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Factors Influencing Dietary Diversity Status of Rural Farming Households: A Case Study of Odeda local Government, Ogun State, Nigeria

MASTER'S THESIS

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Declaration

I hereby declare that I have done this thesis entitled Factors Influencing Dietary Diversity Status of Rural Farming Households; A case study of Odeda Local Government, Ogun state, Nigeria independently, all texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to Citation rules of the FTA.

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Abstract

The study examined the dietary diversity of rural farming households in Odeda local government area of Ogun State, Nigeria. These households face resource constraints that limit their access to optimum food production and procurement, affecting their dietary diversity. The research collected data on socio-economic characteristics, food consumption, food source, and dietary diversity constraints. Various data analysis techniques such as frequency counts, means, percentages, chi-square, t-test, correlation, and ordered logit regression were used. Results reveal that 66.7% of the farming household heads were male, 72.7% were married, 52.7% were Christians had access to extension service, about 79.3% had some form of educations. The mean age, household size, farm size, farming experience and Primary income of the respondents were 42 years, 5 persons, 2.13 hectares, 18.9 years, and N41,340 respectively. Based on food consumption, vegetables, oil and fat and cereals were found to be consumed more among rural farming households were found to be the food consumed most by the rural farming households in the study area. The main source of the food consumed by the rural farming households is the market, however some of the households got some of their food items through their cultivation effort on the farm. The estimated food consumption score shows that the majority (87.3%) are within the borderline while the mean dietary diversity score is 6.99 with majority of the households being in the high dietary diversity group. The constraints that mainly affected dietary diversity are high cost of food (3.90), belief about certain foods (3.72), low income (3.44) and distance to the market (x=3.28). The study found that age and farm size have a significant relationship with dietary diversity, while female-headed households tend to have more diverse diets. However, it remains unclear if rural farming households are achieving adequate quality and quantity in their diets. To promote dietary diversity, the study suggests cultivating different crops alongside the main crops. Further research is needed to explore other areas of food consumption in rural farming households.

Keywords: Dietary diversity, Food consumption, Farming households, Rural, Dietary diversity Score.

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List of the abbreviations used in the thesis.

ADP – Agricultural Development Programme

DD – Dietary Diversity

FAO – Food and Agriculture Organisation

FCS – Food Consumption Score

FS – Food Security

HDDS – Household Dietary Diversity Score

HEI – Healthy Eating Index

HFI – Household Food Insecurity

Hh – Household

IFAD – International Fund for Agricultural Development

IITA – International Institute for Tropical Agriculture

LG – Local Government

NRCRI – National Root Crops Research Institute

NSPFS – National Special Program for Food Security

SSA – Sub Saharan Africa

UN – United Nation

USAID – United State Agency for International Development

USDA – United States Department of Agriculture

WFP – World Food Program

1.0 Introduction

In 2021, it was estimated that approximately 768 million people worldwide were undernourished, with the majority, around 60%, living in developing countries and Sub-Saharan Africa was basically identified as the region with the highest prevalence of undernourishment, with an estimated 282 million people affected between 2019 and 2021 (FAO, 2021). Additionally, more than 70% of undernourished people reside in rural areas where a/agriculture is directly or indirectly dependent (FAO, 2021; Bashir et al., 2012). These issues are particularly relevant to sub-Saharan Africa, where the bulk of the population relies on agriculture as their primary source of food and where malnutrition in low-income households is mostly brought on by a lack of dietary variety (Arimond and Ruel, 2004). Hence, enhancing farm production diversity is increasingly recognized as a potential instrument to ensure the supply of diverse food for rural communities in developing countries to tackle malnutrition. (Khoury *et al*., 2014)

Lack of dietary diversity is unquestionably the main factor contributing to micronutrient malnutrition in sub-Saharan Africa, where both under nutrition and micronutrient malnutrition are still serious issues (FAO, 2013; Thompson and Meerman, 2013). Therefore, a key tactic to enhance nutrition and health is to broaden dietary diversity. This suggests for impoverished farming households to have access to a wide variety of foods, the agricultural output must likewise be diversified (Pingali, 2015). For low-population segments to have improved access to food, agricultural activity involvement must also result in higher dietary quality and diversity (Govender *et al*., 2017). Many of the poor and undernourished people are smallholder farmers and as such diversifying production on these smallholder farms is widely perceived as a useful approach to improving dietary diversity.

Nutrition or nutritional adequacy is interpreted as the adequate consumption of different food groups to maintain a balanced diet and meet daily nutrient needs (Habte *et al.*, 2016). Food security exists when all people always can access sufficient, safe, and nutritious food to meet their dietary needs and food preferences, thus ensuring an active and healthy life (FAO, 2012). Hence, food security is realized when every person has stable and continuous access to different foods that are of good quality and are safe, affordable, and in sufficient amounts (FAO, 2012; USAID 2021).

The idea of "nutrition-sensitive agriculture" is predicated on the idea that agricultural production methods might have a positive impact on the fundamental factors influencing nutrition in rural farming families (Ruel *et al*., 2013). Even while agricultural growth has been significant over the past few decades, emerging nations like Nigeria have not seen a corresponding improvement in the nutrition and health of impoverished rural households (Demeke *et al*., 2017). According to preliminary research, most families in Nigeria experience food insecurity and consume a diet that is insufficient to meet their daily needs for calories, protein, and micronutrients (Ajani, 2010; Akerele, 2015). This perhaps clarifies why the majority of supply-side reforms haven't been able to result in significant or long-lasting reductions in food insecurity in the nation. As a result, economists and other development professionals are becoming more interested in how farming systems in developing nations can contribute to better nutrition outcomes. For this reason, this study is conducted to find out how farm diversity and the status of dietary diversity among households in African countries relate to one another and the factors that influence it. The diet and agricultural diversification are strongly correlated and dietary diversity status among households in African countries and the factors influencing it. Carletto *et al.* (2015) in his study made mention that there is a strong relationship between dietary and farm diversity assess the dietary quality and development of nutritional outcomes in a community, it is critical to understand the impact of crop variety on household dietary diversity status, which is the focus of this work. The majority of rural households, however, lack the means to generate their food (Temple *et al.*, 2016) mainly because of high food prices, unemployment, low wages, inadequate access to markets, poor storage facilities, selling at harvest due to poverty, inadequate control of property and right to land for agricultural production, poor weather conditions.

In addition, Studies reveal a correlation between rising dietary variety and family food security and socioeconomic position which will be extensively looked upon in the further part of this research studies. In contrast to the massive body of prior research studies that demonstrate that dietary diversity is primarily prevalent among rural households and unofficial urban settlements (Labadarios *et al*., 2011). This is explained by the fact that the majority of households in such areas rely on government social grants and, as a result, are less well-off. This present study is designed to further investigate factors influencing dietary diversity status among rural farming household with a case study of Odeda local government of Ogun state, Nigeria.

