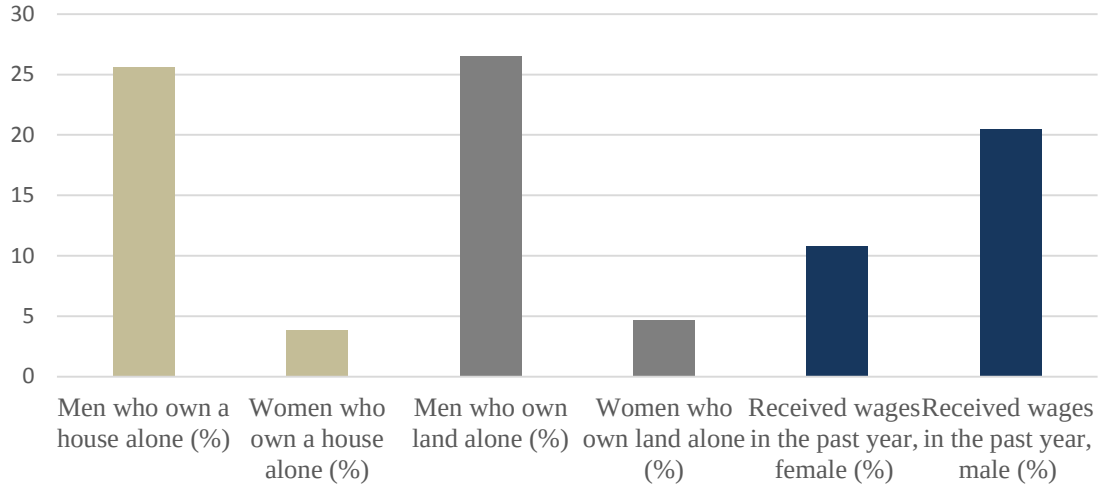


Source: Nigerian Bureau of Statistics (2014)

Third, women lack access to economic resources and basic wage earning opportunities compared to men. Figure 2.2 displays the percentage of men to women who own a house, land and even received wages in the past year. From the Figure, men are about 7 times more likely to own a house than women. More so, the percentage of men who own land alone is about 6 times higher than that of women. In similar trend, less women receive wages in the past year compared to men: men are twice more likely to receive wages compared to women. Evidently, less women have access to economic resources and job paying opportunities than men, which contributes substantially to the poverty rate across gender[5].

[5] Poverty rate for women is about 70 percent as of 2013.

Figure 2.2 Access to Economic Resources and Opportunity across Gender (2010)



Source: World Bank (2016)

With these trends across gender of the household, this study intends to find out the extent to which empowering women (who have performed poorly in most of the statistics) will improve their health status, through an improved dietary diversity. The focus of this study follows policies actions that are directed at improving the empowerment status of women in Nigeria, in terms of access to income and other economic resources, as well as improving the level of education. This study will provide a background to advocate for possible policy actions that should be directed at women, especially by providing empirical evidence on how empowerment can improve their dietary intake. We also go further to considering the household impact of empowering women. This is an important addition as it estimates the impact of empowerment beyond the individual to the household.

3. Overview of the Concept of Empowerment

The consumption of diversity of foods is an internationally accepted recommendation for a healthy diet. This is because dietary diversity is associated with positive health outcomes that can result in the reduction of the vulnerability of individuals to certain health disorders like the incidence of cancer or mortality (Drescher, Thiele and Mensink, 2007). To measure the extent of dietary diversity, especially in individual's consumption, there are different measures that have been applied. In most studies (e.g. Thorne-Lyman, et al, 2010; Taruvinga, Muchenje and Mushunje, 2013), a dietary diversity index have been developed, which considers a count of the

number of the frequency of the number of consumed food items and food groups that are consumed by the individuals in a given period of time.

Women, in particular, play an important role in ensuring quality of food consumption within the household. Apart from women being involved in the production of between 60 to 80 percent of the food produced in developing countries and being responsible for half of the World's food production, women are also critically involved in food security and household dietary distribution per meal intake (FAO, 2016). They play an overwhelming role in ensuring diversity of diet and supplying important vitamins and minerals within the household, which can affect both household and children's nutrition and general wellbeing. With this increasing role of women, especially with regards to food consumption, there is the need to ensure that their empowerment is given paramount attention in policy decisions. FAO notes: "…*despite their role as the backbone of food production and provision for family consumption in developing countries, women remain limited in their access to critical resources and services* …" (FAO, 2016: 3) Some of the resources identified by FAO (2016) include education, training and extension services, access to decision-making responsibility and to credit facilities. Apart from the limitation of women's access to resources, considering empowerment of women matters since there are considerable evidences suggesting that household members do not act in a unitary manner when making decisions over household matters (including food consumption): thus, women within households may not have the same preferences as their male counterparts (Alderman et al., 1995; Haddad, Hoddinott, and Alderman, 1997). Thus, the choices of dietary composition will vary across gender and will be further enhanced for female individuals, especially with empowerment (see e.g. Ibnouf, 2009; Sraboni et al., 2014).

In a broad definition, empowerment entails access to both productive and none productive resources with the main motive of improving the value of individual's orientations towards making decisions that affect both the individual and other related entities. Some authors like Kabeer (2001) have considered empowerment to be the expansion of an individual's ability to make strategic life choices, especially in contexts where such ability had been denied to such an individual. Bertelsen and Holland (2006) also describe empowerment as the capacity to make effective choices and then transform those choices into desired actions and outcomes. These two

definitions are effectively considering empowerment as making quality choices, especially pertaining to the betterment of the individual's life.

Some of life's outcomes that have been identified in studies from the empowerment of women include the closing of gender gap in the usage and control of economic resources, intrinsic benefit that comes with improving self-image, enhanced productivity, and household and children's health and nutrition (Alkire et al., 2013). Malapit and Quisumbing (2015) and Sraboni et al. (2014) also traced empowerment to increased food security, dietary diversity and quality of nutrition for Ghana and Bangladesh households. However, measuring empowerment has remained difficult in scientific studies. Some measures identified by Alkire et al. (2013) that are popularly used, especially at the aggregate level are: the ratios of girls to boys in primary, secondary, and tertiary education; the share of women in wage employment in the non-agricultural sector; and the proportion of seats held by women in national parliament. However, these approaches have two main weaknesses. First, these measures do not capture heterogeneities that may exist across individuals; second, they do not directly measure the empowerment that different individuals experience per time. Thus, they cannot be used to directly measure empowerment at the household levels.