2.0 Literature Review

2.1 Food accessibility as a dimension of food security.

While examining dietary variety, household food security is a significant element that cannot be disregarded. Lack of physical, social, and financial access to enough, safe, and nutritious food to meet needs and preferences for an active and healthy life is known as household food insecurity (HFI) (FAO; IFAD; WFP, 2013). In developing and underdeveloped nations, Household food insecurity (HFI) frequently results in diets that are under-diversified and micronutrient deficient and HFI is associated with inadequate dietary diversity, poverty, and malnutrition, which endangers children's development. Insufficient food (hunger and malnutrition) and diseases brought on by inadequate nutrition (overweight and special needs) and they are two instances where food and nutritional insecurity is seen (K.P.D.S. Alves, 2014; Morais et al., 2014).

Nigeria's rural population accounts for approximately 70% of the country's overall population, with over 90% of these individuals working in agriculture, which continues to remain the country’s main economy sector. Nigeria however continues to rely heavily on food imports (GCG Fraser, 2020). In rural Nigeria, both adults and children frequently suffer from severe malnutrition. Geographically, there are differences in the prevalence of malnutrition across the nation, with 56% recorded in a rural south-western region, where the study location for this research is located, and 84.3% in three rural towns in the northern region of Nigeria. Stunting, wasting, and underweight affect, respectively, 42.9%, 9%, and 25% of children nationwide (Egbetokun, 2020). Limited dietary diversity is the primary cause of malnutrition in low-income households in Sub-Saharan Africa (Ochieng, 2017).

The United States Department of Agriculture (USDA) distinguishes between two types of food insecurity. The first is low food security, which is characterized by complaints of a diet's diminished quality, variety, or desirability, with little to no indication of a diet's diminished intake. The second is extremely low food security, which is characterized by reports of numerous symptoms of disturbed eating habits and decreased food intake. Long-term and short-term food insecurity are both possible. Race and ethnicity, handicap, and work position are all factors that affect one's capacity to get food. When there is little or no money available, there is a higher risk of food insecurity (Healthypeople.gov, 2020).

In sub-Saharan Africa, malnutrition is a major cause of sickness and lowers life expectancy (Yaya OS et al., 2021). Malnutrition is the umbrella term for both overeating and undereating, which can happen even when food is readily available in big quantities if the quality or diversity of the diet is poor (UNICEF, 2020; Global Nutrition Report 2015). On a global scale, malnutrition affects one in three individuals (IFPRI, 2016). In 2019, 687.8 million people were reportedly suffering from hunger worldwide, with 250.3 million of them living in Africa (FAO, 2020; Otekunrin et al., 2020). Small-scale agricultural households in emerging nations account for a higher share of this statistic (Carletto, 2016; Ayinde, 2020).

The most detrimental effect of food instability is malnutrition. Malnutrition in adults reduces labor market and agricultural production. Low birth weights and fetal malnutrition also occur in females as a result. Poor cognitive development and academic performance are consequences of undernutrition in fetuses and young children. Nutritional inadequacies contribute to low school attendance, absenteeism, early dropout, and poor classroom performance in school-age children, which results in lost productivity in adulthood (Mbwana et al., 2017).

Nigeria as a country has the largest economy in Africa and has the potential to have an enormous effect on the global economy, according to the World Bank (2017). Despite strong economic growth, regional imbalances and disparities led to a rise in poverty rates. Estimates indicate that 69% of Nigerians, or those who make less than $1.25 a day, live in relative poverty. Over 70% of the population lives in rural areas. It is crucial to fully examine the situation in order to solve the food and nutrition security status of rural inhabitants and enhance overall food security in Nigeria (World Bank, 2017).To address food insecurity and nutritional challenges in Nigeria, Several initiatives and programs, government has intervened through a number of programs and institutions; these includes the Agricultural Development Programme (ADP), Presidential Initiatives on Agriculture, National Special Program for Food Security (NSPFS), and Fadama Interventions (I, II, and III) in cooperation with the World Bank, as well as the project to biofortify cassava with vitamin A, launched by the federal government with assistance from the International Institute for Tropical Agriculture (IITA) and the National Root Crop (Sanusi et al., 2017).

Food insecurity, malnutrition, and related health problems remains on the increasing side despite the several interventions of the government and significant contributions to these

trends are poor nutritional quality due to choices of foods and insufficient food consumption (Ruel, 2013; Sealey-Potts and Potts, 2014). In Nigeria, the majority of households struggle with hunger, eat fewer diversified, low-quality foods, and consume less on average than what is necessary to meet daily calorie, protein, and micronutrient requirements (Sedodo et al., 2014; Agada and Igbokwe, 2015; Akerele et al., 2015). In spite of attempts to address food insecurity and malnutrition in Nigeria, many households continue to follow routine meals that consist predominantly of basic foods that provide the majority of the household's calories. Agriculture is crucial for addressing hunger and food insecurity in rural areas, and it is the largest industry globally, employing about 38% of the planet's land surface and using about 70% of the world's freshwater intake (Prosekov and Ivanova, 2018). However, despite global food production being ahead of demand for the last fifty years, food security has not yet been achieved, particularly on a global scale. According to the UN data, agricultural production needs to increase by 75% to provide sufficient amounts of food to the world's population by 2050 (Burchi and De Muro, 2016).

Furthermore, diversifying nonfarm sources of income has been of great help to significantly improve food security and nutrition in rural households (Akerele et al., 2017). The availability and accessibility of proper foods in the right proportions and combinations are crucial factors that affect nutritional status (Ruel, 2013). Educating the rural dwellers towards consuming a high-quality, diverse diet that provides the energy and minerals required for optimal health is a sustainable approach to reduce the rate of malnutrition among rural dwellers. Evaluating family food security by assessing the dietary diversity of households is a simple yet useful indicator (Vakili et al., 2013).

2.1.1 Production Diversity and Dietary Diversity in smallholder farm households

Many people believe that the expansion of agricultural diversification on smallholder farms is a good way to increase the nutritional variety and nutrition (Jones and Pellegrini *et al.*, 2014; Powell *et al.*, 2015). In order to ensure that household nutrition is on the increase, several number of recent development efforts have encouraged smallholder diversity by introducing new crop and livestock species (Burlingame *et al.*, 2012; Fanzo *et al.*, 2013). This strategy serves favourably from an environmental standpoint because farm diversification can greatly contribute to an increase in agrobiodiversity (Fanzo *et al.*, 2013).

It is established from a research standpoint that a large portion of produce produced by smallholder farmers is consumed at home, a significant positive association between the diversity of farm production and nutritional diversification is plausible. However, it would be oversimplified to make an assumption that all smallholder farmers are strictly subsistence farmers who do not sell or buy any food. The connectedness between production diversity and nutritional variety becomes more complicated when market activities are being considered. When households have enough money, they can purchase a variety of foods from the market rather than producing everything themselves, hence a reason for diversification (Jones *et al.*, 2014).

Up to a certain degree, farm diversification may support income growth and stability, but after that point, additional diversification may lower household income due to lost gains from specialization (Chege *et al.*, 2015). The relationship between production and consumption diversity has great tendency to change because lower household incomes are frequently linked to lower nutritional quality. When relying on markets, nutrition consequences in farm households will also depend on how functioning the market's function is and who controls the household's revenue from off-farm employment and commercial farm sales (Chege *et al.*, 2015; Fischer, 2012).

Generally, gender factors can significantly influence a family's access to food and nutrition, hence, the reason for relationship between diversity in production which eventually lead to increase of the household income, and this varies on the circumstances. Despite the existence of recent case studies (Keding *et al.*, 2012) on the nutritional effects of smallholder farm diversification initiatives, linkages and influencing factors have not been examined from a wider angle.

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2.2 Socio-economic characteristics of rural farming household in Odeda LGA.

A study carried out by Akerele and Oyebanjo (2016) and Oyedepo *et al.* (2015) to examine the pattern and determinants of asset ownership in this region had completed more than five years of formal education, suggesting that education is a key factor in the identification and exploitation of investment opportunities. The high proportion of respondents with formal education may reflect their awareness of the benefits of increased agricultural productivity brought about by better use and the provision of non-farm income by more educated individuals. The study also showed that the majority of people

were under 50, with a mean age of 41, indicating that the respondents were in the working class and within the range of those who were economically engaged. Indicating that farming is a highly important source of livelihood for them, the majority of respondents (50.8%) were married and had established families with responsibilities.

According to data from Camfiled (2014), the majority of households (97.5%) had between one and ten individuals, indicating a large pool of labor for farm work as well as food security. 95% of the respondents identified as self-employed, with farming as their primary occupation. With a mean income of N33, 587.5, the majority of them (88.3%) had farm earnings that were less than N50, 000 (139 US dollars) each month (93.30 US dollars). The majority (86.7%) of the respondents earned less than 50,000 (139 US dollars) and N35, 853.3 (99.59 US dollars) on average. More than half of the respondents (62.5%) worked in secondary occupations like artisan, trading, and teaching.

Findings by Ashimolowo et al. (2013) on the perceived impact of adolescent pregnancies, the majority of the people living in this area in southwestern Nigeria are Yoruba (85.00%) and engage in a variety of agricultural pursuits. The report records further by stating that 87.5% of respondents worked in the agriculture, 25.8% in trading, and 20% in hunting, while 12.5% and 5.8% worked in fishing and timber production, respectively. The results of this study suggest that, with almost half of the respondents (45.50%) having between six and ten years of experience in farming and the majority of respondents basing the majority of their household income on farm operations, farming is a prominent vocation among rural residents. Additionally, it implies that rural residents work several jobs as a means of reducing the dangers associated with farming operations.

The Study carried out (Ashimolowo *et al.*, 2013) established that Federal Government's Universal Basic Education (UBE) program, which aims to provide rural residents with at least a primary education, may be the cause of the larger number of respondents (46.70%) who had completed elementary school. The low level of education in the study area is then connected to the high cost of secondary and tertiary education and teenage pregnancy, which prevent rural children, especially girls, access to education (Ashimolowo *et al.*, 2013) and since the study was female teenager-centred, it was realized that pregnant teenagers are more involved in food crop production activities than any other agricultural activities, as the majority (93.20%) of female teenagers go into

more cassava (31.00%) production than maize (27.50%), yam (20.70%), and other agricultural production. This shows that they are predominantly farmers that grow staple foods like cassava, maize, and yam, and it could also be concluded that cassava, maize, and yam seem to be the staple foods in the study area, like other southern parts of the country (Ashimolowo *et al.*, 2013).

2.2.1 Dietary diversity status of rural farming household in Odeda LG area.

There is limited information available on the dietary diversity score (DDS) of rural farming households in Odeda local government area. However, a study conducted by Sanusi and Babatunde (2017) examined potato consumption among households in Odeda LGA of Ogun State, Nigeria. Their findings revealed that almost half (48.8%) of the represented households eat up less than 11 kg of sweet potato per month, and 75.0% consumed less than 11 kg of Irish potatoes each month. These results suggest that potato crops are not widely consumed in larger quantities by households in Odeda.

Nupo et al. (2013) investigated the dietary diversity scores and nutritional status of women in two seasons in the Odeda LG area. The study concluded that the DDS of the subjects was low, and that the subjects had an average nutritional status. The study also revealed that malnutrition assessed by MBI has to be confirmed by WHR, MUAC, and skin fold thickness as a correlation exists between them. The authors suggested that nutrition education is needed in rural villages to improve the dietary diversity of the villagers. The study included 206 respondents, with 21% of the population having an energy intake of less than 1,600 kcal per day, 41% having an energy intake of between 1,600 and 2,200 kcal per day, and 38% having an energy intake of greater than 2,200 kcal per day. A total of 60% of the subjects consumed more than 46 g of protein per day, while 33% consumed more than 30 g of fat per day. During the second season, 15% had an energy intake of less than 1,600 kcal/day, 59% had an energy intake of between 1,600 and 2,200 kcal/day, and 26% had an energy intake of greater than 2,200 kcal/day. Of the total percentage, 45% of the subjects had protein consumption of less than 46 g/day while 55% consumed protein above 46 g/day. 28% of the subjects had fat consumption of less than 30 g/day, while 72% consumed fat above 30 g/day.

Akinbule et al. (2022) conducted a second cross-sectional survey on 250 women (18–49 years old) in the same area to evaluate the risk factors for hypertension in women of childbearing age in the communities of Odeda local government area, Abeokuta.

According to the study, less than half of the respondents had a good food variety score, only about one-third of them met the minimum dietary diversity requirements, and only about one-fourth had an acceptable food consumption score (FCS). The women who met the minimum dietary diversity requirements and had an acceptable food consumption score were more likely to have higher (more adequate) micronutrient intakes, as noted in the study. Although more than two-thirds of the women had appropriate intakes of calories, carbs, protein, vitamins B3, B12, zinc, and iron, more than half of them had insufficient intakes of fat, fibre, vitamins A, C, B1, B6, folate, calcium, salt, potassium, and magnesium. The majority of the respondents had poor food intake ratings and did not meet the required level of dietary diversification. Additionally, more than a quarter of the respondents who were overweight had abdominal obesity, as reported by the study.