To circumvent this challenge of measuring empowerment, Alkire et al. (2013) developed a new empowerment index that considers women in agriculture. The index is survey-based and it is designed to measure the empowerment, agency, and inclusion of women in agriculture based on data collected by interviewing men and women within the same households. This index is classified into five domains – women's input in productive decision and their autonomy in production; women's decision over the ownership, purchase and sale of productive assets as well as access to and decision over credit; control over the use of income; women's involvement in groups and ability to speak in the public; women's decisions over time for leisure and work. This measure of empowerment has gained credence in some studies like Sraboni et al. (2014) and Malapit and Quisumbing (2015), where the authors applied the Alkire et al. (2013) empowerment index in Bangladesh and Ghana.

Alkire et al. (2013) acknowledge that empowerment is inherently context-specific and it is shaped by socioeconomic, cultural, and political conditions of the specific country or region that is being studied. This can make comparison of empowerment across countries to be problematic (Malhotra and Schuler, 2005). In a bid to apply the wisdom of Alkire et al. (2013) measure to Nigeria and to focus on a sample that goes beyond the agricultural sector, some components like women being able to decide on furthering education, owning an/a insurance/savings scheme, and owning and using technology that can enhance information and connections, are included in the empowerment index that was used in this study. Studies have shown that indices such as completion of post-secondary school education, using and owning information and connectivity gadgets and having an/a insurance/savings scheme is a direct measure of the level of empowerment in some developing countries. For instance, the patriarchal practices in some developing countries (like Nigeria) make considering a post-secondary education to be an act of a quality decision by the individual.

Taking up insurance and savings schemes has largely been considered as an outcome of empowerment in countries where there is a high level of inequality in access to finance. Focusing on this as an outcome variable from empowerment has its merits, such as: increase household investment in productive assets, improved consumption in the event of contingencies, and increase in women's ability to have a control over their lives in the case of death of the principal provider of the household[6] (Buvinic and Furst-Nichols, 2013). Some studies in Malawi used savings outcome to measure the extent to which women are empowered, in terms of self-reliance and the need to improve their social and economic status (Waller, 2014). This is also related to having access to and using technological gadgets like mobile phones and other connection and information devices. Information and communication devices have spread rapidly over the last decade, especially in Africa (Asongu, 2013)[7]. Despite this increase, not every person owns or is able to use a communication/information gadget. Since these gadgets are personal devices, that if owned and not shared, provide the owner with a degree of independence and autonomy, then it becomes necessary to include this variable as an indicator that shows the level of empowerment

[6] This is only relevant for households with male heads.
[7] For example, the number of mobile phone and internet users per 100 persons has risen from 12.0 and 2.0 in 2005 to 75.7 and 22.4 in 2015 (World Bank, 2016). Africa also has the fastest ICT growth rate, compared to other regions of the world (see Asongu & Nwachukwu, 2016c).

of an individual. In essence, women owning mobile phones could arise as a result of the level of their empowerment. Buvinic and Furst-Nichols (2013) emphasized that technology adoption and effective use of such technology is a direct measure of empowerment. Some other studies like Mutua et al. (2014) have modified the Alkire et al. (2013) index to study social and economic empowerment in Kenya. The authors have included health outcomes, addition and removal of some indicators to the Alkire et al. index.

4. Data, Empirical Specification and Estimation Strategy

Data

The data for this study is sourced from the World Bank's Living Standards Measurement Study (LSMS) - Integrated Household Survey, conducted in collaboration with Nigeria's National Bureau of Statistics. Nigeria is one of the seven countries in Africa that is covered by the LSMS[8]. The LSMS dataset is a household type of micro data that contains variables that reflect household conditions across the different states of Nigeria. It also includes information on women's contribution to decision making process on land assets, buildings and income usage, data on savings and insurance schemes that are engaged by women (and other household members), as well as their access and usage of information and communication gadgets. Information such as household income, consumption distribution, gender (including that of the household head), count of household asset and infrastructure, are also contained in the dataset.

The latest LSMS_ISA wave (i.e. 2012/2013) household data is used for our analysis. The 2012/2013 LSMS_ISA data consist of 5,000 households and contain other additional data on agricultural activities, other household income activities, and household expenditure and consumption. Specifically, the second wave of the LSMS_ISA data was carried out in two visits (post-planting visit in September – November 2012 and post-harvest visit in February-April 2013). The post-harvest data was used for this analysis: these data adjust for households that have changed location after the post-planting visit.

[8] The dataset, structured questionnaires, manuals and codebook are available online at World Bank Webpage (http://go.worldbank.org).

Empirical Specification

To examine the relationship between women's empowerment and intra-household dietary intake, we estimate the following equation:

$$D.D_i = \beta_i + \alpha_i empowerment + \theta_i x + \varepsilon_i$$

Where $D.D_i$ is a vector of dietary diversity of the individual, $\beta, \alpha \; and \; \theta$ are unknown parameters that are to be estimated. "x" is a vector of the household-level characteristics and "ε" is the error term.

The household dietary diversity was measured using the count of food groups based on the 7-day recall household food consumption data in the LSMS_ISA survey. The food groups used for this study are based on 11 food categories as identified in the Food and Agricultural Organization guidelines for measuring dietary diversity. These categories include cereals, tubers, legumes, meat, egg, vegetables, fruits, oil, sweets, mil and fish. This measure is increasingly been used in computing dietary diversity (see Taruvinga, Muchenje and Mushunje, 2013). More so, Sraboni et al (2014) admonishes the use of our measure, other than the calorie availability indicators that would have been a suitable alternative measure. The authors criticized calorie intake measure because it does not reflect the quality of foods available to the household.

The empowerment index is our key independent variable. Our index is computed using the individual level data of household's male and female. We present the different domains of our empowerment index, with their indicators in Table 4.1. Each of the domains haves equal weights, as are the indicators within the domains. Individuals are defined as empowered when their empowerment index tilts towards a higher value closer to 1 and are disempowered in the situation when their empowerment index tilts away from 1 and towards 0. The different domains of empowerment are defined as follows:

(i.) Education: this domain concerns the individual's decision to pursue a post-secondary education.

(ii.) *Resources:* this domain concerns ownership, access and decision making over productive economic resources in the household such as land, wage income and building.

(iii.) *Insurance*: this domain considers the individual's ability to make decisions over owning a savings and/or an insurance scheme for future and contingent events.

(iv.) *Group activities*: this domain contains the individual's involvement in economic or social groups.