2.2.2 Effects of socioeconomic characteristics on dietary diversity

According to Baylis et al. (2013), economic activities like agricultural marketing strategies that promote agricultural commercialization are an effective means of enhancing agricultural production, increasing agricultural family income, and improving household nutrition. Ogutu et al. (2020) suggest that commercialization, as a part of economic activity, can increase the availability of locally produced commodities and influence dietary improvements and nutrition by changing gender roles in the household. Thus, examining the intricate relationships among socioeconomic processes such as market-oriented agriculture, food diversity, and household nutrition status is logical.

It is important to note that policies aimed at improving dietary diversity and children's nutritional status may not encompass variables that promote dietary variety. Therefore, caution must be exercised while approaching this issue. The report highlights the importance of market interaction, as farmers can improve and modify agricultural commercialization and convert their earnings into a wider variety of nutrient-dense foods.

Several studies have explored how marketing can support family food security and nutrition. For instance, Baylis et al. (2013) used household panel data from rural China between 1989 and 2000 to examine the impact of agricultural market changes on nutrition and found that market liberalization improved nutrition. Similarly, Koppmair et al. (2017) and Murendo et al. (2018) discovered a positive correlation between agriculture commercialization and dietary variety among families, women, and children. Conversely,

Carletto et al. (2017) observed that commercialization had little effect on nutritional status in Malawi, Tanzania, and Uganda.

According to Poorrezaeians et al. (2015), a number of socioeconomic factors, including age, income, and education, might have an impact on people's dietary diversity. As a result, these aspects must be considered in policy recommendations and interventions targeted at addressing food security.

Isaura and colleagues (2022) investigated the association between childhood socioeconomic status and food intake ratings. The majority of survey respondents were men under the age of 40 with low educational attainment, who were married or had been married, and never smoked. The study found that female participants were more likely to experience food insecurity, have less than 12 years of schooling, and suffer from poor health, including obesity and CVD. Previous research by Weigel et al. (2016) and Ramezani et al. (2017) has shown that women, individuals with low levels of education, and those with low socioeconomic status are particularly vulnerable to food insecurity, which exacerbates their health problems. Lawlis et al. (2016) and Lee et al. (2020) found that low education levels lead to poor employment opportunities and low income, which result in poverty and food insecurity among women, especially those who live alone or are single parents.

Furthermore, the food consumption score has been shown to be positively and significantly correlated with the parents' marital status by Korkalo et al. (2017) and Oladimeji et al. (2018). According to this, the food consumption score would drop by 1.379 units if the parents' marital status changed, such as through divorce, widowhood, or separation. Having access to a variety of meals is more likely for kids whose parents are married. The connection between parenting style, parental socioeconomic status (including financial, educational, and employment factors), and parents' marital status may account for the relationship between marital status and the results. The situation of the parents affects how they rear and feed their children. Yet, compared to children with single mothers, children with two parents are more likely to have their healthcare needs satisfied (Irvin et al., 2018). Due to their connections to food consumption, one of the cornerstones of food security, healthcare needs are crucial for every household member (Dean et al., 2018). Several factors determine the dietary diversity of people in a region, including the community's past consumption behavior, traditional practices, and the extent of technology related to food production, processing, preparation, and storage

(Keding et al., 2013), agricultural biodiversity in the region, and the diversity of its farming systems (Herforth, 2010).

Qineti et al. (2017) estimated the quantiles of food security and found that income and rising urbanization had a positive and significant impact on the consumption of diverse diets for households in the lowest quantile. This suggests that as wealth and infrastructure facilities advance, household consumption of foods high in nutrients will rise. Adding a new family member also significantly reduces the diversity of diets, which frequently restricts access to a larger variety of foods and can encourage repetitive diets that further raise the incidence of micronutrient deficiencies in urban settings. However, this finding goes against the conclusions reached by Woldehanna and Behrman (2013) and Ecker et al. (2013), who discovered that larger households benefit from economies of scale. The research of Rizov et al. (2015) and Gaiha et al. (2015) is in agreement with this one (2013).

2.3 Constraints affecting the consumption of diverse diet among rural farmers.

Chewe et al. (2021) investigated that the amount of cultivated land, the size of the household, the number of livestock units, the education of the household head, the receipt of extension information, and the use of fertilizers were factors found to be positively correlated with dietary diversity in households. The study stated that the aforementioned elements can boost household income, improve resources, and make it possible to buy a wider variety of foods. Dietary diversity may be constrained in rural family communities if these components are lacking.

According to Pamela (2021), economic access might be a better strategy for achieving household nutritional diversity than agricultural diversification. The necessity for legislative action to improve women farmers' access to resources like income and inputs is highlighted by this. Moreover, policy interventions that target enhancing agricultural productivity and subsequently, access to income, in conjunction with behavior change communication that disseminates knowledge on the significance of embracing a diverse diet, might promote household dietary diversity. From a policy perspective, improving access to urban markets by investing in rural transportation systems should also be considered due to the considerable distance between farmers and metropolitan centers.

Deborah et al. (2021) identified household production, agricultural and nutritional knowledge and awareness, information access and usage, household income, and time as the most important factors of dietary diversity. Additional drivers were the distance to the market, the cost and variety of foods available in the markets, and the relationship between gender dynamics and the aforementioned determinants. Dietary diversity may be limited by the absence of certain components.

According to FAO (2014), the production methods used by smallholder farmers and their access to markets have an impact on household food consumption patterns and dietary diversity. Rapsomanikis (2015) adds that output variety can lessen the responsiveness of smallholder farmers to shocks like poor harvests and low harvest prices. Less wealthy households with less farm diversity and market access experience a greater influence from production diversity on dietary diversity, whereas households with higher incomes and market access experience a lesser impact (Sibhatu, 2015 and Kissoly, 2018). Thus, addressing both the productivity and production diversity and markets access of similar smallholder farmers is crucial to improving their dietary diversity and food security.

In addition, Borelli et al. (2020) and Kahane et al. (2013) discuss how the consumption of fruits and vegetables is limited by seasonal availability, and a lack thereof does not necessarily lead to purchase even when income is available. Given the fact that the bulk of fruits are sold, fruit availability and consumption in households are correlated with fruit production diversity and potential revenue. It has been suggested that expanding the number of types available will enhance consumption by enhancing year-round availability of micronutrient-rich fruits and vegetables (Biodiversity International, 2017). Agro-biodiversification evaluations, targeted diversification, and fruit and vegetable consumption promotion can therefore take advantage of the diversity of fruits and vegetables to alleviate seasonal access issues.

Also, agricultural and nutrition knowledge and awareness informed the priority crops in terms of food production, consumption, and diversity. Inadequate nutrition information was also noted, including an incorrect understanding of dietary diversity. This knowledge gap corresponds with agricultural and dietary practices and choices. Agricultural knowledge and income have been reported to have impact on input and technology use and adoption **(**Rapsomanikis, 2015 and World Bank, 2018), and improving nutrition

knowledge and skills has been shown to improve dietary practices (Kulwa *et al.*, 2014 and Murendo *et al*., 2018).