(v.) *Information/connection*: this domain is focused on the individual's ability to own and use information and technology equipment that can enhance information and connection with the immediate and distant environments.

Table 4.1 Empowerment Index: Domains, Indicators and Weights

Domain	Indicator	Weight
Education	Education	1/5
Resources	Right to sale of land owned	1/20
	Own income	1/20
	Decides on the income	1/20
	Own building	1/20
Savings/Insurance	Own savings/insurance	1/5
Group activities	part of a finance group	1/10
	part of a social group	1/10
Information/connection	access to information	1/10
	access to connection	1/10

Source: Authors

The other control variables in our equation include average age of the household, share of household members that are educated, household size, share of female in the household, income per capita of the household, share of adult in the household and household expenditure on electricity per capita. The summary statistics of the all the variable used are presented in Table 5.1. Likewise, the statistics for the share of the different domain of empowerment in the overall index is presented in Figure 5.1.

Estimation Strategy

Two main estimation strategies are applied in this analysis. The first is testing specific relationship between empowerment and dietary intake across households. This allows us to assess how changes in empowerment would affect different types of household dietary intake. The analysis is performed using non-parametric regressions that are based on the local polynomial regression approach. This type of regression fits the relationships between the variables of interest, such that separately fitted relationships are obtained at different values of the independent variable, so as to accurately predict the regression lines. This technique has its unique advantage, which include: first, and unlike the parametric linear regression technique, it allows for a relaxation of the linearity assumption and can predict estimators and inference procedures that are less dependent on functional form assumptions (Yatchew, 1998; Frolich,

2006). Second, different forms of relationships can easily be explored between variables of interest, which makes it useful for exploratory data analysis and for practical and policy relevant analysis. Third, the non-parametric regressions permit, in many cases an estimation of variables despite their endogeneity status (Frohlich, 2008).

The parametric regression approach (in the form of the Ordinary Least Square (OLS) regression) and the Instrumental Variable approach are applied in this study. The OLS is included to provide a baseline analysis for the estimated relationship. However, some household characteristics may be affected by the same factors that influence its dietary diversity; thus, our empowerment variable may be prone to endogeneity issues. We apply the standard instrumental variable technique to correct for possible endogeneity bias. We use the following instruments at the household level: (i) the difference in ages between the primary male and female decision makers and (ii) the type of building in which the household currently resides. The first instrument is computed based on the age difference between male and female household members that are adult and who are capable of making decisions within the household. The motivation for this instrument is that it reflects the differences in human capital and therefore shows the relative bargaining strength within the household (see Quisumbing and Hallman, 2005). The type of building that the household resides in is indicative of households' level of physical capital.

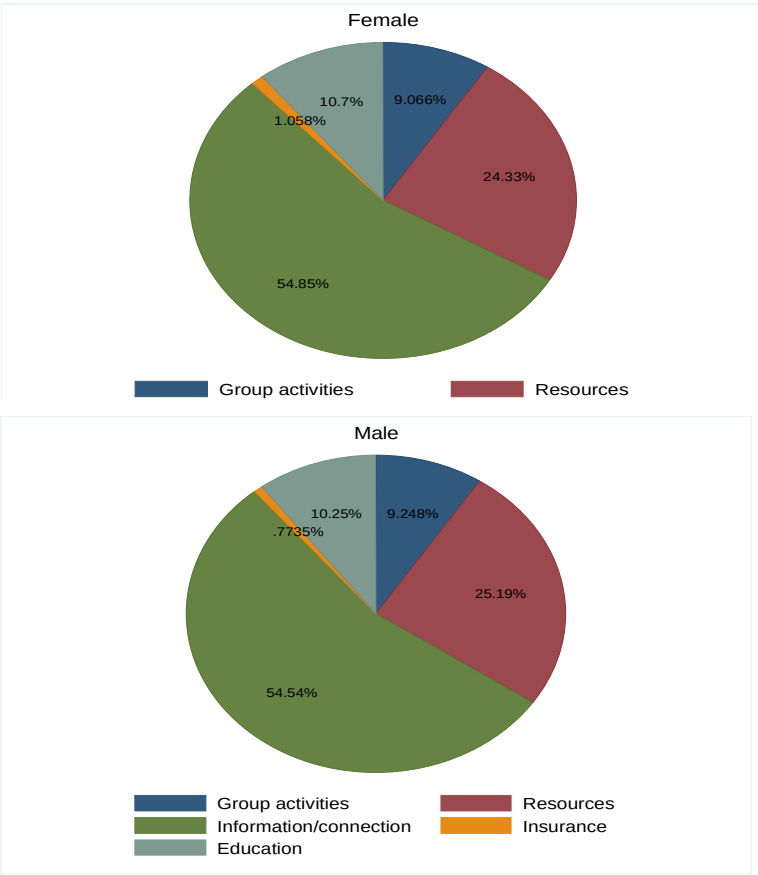
5. Results and Discussions

Descriptive and Summary Statistics

The pie chart in Figure 5.1 shows the sizes of the different domains of empowerment for the male and female household members in our sample. Clearly, there is no much difference in the different domains of empowerment across the gender of the household member. The connection and information domain have the highest contributions to the empowerment of the individuals; this is followed by the resources of the individuals, which contribute about 24 percent of the individual's total empowerment. The education and group activities domain are the third and fourth important contributors to empowerment across gender, while insurance scheme contributes only a marginal fraction of the pie. The inference from the pie chart is that both male and female genders are better empowered in terms of information and connection; however, they are mostly disempowered in terms of the security of their future based on access to insurance

schemes. There is the need to also improve the empowerment status across gender in relation to group activities and education.

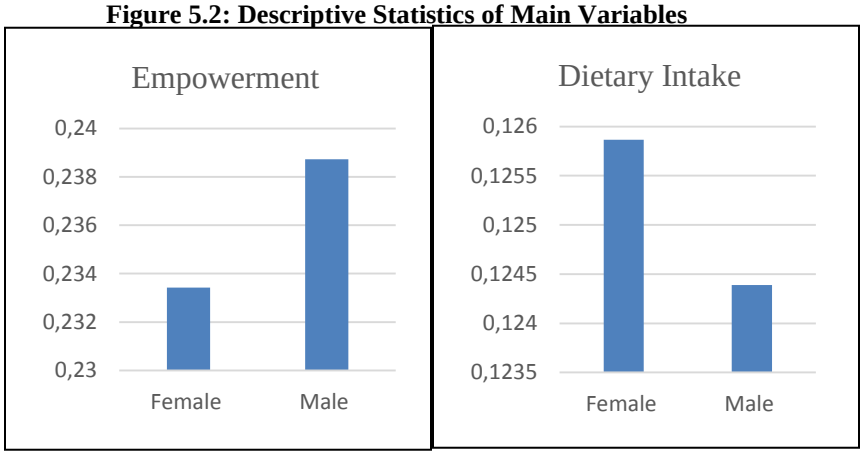
Figure 5.1: Contribution of Each of the Five Domains to Women's Empowerment in Nigeria



We begin by presenting the descriptive statistics of our main variables: these include the average weight of the household, the dietary intake and then the empowerment index. Clearly, the empowerment index across the male and female household shows that though (on the average) the two groups of households have similar empowerment scores, the male households tend to have a higher empowerment score. The scores (0.233 for female and 0.238 for male) connotes that on the average, the two households are less empowered considering that they have only 23 percent positive scores of the 10 indicators of empowerment according to our measure. We also go through the average dietary intake as displayed in Figure 4.2. The female households have

higher dietary intake: just like the empowerment index, the two groups of households are within a similar range of dietary intake. Thus showing that there is not much difference (in terms of evident contrast) between the male and female household dietary intake. However, it is evidently cleat that the bars for the female households exceed those of the male households, so that it can be concluded that though the dietary intake across households types are within the same strata, the female households tend to exceed their male counterparts in the volume of dietary intake.

Figure 5.2: Descriptive Statistics of Main Variables



The descriptive statistics are further presented in Table 5.1 for the entire variables in our econometric model. Some important highlights from Table include: on the average, many of the households own no asset. This is not different when considering the different households, in terms of the gender of the household-heads. On the average, the mean age of households' members is about 17 years, showing that the households may consist of younger individuals. About 1 person in the household has post-secondary school education, while 33 percent of the households have individuals that are 18 years and above. The average household size is 9 individuals, where both the male and female households have similar sizes. The income per capita is higher for the male households than their female counterparts: overall, the income per capita for the entire household is only 2604.59 local currency, which is equivalent to 16.5 US$, using the respective exchange rate. The empowerment index and the dietary intake are not different from the graphs presented in Figure 5.2. Evidently, the empowerment index is quite low for the households represented in this study: this trend cuts across both the male and female households. The dietary intake was also relatively small for the entire sample and even across the different categories of the households.

Table 5.1: Descriptive Statistics of Entire Variables

	Total		Male Hh		Female Hh	
Variable	Mean	S.dev	Mean	S.dev	Mean	S.dev
Age (Years)	16.78	20.59	16.27	19.61	17.38	21.60
Educ. Per cap	0.13	0.32	0.13	0.33	0.12	0.32
Share adult	0.33	0.44	0.32	0.44	0.33	0.44
Share Female	0.51	0.47	0.09	0.19	0.97	0.12
Hh Size	9.16	13.02	3.53	3.81	3.84	3.20
Income Per cap	2604.59	31728.93	3254.45	44179.22	2014.73	9881.47
Elect. Per cap	16.44	49.23	15.14	29.19	17.75	63.14
Dietary Intake	0.13	0.34	0.13	0.34	0.12	0.34
Empowerment	0.23	0.14	0.24	0.14	0.23	0.13

As a further descriptive analysis, this study presents the correlation analysis to check two important results: first, to understand the bivariate relationship that may likely exist between the variables of interest, and the control variables. Second, it enables us to understand whether there is existence of multi-collinearity problems across the variables that will be included in the model. The results of the pairwise correlation for the entire sample are presented in Table 5.2[9].

Table 5.2: Correlation Analysis

	Dietary Intake	Empowerment	Age	Educ. Per cap	Share adult	Share Female	Hh Size	Income Per cap	Elect. Per cap
Dietary Intake	1.000	----	----	----	----	----	----	----	----
	0.029*								
Empowerment	(0.000)	1.000	----	----	----	----	----	----	----
	0.010*	0.089*							
Age	(0.000)	(0.000)	1.000	----	----	----	----	----	----
	0.021*	0.548*	-0.033*						
Educ. Per cap	(0.000)	(0.000)	(0.000)	1.000	----	----	----	----	----
	-0.040**	0.148*	0.750*	0.018					
Share adult	(0.002)	(0.000)	(0.000)	(0.773)	1.000	----	----	----	----
	0.030***	-0.019*	0.042	-0.023*	0.013*				
Share Female	(0.057)	(0.000)	(0.000)	(0.000)	(0.000)	1.000	----	----	
	0.017*	0.075*	-0.020*	0.019*	-0.061*	0.038*			
Hh Size	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	1.000	----	----
	0.040*	0.007*	0.002	0.008***	0.003*	-0.020*	0.004*		
Income Per cap	(0.005)	(0.000)	(0.1338)	(0.055)	(0.000)	(0.000)	(0.008)	1.000	----
	0.008*	0.046*	0.028*	0.018*	0.033*	0.015*	-0.013*	0.005**	
Elect. Per cap	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.022)	1.000

Note: The superscripts *, ** and *** imply 1, 5 and 10 percent levels of significance. The values in parenthesis are the probability values.

Attention is given to the first column of the Table considering the bivariate relationship between the other explanatory variables and the main explained variable – dietary intake. It is apparent

[9] Those of the Male Hh and Female Hh are not presented for brevity, but are available upon request.

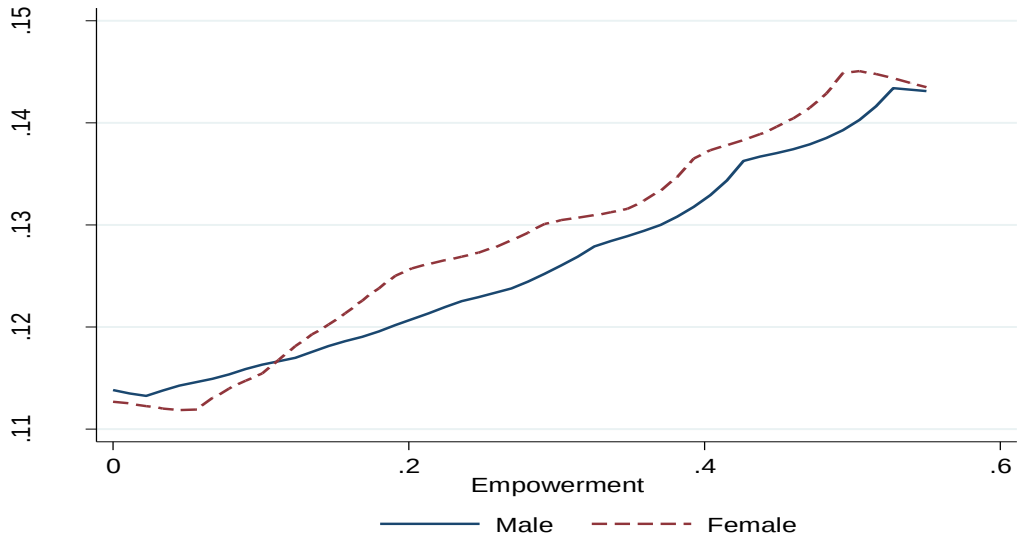
from the Table that all the explanatory variables have a positive bivariate association with intra-household dietary intake and the variables were significant at the 1 percent level. Concisely, signs and significant value of the empowerment and the other explanatory variables suggest that they positively explain the intra-household dietary intake. This result is consistent when considering the male and the female individuals[10]; however, the coefficient for the empowerment variable was higher for the female individuals than for their male counterparts. Thus, implying that empowering female may have higher impact on intra-household welfare (in terms of dietary intake), compared to their male counterparts.