The women mentioned that “time” was a major obstacle that prevented the development of diversity and the preparation of balanced diets. In earlier studies, time has also been identified as a variable influencing children's feeding habits and dietary. Due to their critical responsibilities in both agriculture and nutrition, women are more affected by agricultural interventions, even if the affected family members' time commitments typically increase. In addition, different family members (men, women, children, and young adults) respond to the increased labour and time demands in different ways, which has an impact on how nutrition interventions are felt by those groups of people. (Johnston *et al.*, 2018). Therefore, gender-related issues must be addressed, and labour-and time-sensitive techniques must be incorporated into intervention designs. Household income does not only affect the purchase of food but also affected the quantity of harvests allocated for household consumption and its mode of allocation to address different needs.

This information explains the food security situation in light of the food production for both food and income reported among smallholder farmers. Men were noted to sell more of the harvests, thus compromising household food security and dietary diversity. This determinant also led to the sale of most, if not all, fruits produced. Income or wealth is a well-reported determinant affecting food security and dietary diversity directly through purchasing power and indirectly by affecting agriculture and agro-biodiversity (Harris-Fry *et al.*, 2015; Powell, 2017).

2.4 Dietary diversity guidelines.

Dietary diversity is a qualitative indicator of food intake that shows household access to a range of foods and also serves as a stand-in for a person's diet's nutrient sufficiency (FAO, 2014). The Food Guide Pyramid and the USDA Dietary Guidelines both list dietary diversity as one of the qualities of a healthy diet (Poorrezaeian et al., 2015). According to the USDA dietary guideline and the Food Guide Pyramid, dietary diversity is one of the characteristics of healthy diet (Poorrezaeian *et al.*, 2015). The purpose of dietary diversity guidelines is to offer a universally applicable, standardized questionnaire from which different dietary diversity scores can be computed (FAO, 2014). Counting

the number of food groups ingested throughout a reference period is more common than adding up the number of foods to determine dietary diversity (Vakili et al., 2013).

According to Vakili et al. (2013), dietary diversity can be utilized as a proxy indicator of food access at the household level while serving as a reflection of dietary quality at the individual level in a study conducted by Poorrezaeian *et al*. (2015), measuring dietary diversity, a 24-hour dietary recall questionnaire was completed for each participant in a face-to-face interview. The FAO (2013), dietary diversity score questionnaire was used to determine the dietary diversity score of each participant (Kennedy *et al*., 2013). In accordance with the structure of this guideline, all food items were divided into 9 food groups, including: (1) cereals and white roots, (2) milk and dairy products, (3) vitamin A-rich vegetables and fruits, (4) green leafy vegetables, (5) other vegetables and fruits, (6) meat, fish, and sea food, (7) organ meat, (8) eggs, and (9) nuts, seeds, and legumes. The dietary diversity score was calculated using a minimum consumption of at least half serving of one food item from each of the mentioned food groups. The score of dietary diversity was the total of all food groups' scores. The range of dietary diversity score was from 0 to 9. Dietary diversity score was classified into two groups; (1) low (≤3) and (2) high (>3) (Drimie *et al*., 2013).

The Dietary Guidelines for Americans (DGA) recommend the Healthy Eating Index (HEI) as another effective tool for assessing the quality of diets. Guenther and colleagues (2014). For instance, the Healthy Eating Index created by Guenther et al. (2013) and NCI (2017) was initially based on the 1990 Dietary Guidelines for Americans, granting higher points for a greater va66riety of food items and a suitable daily intake of grains, vegetables, fruit, milk, meat, total fat, saturated fat, cholesterol, and sodium. Higher food-based diet quality scores have been consistently shown to decrease illness risk, including the HEI, Alternative HEI, and dietary techniques to Stop Hypertension (Schwingshackl et al., 2015; Chiuve et al., 2012).

The 2015–2020 Dietary Guidelines for Americans defined diet variety as a diverse assortment of foods and beverages across recommended food groups (USDA, 2015). In addition to illustrating how to calculate each score and how to build other indicators of significance from dietary diversity data, the recommendations also explain how to adapt and use the dietary diversity standards. Prior editions of the Dietary Guidelines for Americans emphasized 5 food groups: vegetables, fruits, grain-based foods such as bread and pasta, dairy foods, and protein sources such as red meat, poultry, beans, eggs, and

nuts (USDA, 2017). The 2015–2020 Dietary Guidelines for Americans places emphasis on choosing a variety of nutrient-dense foods across and within all food groups, with a focus on various veggies and protein sources in particular.

2.4.1 Dietary diversity indicators.

Measuring dietary diversity offers a quick, economical, and logistically simple technique to evaluate household- or individual-level nutrition outcomes. Focusing on dietary diversity is one method o*f detecting nutrition outcomes given the recent emphasis on improving maternal and child nutrition outcomes (SDGs, agriculture-nutrition pathways). This note addresses the most important dietary variety indicators already in use and describes how they might be created or altered to be included in a more comprehensive household survey (Gupta, 2016).

The Food Variety Score (FVS) and the Dietary Diversification Score are two popular count-based measurements of dietary diversity (DDS). An FVS is a count of all foods consumed during a specified recall period. A DDS estimates the number of food groups that were ingested within a specific recall period after collapsing the same meals by food group. One of the most widely used metrics is the FAO's dietary diversity score (FAO). It's a straightforward tally of the food groups ingested throughout the last 24 hours. The score is regarded as a substitute for nutritional adequacy when calculated at the individual level (IDDS). The Women's Dietary Diversity Score, specifically in women (15-49 years old), reflects micronutrient sufficiency (WDDS). The Minimum Dietary Diversity-Women (MDDW) indicator, which the FAO and FANTA created more recently, collapses the individual dietary diversity scores to a binary score based on whether a certain minimum number of food groups are ingested (FAO, 2014).

The FAO's DDS can also be calculated at the household level (HDDS). The HDDS shows a household's ability to purchase food on a budget as contrasted to the IDDS. The two primary differences between the elements and computation of the dietary variety scores described above are the total number of food groups considered and how meals consumed outside the home are handled. The dietary variety score created by TCI's work on developing a dietary diversity module as part of its focus on building a Minimum Nutrition Dataset for Agricultural Surveys (MNDA) is calculated based on a 3-day recall. Details about food intake and sources outside of the home are included in the module (for the respondent as well as children).

Food frequency indicators provide a count of the typical frequency of consumption of various food products over a specific recall period. Measurements of frequency-based dietary diversity may be qualitative, semi-quantitative, or quantitative in nature. When data is only collected on how frequently a certain meal or food group is consumed, the resulting indicator is said to be of a qualitative nature. To improve the qualitative measure of consumption frequency, portion information might be used. We obtain a semi-quantitative food frequency questionnaire when the portions utilized (cups, bowls, and spoons) are standardized (FFQ). A quantitative FFQ, on the other hand, is created when respondents are permitted to estimate the quantities of food items ingested.