Estimation Result

The estimation result begins with considering the non-parametric regression lines of dietary intake and empowerment across the gender of the household individuals. The local polynomial regression performs a kernel-weighted local polynomial regression of the line of dietary and empowerment, and then displays the smoothed values of the graphs with the horizontal lines displaying the average empowerment index. This type of analysis presents a first-hand display of the regression lines between our variables of interest. The graph is presented in Figure 5.3: individuals with low empowerment index have lower dietary intake. The importance of individual dietary intake constantly increases with rising empowerment index. This evidence is consistent with our predictions that the proportion of individual dietary intake increases with the level of empowerment. FAO (2011) and World Bank (2011), likewise confirm the result that empowerment essentially increases food security and reduces household hunger – for which dietary intake is a significant component.

[10] Results were not presented for brevity, but are available upon request.

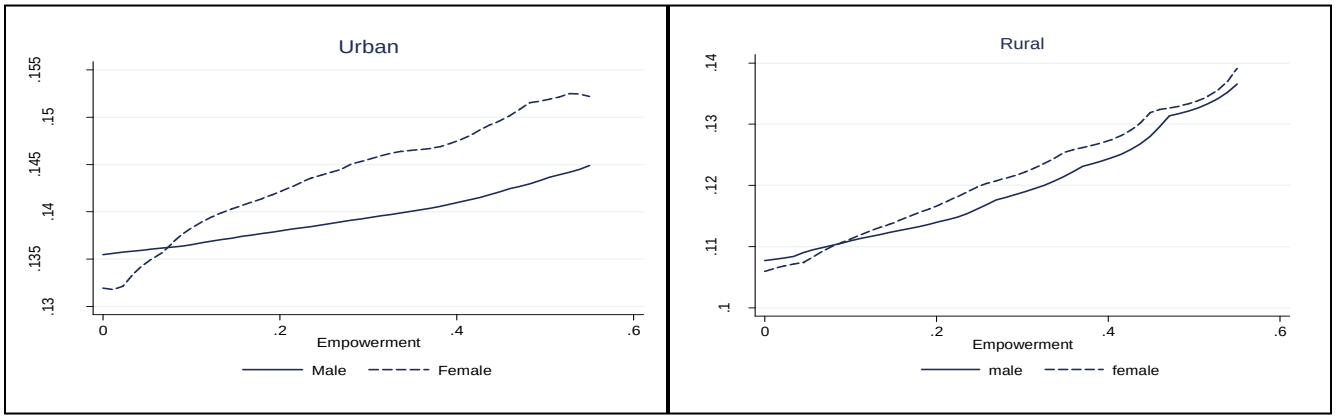
Figure. 5.3: The local polynomial graph (Dietary Intake and Empowerment)



We also go further to observe the kernel-weighted local polynomial regression for the variables – dietary intake and empowerment – across the individuals' household location (i.e. rural vs. urban). From Figure 5.4, we find some evidence of gender differences across different locations of the individuals. For those individuals in the urban area, it is evident that a unit increase in empowerment will have a higher impact on dietary intake for women compared to their male counterparts. Evidently, the gap between male and female individuals widens as the empowerment index increases. Thus, females are more likely to improve their dietary intake as their empowerment increases compared to the male individuals. A similar trend is seen for the regression line between empowerment and dietary intake for individuals in the rural area, except for the fact that the gap between the male and female shrinks unlike the urban dwellers. As the empowerment index increases, the female individuals' dietary intake still maintained a marginal gap compared to their male counterparts. One important take-away from this analysis is that; possibly, women improve their diet better than their male counterparts at similar levels of empowerment. This connotes that a higher impact can be achieved on improving the intra-household dietary intake if women are better empowered. More so, the household location may not really matter as a similar impact is achieved for dietary diversity with empowerment. This result is especially unique to Nigerian households as some other studies have considered only rural households: in Nigeria, empowerment may not only be excluded to rural dwellers

considering the strength of cultural stereotype that relegates women to a specific role and behaviour.

Figure. 5.4: The local polynomial graph (Dietary Intake and Empowerment) across Hh Location



Apart from the non-parametric regression, based on local polynomial estimations, we go further to present parametric estimations based on the standard OLS regression while factoring in the household fixed effect, and the instrumental variable estimations. For obvious reasons, the parametric estimations allow for the option of controlling for other important variables that affect intra-household dietary intake, apart from our main explanatory variable (empowerment). Assuming these variables are not controlled for, our regression analysis may be confronted with omitted variable bias and the estimated relationships may not be rightly predicted. Another important advantage of considering our parametric estimation technique is the capacity to control for possible endogeneity issues that may be vivid in our predictive relationships. The likely omitted variable bias will be handled with our two econometric techniques and the endogeneity issues will be specifically taken care of using the instrumental variable estimation techniques.

We present the parsimonious econometric estimates in Table 5.3, which contains the effect of the empowerment variable on household dietary intake for the entire households, the male and female household members. The OLS results across the three models suggest that generally, the empowerment variable is positively and significantly associated with dietary intake. The coefficient was larger for the female group than for their male counterparts. In essence, women dietary diversity will be better enhanced with empowerment compared to the male individuals.

Before considering the coefficients from the instrumental variable (IV) estimations, it is important to note that the diagnostics are presented at the end of the Table. The endogeneity test for the three IV estimations implies that the endogenous variables are relevant and are, in fact, endogenous, thus supporting the need to use the IV estimation to deal with the endogeneity problem. The over-identification and under-identification test results confirm that the instruments are valid and the models efficiently identified. The signs and significant values of the coefficient show a similar pattern as in the OLS estimations. From the IV estimation results, it is evident that empowerment has a positive effect on dietary diversity, the effect being higher for female-headed households. In addition, the coefficients in the IV estimation are higher than those in the OLS regression, meaning that neglecting endogeneity of the empowerment variable could lead to understate its effect on households' dietary diversity. ncreases better with empowerment than that of the male. The larger coefficient of the IV estimation submits that neglecting endogeneity of the empowerment measures may underestimate the impact of increasing empowerment on our outcome. In fact, the coefficient for the female household members is about nine times higher than that of the male. This finding agrees with previous works in Bangladesh that has shown a positive impact of empowerment on dietary intake, with higher impact for females (Kumar and Quisumbing, 2010; Malapit et al, 2015).

Table 5.3: Regression Results – Empowerment and Dietary Diversity

	Total		Male Hh		Female Hh	
	OLS	IV	OLS	IV	OLS	IV
Empowerment	0.074	0.326	0.063	0.322	0.082	3.081
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.108	0.201	0.110	0.200	0.106	-0.595
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.009	0.100	0.006	0.100	0.001	0.022
F(1, 4813)	7.140	42.340	76.330	43.900	26.870	11.340
Prob.	0.000	0.000	0.000	0.000	0.000	0.001
Under ID test p, Ho: underidentified		0.000		0.000		0.000
Weak ID test stat (Cragg-Donald Wald F statistic)		5.530		5.530		6.600
		65.810		65.120		24.760
Endogeneity test p, Ho: exogenous		(0.000)		(0.000)		(0.000)

Note: The superscripts *, ** and *** imply 1, 5 and 10 percent levels of significance. The values in parenthesis are the probability values. The instrument used for the IV estimation is the difference in ages between the primary male and female decision-makers. We used only individuals that are of the age 18 years and above to compute this variable.

A broader model that controls for other explanatory variables is computed and presented in Table 5.4. This estimation controls for other variables that may explain the dietary intake of individuals, but which were not included in the parsimonious estimations in Table 5.3. As usual,

the OLS and IV estimates are displayed in the Table, and the diagnostic of the IV are presented at the lower segment of the Table. From the Table, the sign and significant values of the empowerment variable remained consistent throughout the models, and even across the gender of the household members. More so, the coefficient for the empowerment variable for the female household member shows a higher effect of empowerment on dietary diversity compared to the effect observed for their male counterparts. Evidently, an increase in female empowerment will result in a significant improvement of about 39 percent of dietary diversity; the male will only experience a 14 percent increase in dietary diversity with an improved empowerment index.

Moving on to the individual indicators, in Table 5.4 we find that the share of females in households matters, but not consistently across different households. In male dominated households, female share has a positive and significant impact on dietary diversity. This is also similar for the size of the household: a positive and significant impact is observed, unlike the households that are dominated by women. Apparently, it can be said that household size and share of female in a female dominated household do not play a significant role in the extent of dietary diversity. Other variables like income, education and the cost of electricity play a consistent positive and significant role in defining the extent of dietary diversity across the different household types. The signs and levels of significance of these variables are consistent with the results of studies like Sraboni *et al* (2014), Malapit and Quisumbing (2015). The result suggest that better human capital development, income and the amount per capita that are spent on electricity infrastructure significantly increase household dietary diversity. The share of adult and average age of the household shows both negative and positive effect; however, their levels of significance were inconsistent across the different columns of Table 5.4

Table 5.4: Regression Results – Empowerment and Dietary Diversity

	Total		Male Hh		Female Hh	
	OLS	IV	OLS	IV	OLS	IV
	0.026*	0.563*	0.023***	0.140*	0.077	0.391*
Empowerment	(0.003)	(0.000)	(0.086)	(0.000)	(0.517)	(0.000)
	0.003	0.004**	0.002	0.013*	-0.002	-0.008
Share Female	(0.117)	(0.032)	(0.677)	(0.021)	(0.675)	(0.153)
	0.185	0.058	0.215	0.004***	0.134	-0.005
Hh Size	(0.225)	(0.747)	(0.258)	(0.066)	(0.489)	(0.180)
	0.008*	0.007*	0.008*	0.006*	0.008*	0.007*
Income Per cap	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	0.003	0.102*	0.003	0.236*	0.009**	0.074*
Educ. Per cap	(0.426)	(0.000)	(0.495)	(0.000)	(0.047)	(0.002)
	-0.011*	-0.025*	-0.011**	-0.036*	-0.005	-0.020*
Share adult	(0.002)	(0.000)	(0.026)	(0.000)	(0.269)	(0.000)
	0.019*	-0.029	0.019***	0.011*	0.012	0.109
Age	(0.010)	(0.723)	(0.097)	(0.000)	(0.151)	(0.174)
	0.063*	0.050*	0.057*	0.024***	0.065*	0.056*
Elect. Per cap	(0.000)	(0.000)	(0.000)	(0.055)	(0.000)	(0.000)
	-0.806	-0.289	-0.941	-0.594**	-0.560	0.502
Constant	(0.256)	(0.730)	(0.285)	(0.018)	(0.533)	(0.164)
R-squared	0.032	0.120	0.031	0.120	0.033	0.128
F-Stat	48.670	88.320	22.900	48.160	28.630	47.530
Prob.	0.000	0.000	0.000	0.000	0.000	0.000
Under ID test p, H_0: under-identified	----	0.000	----	0.000	----	0.000
Weak ID test stat (Cragg-Donald Wald F statistic)	----	7.250	----	8.750	----	5.530
	----	25.500	----	24.930	----	23.790
Endogeneity test p, H_0: exogenous	----	0.000	----	0.000	----	0.000

Note: The superscripts *, ** and *** imply 1, 5 and 10 percent levels of significance. The values in parenthesis are the probability values. The instruments used for the IV estimation are the type of building of the household and the difference in ages between the primary male and female decision-makers. We used only individuals that are of the age 18 years and above to compute this variable.

We go further to examine the relationship (dietary diversity and empowerment) at the household level. Two household groups were considered based on the gender of the household and the proportion of female in the households. The first group considers the gender of the household head (i.e. whether male – or female – headed households), and then re-estimated the model to see the size and significance of the coefficients. The second group of households divides the sample according to the share of females that are living in the household (i.e. 1 if the proportion of female in the household is higher than 50 percent and 0 otherwise). Households where there is equal representation of female and male individuals are not included in this analysis. The summarized results of the OLS and IV estimation techniques, alongside the diagnostic checks of the IV, are presented at the bottom of Table 5.5.