2.4.2 **Factors that Determine the Dietary Diversity Score in Rural Households**

A key element in minimizing food insecurity is having access to enough food that is also nutritious (Chegere *et al.*, 2020 and Armstrong *et al*., 2020). The degree of information accessible on a healthy, balanced diet and socioeconomic characteristics is tied to efforts to ensure food security (Lin *et al*., 2020; Singh *et al*., 2020). The level of consumption of foods like fruits, vegetables, and proteins, which are associated with the avoidance of unfavourable health disorders, is also related to specific socio-demographic characteristics (Singh *et al*., 2020). Additionally, it has been discovered that eating habits outside the home can influence the dietary diversity of families (Ochieng *et al*., 2017).

Food availability in rural places depends on the environment's resources and the ability to produce food through agriculture, more specifically, the availability of a variety of agricultural items for self-consumption raises the standard of a family's diet in agricultural production areas (Chegere *et al*., 2020). Taking away barriers to market access for farmers encourages households to eat a variety of foods (Chegere *et al*., 2020 and Abeywickrama *et al*., 2020), therefore, the proper design and execution of public policies with a focus on women and vulnerable groups will determine the appropriate development of good practices for reducing malnutrition.

Dietary diversity (DD), particularly within and within food groups and between various kinds of particular foods, is crucial for a high-quality diet since it essentially ensures an appropriate intake of necessary nutrients and significant non-nutritive components (Fanzo *et al*., 2013). The number of various foods or food groups in a diet is used to calculate DD but other groups, classification schemes, and time periods have been employed (Berti *et al*., 2013).

Findings from numerous contexts consistently support the significance of including a wide selection of foods in one's diet, despite the various methodologies used to quantify dietary diversity and the differing causes of differences between locales (Fanzo *et al*., 2013). Lack of income has an impact on DD, primarily because fewer proteins, fruits, and vegetables are consumed. Foods that are high in protein cost more than foods that are high in carbs or saturated fat Contreras (Daz, *et al*., 2017).

Household dietary diversity (HDD) is a tool for assessing a household's financial ability to access a range of foods during a specific time frame (Huluka *et al*., 2019) and Household Dietary Diversity Score (HDDS) is calculated using the dietary diversity questionnaire guide. Kennedy (2013), described it as a straightforward tool for evaluating food access and is frequently used to qualitatively determine food consumption, including the variety of foods available to a household (Rodriguez, 2017 and Vaitla, 2017).

Similar studies demonstrate a favourable correlation between agricultural diversity and DD, however dietary diversity is more strongly influenced by market availability (Koppmair *et al*., 2017). Additionally, socioeconomic elements which includes income, level of education, and knowledge about healthy nutrition have a defined impact on DD. The contribution of food grown for self-consumption has been the focus of farmer HDD evaluation (Rodrguez, 2017). The diversity of the diet is increased, in accordance with Jones et al. (2012), by the availability of items that make access easier. Alam (2012) mentions that having access to knowledge affects how people make decisions to achieve a nutritional balance. Also, taking part in knowledgeable groups helps to create a setting where positive adjustments in eating habits can occur (Singh et al., 2019).

3.0 Aims of the Thesis

Attaining optimal dietary diversity is crucial to ensure the nutritional well-being of rural farming households. However, there is a lack of information on the factors that inhibit the achievement of this status.

Therefore, the aim of this master's thesis is to comprehensively examine the various factors that influence the dietary diversity status of rural farming households in the area. The study seeks to identify the determinants of dietary diversity, such as socioeconomic status, access to markets, food availability, and cultural practices, among others. By doing so, the study aims to provide valuable insights into the factors that affect the dietary diversity status of rural farming households in Odeda, Nigeria, and offer recommendations for interventions that can improve their nutritional status and overall well-being. Through this research, it is hoped that a better understanding of the factors influencing dietary diversity status among rural farming households in Odeda can be achieved, which can ultimately inform policy and practice aimed at improving the health and nutritional outcomes of these communities and Nigeria at large.

3.1 Hypothesis

Hypothesis 1

There is no Significant Relationship between socioeconomic characteristics and the dietary diversity of the farming households.

Hypothesis 2

There is no significant difference between the dietary diversity score of male and female headed households in the study area.

Hypothesis 3

There is no significant relationship between the dietary diversity and the frequency of consumption of food items in the study area.

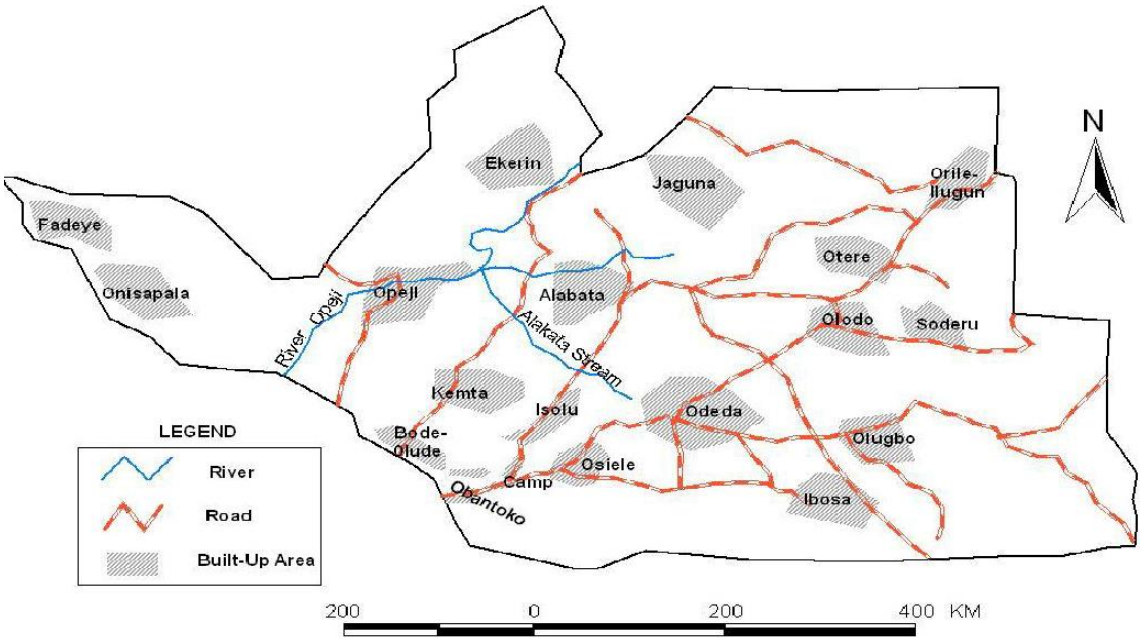
Hypothesis 4

There is no significant relationship between the sources of food consumed and the dietary diversity of the farming households in the study area.