Some interesting outlooks are observed with regards to the behavior of the empowerment variable across the different types of household. The first is that the empowerment variable

remained consistently positive when considering households that are female biased. For instance, households that have larger percentage of female tend to have a positive and significant empowerment impact on dietary diversity. Likewise, in households with female heads, the empowerment variable remained positive and significant. Clearly, an improvement in female empowerment will result in a further increase of about 36.5 and 43.2 percent of household dietary intake for households with more women and those with female heads. For the other categories of households (those with a smaller share of female members and male headed households), it is evident that the coefficient of the empowerment variable was not significant, despite that it was positive. This result confirms the rhetoric that, when related to food consumption and diversity, focusing empowerment interventions on benefiting a large proportion of women will be more impactful on the household than when excluding more women.

Table 5.5: Regression Results – Empowerment and Dietary Diversity across Different Household Types

	>50% Female		<50% Female		Female Head		Male Head	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	0.034*	0.365*	0.014	0.135	0.034	0.432*	0.023	-0.030
Empowerment	(0.005)	(0.001)	(0.262)	(0.158)	(0.059)	(0.000)	(0.349)	(0.710)
	0.011	0.013	0.053*	0.061	0.009	-0.003	0.003	0.003
Share Female	(0.557)	(0.440)	(0.008)	(0.000)	(0.912)	(0.701)	(0.703)	(0.703)
	0.118	0.021	0.180	0.002	0.200	-0.005	0.224	0.003
Hh Size	(0.686)	(0.509)	(0.342)	(0.494)	(0.797)	(0.966)	(0.142)	(0.300)
	0.007*	0.007*	0.008*	0.008*	0.007*	0.008*	0.008*	0.090*
Income Per cap	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	0.044	0.068*	0.009***	0.156	0.005**	0.082*	0.003	0.007
Educ. Per cap	(0.414)	(0.006)	(0.076)	(0.431)	(0.458)	(0.002)	(0.734)	(0.653)
	-0.007	-0.021*	-0.014*	-0.017*	-0.007	-0.024*	0.014***	-0.012
Share adult	(0.140)	(0.000)	(0.006)	(0.000)	(0.916)	(0.005)	(0.060)	(0.112)
	0.017***	0.016**	0.003**	0.002*	-0.003	0.003	0.016	0.035
Age	(0.070)	(0.036)	(0.021)	(0.133)	(0.765)	(0.714)	(0.905)	(0.978)
	0.067*	0.051*	0.007*	0.064	0.008*	0.007*	0.099*	0.095*
Elect. Per cap	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	-0.422	0.237	-0.773	-0.119**	0.998	0.056	-0.978	-0.175
Constant	(0.718)	(0.472)	(0.379)	(0.612)	(0.782)	(0.964)	(0.167)	(0.461)
R-squared	0.033	0.131	0.031	0.136	0.031	0.125	0.036	0.134
F-Stat	29.51	47.73	23.090	43.990	15.220	22.52	12.83	20.04
Prob.	0.000	0.000	0.000	0.000	0.000	0.000	(0.000)	(0.000)
Under ID test p, H_0: under-identified	----	0.000	----	0.000	----	0.000	----	0.000
Weak ID test stat (Cragg-Donald Wald F statistic)	----	8.750	----	7.250	----	5.530	----	7.250
	----	8.190	----	1.999	----	10.990	----	25.18
Endogeneity test p, H_0: exogenous	----	0.004	----	0.159	----	0.000	----	0.000

Note: The superscripts *, ** and *** imply 1, 5 and 10 percent levels of significance. The values in parenthesis are the probability values. The instruments used for the IV estimation are the type of building of the household and the

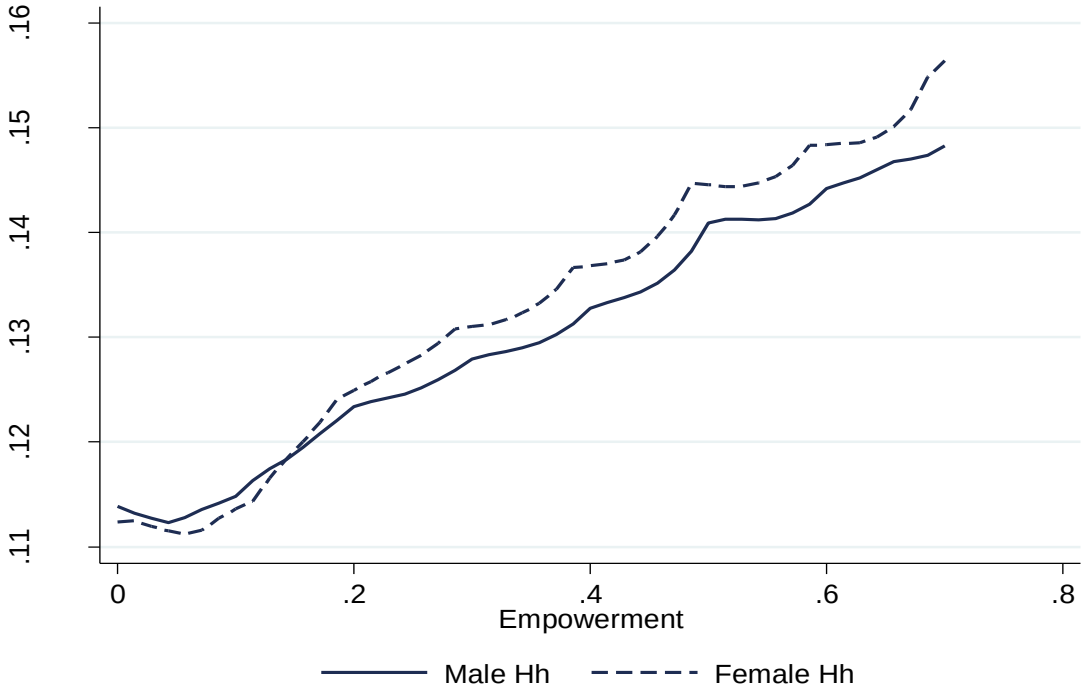
difference in ages between the primary male and female decision-makers. We used only individuals that are of the age 18 years and above to compute this variable.