4.0 Methodology

4.1 Study Area

Map of the study Area



Source: (Taiwo *et.al*, 2011)

The study was conducted in Odeda local government area of Ogun State, Nigeria. Odeda Local government area is one of the 20 local government areas in Ogun State. The Local government is located in the western part of Nigeria and its one of the agrarian local governments in the Ogun state of Nigeria and has a mix of both rural and urban settlement. Odeda Local Government Area share boundaries with Abeokuta North, Abeokuta south, Obafemi Owode Local Government and Oyo state in the South, West, East and North respectively. It is located at 7o13'N and 3o31'E in latitude and longitude, respectively, and has a land area of roughly 1,560 km2. Approximately 110,000 people call the area home according to the most recent census taken there. The area's typical temperature is around 30 degrees Celsius, and the humidity level is at 95%. The local government area is situated in a tropical region, which is distinguished by the rainy season and the dry season. The dry season is between November and March, whereas the rainy season lasts from April to October (OGADEP, 2010). Within the area, there is a moderate amount of rainfall, sunshine, and humidity. The area is therefore perfect for farming and livestock grazing. Within the area, there is a moderate amount of rainfall, sunshine, and humidity.

Thus, the region is a favourable location for various crop and animal production relevant to national food security. The majority of the local population works in agriculture. Although there are other tribes there as well, like the Igbos, Hausa, and those from the middle belt, the bulk of the local tribes speak Yoruba. There are around 25 semi-urban settlements and 860 villages and hamlets, according to OGADEP (2010). Some of the arable crops grown in the region include cassava, cocoyam, maize, different vegetables, cowpea, cocoa, and oil palm. The primary cash crop is oil palm. Goats, pigs, poultry, sheep, and cattle are among the main species of livestock (NBS, 2009).

4.2 Research Design

This research work will make use of exploratory and descriptive designs in other to review the focus of the study which is to understand the factors influencing the dietary diversity of farming households in Odeda local government area of Ogun State. The exploratory component of the research design will seek to help in explaining the factors that influence dietary diversity of the farming households in the study area while the descriptive part explored the various trends in the study area as regards dietary diversity.

4.3 Data Collection

- Primary data was be used for the purpose of this study and a questionnaire guide was designed to capture the socioeconomic variables, diet class consumed and frequency of consumption from rural farming households in Odeda local government area of Ogun State, Nigeria.
- A sample selected for this study was based on the availability of the respondent and their willingness to participate in the survey. Basically, the use of primary data for the study was important because it allowed the review of current happenings in the locality which may not have been the case if secondary data was used for the study.
- Dietary diversity assessment was accessed using the household dietary diversity score (HDDS). Dietary diversity and this calculated using a simple count of food groups consumed over a 24-hour recall period using the FAO guidelines and supported with the Food Consumption Score (FCS) guide which was used to measure the diet quality of the rural farming households.

4.4 Sampling Procedure and Sample Size

Multistage sampling technique will be used to gather information from 150 households with the use of a structured questionnaire. The first stage is the purposive selection of Odeda Local Government. The local government was purposively selected because it has a lot of rural settlement distributed across the local government area.

The second stage involved the use of a simple random sampling technique to select five communities. The communities selected was done based on the sample frame of communities in the local government and then using a simple random sampling procedure, five communities were selected for the purpose of selection of participants for the study.

The last stage was the random selection of thirty (30) households from each of the selected Communities to produce a sample size of 150. The data collection on the field was coordinated by me and assisted by trained enumerators who were selected based on their field experience in data collection.

Table 1: Stages that would be Involved in Sampling Procedure

Stages	Selection	Method of Selection
1	Selection of Odeda Local Government Area (LGA)	Purposive sampling technique
2	Selection of Five communities in the LGA	Simple random technique
3	Selection of thirty Respondents in each Community	Simple random technique

4.5 Method of Data Analysis

The data collected was analysed in achieving the objectives of the study using descriptive statistics while ordered logit, T-test and Chi square was used in testing the hypothesis stated for the study.

4.6 Analytical Technique

4.6.1 Descriptive statistics

Descriptive statistics, such as frequency distribution tables and percentages, was used in achieving objectives 1 and 2. The following are demographic and socioeconomic factors was considered in this study: household size, educational status, farm size, farming experience, income, occupation, age and religion among other socio-economic variables. The constraints to dietary diversity will also be accessed using descriptive statistics with measurement on the field making use of the five-point Likert scale.

4.6.2 Dietary diversity score

The analysis of goal 3 was conducted using the Dietary Diversity (DD) score, which is based on the 24-hour recall of food consumption. To calculate the DD score, the number of food types consumed by agricultural households over the 24 hours before to the in-home survey is tallied. The primary food categories for the study included fourteen (14) distinct food types, and each food group that families had consumed during the previous 24-hour period was categorized as one, whilst the food groups that they had not ingested were represented as 0 (USAID, 2012):

1. Cereals.
2. Root and Tubers
3. Vegetables
4. Fruits
5. Meats
6. Eggs
7. Fish or seafood
8. Legumes, Nuts and Seeds
9. Milk and Milk Products
10. Fats and Oil
11. Sugar, Honey and Confectionaries
12. Seasonings and Beverages

The Households reported whether or not they have consumed any of the above-mentioned food groups. A “yes” response was scored “1” and “no” response scored “0”. The scores will then be summed up to create the household DD score, which ranged from 0 to 12. This score was classified into consumption of four or less food groups (DD ≤ 4) — lower DD, and consumption of five or more food groups (DD ≥ 5) — higher DD and used in the subsequent analysis.

4.6.3 Food Consumption Score

The World Food Program created the FCS as a frequency-weighted dietary variety score (Leroy et al., 2015). Numerous studies, including those conducted by Weismann et al. (2009) in Haiti, Burundi, and Sri Lanka, Mason et al. (2015) in Tanzania, Nsabuwera et al. (2015) in Rwanda, and Goodman et al. (2016) in Kenya, have validated and used the FCS indicator.

The FCS is made up of three parts: the variety of foods consumed, how often those foods are consumed, and how nutritious the food groups are. International Food Program (2012). A household's consumption of various food types throughout a reference period is described by the dietary variety component. The frequency of consumption of a food group in a household during a recall period is indicated by the food frequency. Eight food groups, including grains, legumes, vegetables, sugar, oil, fruits, milk, and meat/fish/eggs, are used in the FCS. To gather information on food intake at the household level, a country-specific list of foods and food groups is employed. Utilizing typical food group weights, the nutritional value is calculated. Starting with lower values like sugar and oils (0.5), vegetables and fruits, and then moving up in weight are the nutritional values.

The food group score was calculated within each food group by summing up the consumption frequencies. Each group score that is obtained was multiplied by its weight. The results are then summed up to obtain and create the FCS (Carollete et al., 2013).