The signs and significant values of most of the control variables changed across household types, especially when compared to the behavior of these variables in Table 5.4. For the households that are female-biased, the income, education, the average age of the household's members and household spending on electricity were found to be significantly explaining dietary diversity. For the male-biased household, most of these variables lost their significance.

Robustness

We use an alternative measure to capture the empowerment variable. Following the example of Sraboni et al. (2014), this alternative measure captures empowerment based on a sub-sample of households in which both the male and the female empowerment scores are available. This new measure consists of the gender parity gap in which the difference between the male and female empowerment index are generated. The gender parity gap if equal to zero if the women empowerment score is equal or exceeds the male one. Figure 5.5 clearly shows a positive relationship between the new empowerment measure and dietary diversity intake, and the dietary diversity outcomes of the female gender tends to outperform those of the male at every single level of empowerment. This result is similar to those of Figure 5.3 and 5.4; thus, suggesting that a positive relationship between empowerment and dietary diversity is still expected with the new empowerment measure.

Figure. 5.5: The local polynomial graph (Using New Empowerment Variable)



Turning unto the parametric regressions based on the OLS and IV estimation, the results from these estimations are presented in Table 5.6. From the Table, not much difference is observed for the main explanatory variable – empowerment. The coefficient of this variable maintained a positive effect across the different estimation technique. One important difference between these results and those reported in Table 5.4 is that in this new estimation, the empowerment variable lost its significance using the OLS estimation. Since we do not base our inference on this estimation technique, and the signs of the variable remained unchanged, it does not raise a concern for us. A more important outcome from this new estimation in Table 5.6 is that female empowerment still maintained a higher impact on household dietary diversity unlike the male empowerment.

Table 5.6: Regression Results – Empowerment and Dietary Diversity

	Total		Male Hh		Female Hh	
	OLS	IV	OLS	IV	OLS	IV
	0.011	0.391*	0.016	0.099*	0.077	0.391*
Empowerment	(0.371)	(0.000)	(0.169)	(0.000)	(0.517)	(0.000)
	-0.002	-0.008	0.005	0.017*	-0.002	-0.008
Share Female	(0.673)	(0.153)	(0.314)	(0.006)	(0.675)	(0.153)
	0.121	-0.005	0.190	0.001*	0.134	-0.004
Hh Size	(0.536)	(0.180)	(0.293)	(0.000)	(0.489)	(0.180)
	0.009*	0.007*	0.008*	0.009*	0.008*	0.007*
Income Per cap	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	0.009	-0.074*	0.006	0.363*	0.009**	-0.074*
Educ. Per cap	(0.052)	(0.002)	(0.190)	(0.000)	(0.047)	(0.002)
	-0.005*	-0.020*	-0.015*	-0.072*	-0.005	-0.020*
Share adult	(0.255)	(0.000)	(0.002)	(0.000)	(0.269)	(0.000)
	0.015***	0.001	0.002**	0.001*	0.012	0.001
Age	(0.100)	(0.174)	(0.012)	(0.000)	(0.151)	(0.174)
	0.007*	0.006*	0.006*	0.002***	0.065*	0.006*
Elect. Per cap	(0.000)	(0.000)	(0.000)	(0.229)	(0.000)	(0.000)
	-0.493	0.501	-0.815	0.919*	-0.560	0.501
Constant	(0.586)	(0.164)	(0.330)	(0.002)	(0.533)	(0.164)
R-squared	0.032	0.128	0.030	0.107	0.033	0.361
F-Stat	29.820	47.530	22.29	42.77	28.630	47.53
Prob.	0.000	0.000	0.000	0.000	0.000	0.000
Under ID test p, H_0: under-identified	----	0.000	----	0.000	----	0.000
Weak ID test stat (Cragg-Donald Wald F statistic)	----	5.530	----	7.250	----	6.66
	----	39.75	----	36.27	----	23.79
Endogeneity test p, H_0: exogenous	----	0.000	----	0.000	----	0.000
Nos. of Households	1128	1128	1109	1109	1128	1128

Note: The superscripts *, ** and *** imply 1, 5 and 10 percent levels of significance. The values in parenthesis are the probability values. The instruments used for the IV estimation are the type of building of the household and the difference in ages between the primary male and female decision-makers. We used only individuals that are of the age 18 years and above to compute this variable.

Conclusion and Implications of Results

The relationship between empowerment and household dietary diversity is not well tested, especially when considering women and in low middle income countries. Testing this relationship using Nigerian national household survey arrives at several interesting findings.

First, as generally expected, average household empowerment is an important determinant of dietary diversity. Furthermore, consistent with gender differences in dietary intake and across different levels of empowerment, the dietary effect from empowering female household members differs considerably from those of the male gender. Our findings are clearly in line with previous findings (Mutua et al., 2014; Sraboni et al., 2014; Waller, 2014).

Second, we find that the empowerment effect on dietary diversity differs across household biases towards females. For households with higher bias towards the female and female leadership, we find a significant and higher dietary diversity impact, compared to those that are less biased towards the female. This suggests that a different effect is expected across households from an improvement in their level of empowerment, but depending on the household biasness towards women. This biasness includes basic indices such as: (i) is the household composed of more female? (ii) is the head of the household a female? If the answers to these questions are affirmative, then we expect that empowerment will significantly yield an improved dietary diversity.

Third, the analysis suggests that greater empowerment will result in improved dietary diversity, especially when the empowerment is directed at females and households that are female-biased. In essence, the result is not in any way suggesting that male empowerment is less important; at least for most of the variables, we observed a positive impact on dietary diversity. However, the results suggest that any action taken towards improving female empowerment will generate a significant and higher impact on the dietary diversity of the household. There are two important channels through which female empowerment will generate a very high and significant impact on household dietary diversity. The first is that with empowerment, women will have the capacity to make better choices on the quality and mix of diet that the household will be consuming. This is unlike males, whose main responsibilities in the household are not directly tied to diet or decision over the choice and mix of diets. Second, women play a significant role in household food consumption and production. This makes the female gender to be better acquainted with vast choices of meals that can be advantageous for the household consumption. In essence, when considering household health through diversity of diet, it is important to pay much attention to programs and interventions that can empower women.

Altogether, our findings merit further research on the relationship between inequality and health in low middle income countries, where gender inequality is higher and women are confronted with varying socio-economic discriminations. A possible direction for further studies is to include proxies for various mediators in order to determine the linkage through which the positive empowerment-household dietary relationship is achieved. Moreover, it is also desirable

to identify the consistency of our prediction using field survey and based on qualitative type of data.

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