The FCS is calculated as follows using the formula below (Jones et al., 2013)

$$FCS = a_1b_1 + a_2b_2 + \ldots a_8b_8 \qquad (1)$$

where a = frequency (1-week recall period), b = weight (meat, milk, and fish = 4; pulses = 3, staples = 2, vegetables and fruits = 1, and oil and sugar = 0.5), and n = dietary groups.

The World Food Program sets standards and guidelines for the selection of the threshold intervals. Poor (21.5), borderline (21.5–35), and satisfactory (> 35) are the three categories into which FCS places homes.

4.6.4 Ordered Logit

The ordered logit model was used to examine factors influencing dietary diversity; among the farming household, it is a regression model for an ordinal response variable. The use of the model was premised on the fact that different factors influence people of different dietary diversity groups in the study area and as we move from one dietary diversity group to the other, the factors change.

To capture such phenomena in mathematical form:

$$\mathbf{Y_i = \beta X_i + U_i} \quad \textbf{(1)}$$

Where Y_i is the observed response for the i^{th} individual adult who is either in the high dietary diversity, medium diversity or low dietary diversity class. X_i is a set of independent socioeconomic and demographic variables such as age, gender, level of education, farm size, farming experience among others.

The logit model uses a logistic cumulative distributive function to estimate.

The model is then estimated using the maximum likelihood method. To analyse the factors influencing the dietary diversity of the farming households, the empirical model estimated is:

$$P(DD = 1/X) = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \mu_i$$

Where the dependent variable P (DD = 1/X) is the probability that the household's dietary diversity is dependent on list of independent variables which are listed.

Table 2 Description of the variables

Variable	Description
Age	The age of the farming household head
H_{sex}	The sex of the farming household head in the study area male=1 and 0 otherwise
H_{edu}	The level of education attained by the adult individual or household head
Farmsz	The farm size of the farming household in the study area
Farmexp	Farming experience which is measure in years.
Income	The level of income of the adult individual or household head

5.0 Results and Discussion

5.1 Summary of socio-economic characteristics of farming households

The socio-economic characteristics of the household examined include age, sex, religion, marital status, educational status, household size, farming experience, farm size, household income and off-farm activity. Table 3 shows the age distribution of household head, their sex, marital status, their educational level and farming experience.

The results from table 3 showed that 75% of household heads are males while 25% are females. The sex distribution of the farmer could have an implication on the level of income that comes into the household.

Also, 12.7% of household heads are between the age range of 46-50 while 12.0% of household head are between the age range of 41-45, 28.7% of household heads fall between the age of 36-40 while 20% have their age above 50 years and the remaining 14% of the sampled farming household head are below 31 years of age. The mean age being 42 years. According to Ibitoye (2013), farmers within the productive age group of 20-50 years are likely to possess the necessary strength to carry out farming operations. This implies that the majority of the respondents are still within the productive age.

As shown in table 3, 52.7% of household heads which forms the modal group are Christian while 31.3% are Muslims and the remaining 16.0% are traditionalist. The survey revealed that majority (72.7%) of the sampled household head are married, 10.7% of the household head are widowed while the remaining 12.7% and 4% are divorced and single respectively.

Also looking at the number of years the household head has spent on farming (farming experience), it shows that 29.3% of the household head has the range of 16 and 20 years as their farming experience and this is also the same with those having farming experience less than 10 years, 14.7% have farming experience greater than 30 years, 12.7% of the household head have years of farming experience between 11-15 years while household head with farming year experience between 21 and 25 had 8.7% and household with farming year experience 26 and 30 make up the remaining 6.0% respectively. The mean farming experience being 18 years. This agrees with the view of Akorede (2004) and Ajao (2000) who asserted that the more the farming experience of farmers, the more exposed to farming operations they become and the better the use of management practices.

Table 3: Distribution of Household head by age, sex, marital status, educational level and farming experience

Variables	Frequencies	Percentage	Mean	Standard Variation
Sex				
Female	50	33.3		
Male	100	66.7		
Total	**150**	**100.0**		
Age				
<31	21	14.0	42.16	9.63
31 – 35	19	12.7		
36 – 40	43	28.7		
41 – 45	18	12.0		
46-50	19	12.7		
>50	30	20.0		
Total	**150**	**100.0**		
Religion				
Christianity	79	52.7		
Islamic	47	31.3		
Traditional	24	16.0		
Total	150	100.0		
Marital status				
Single	6	4.0		
Married	109	72.7		
Divorced	19	12.7		
Widow/widower	16	10.7		
Total	150	100.0		
Farming Experience (Years)				
<=10	44	29.3	18.92	9.273
11-15	19	12.7		
16-20	44	29.3		

21-25	12	8.0
26-30	9	6.0
>30	22	14.7
Total	150	100.0

Table 4 shows the distribution of the farming household heads by household size, educational level, members of household working, occupation of household head and farm size. From the table, it can be deduced that majority (42.0%) of the household had household sizes between 3 and 5 members, 32.7% had household sizes of between 6 and 8 household members, 14% had household sizes greater than 8 members and 11.3% had household size lesser than 5 members.

The ratio of working to non-working members in the households shows that 40.6% of the households have between 26 to 50% of their household members working while 31.3% percent have between 51 and 75% of the household member working. This implies that majority of the household members a quarter of the household members involved in a paid work. The educational level of the household head shows that 55% of the household head are educated up to the secondary school level, 37% of the household head were educated to the primary school level while 31% had no formal education and 27% of the household head were educated up to the tertiary level.

Based on the farming status of the household head, it was observed that 58.7% of the household head are into full time farming while the remaining 41.3% take farming as part time.

In addition, 36.7% of the household head have farm size between 1.01-2 ha, 25.4% of the household head have farm size less than 1.01 hectares, 19.3% of the household head have farm size ranging between 1.01 and 2 hectares while 17.5% of the household head have farm size greater than 4 hectares and also another 13.3% of the household head have farm size ranging between 2.01 and 3 hectares. The remaining household head with 7.5% had farm size ranging between 3.01 and 4. The result shows that majority of the farming households are operating small farms, and this may be because of the labour requirement needed in agricultural production. This makes the household have a plot of manageable size.

Table 4: Distribution of the Rural Farming Household heads by household size, educational level, members of household working, occupation of household head and farm size

Variables	Frequencies	Percentage	Mean	(Standard Variation)
Household size				
< 3	17	11.3	5	2.43064
3 – 5	63	42.0		
6– 8	49	32.7		
> 8	21	14.0		
Total	150	100.0		
Ratio of Non-working to working				
Household Members				
<=25%	14	9.3		
26%-50%	61	40.7		
51%-75%	47	31.3		
>75%	26	17.3		
33.00	2	1.3		
Total	150	100.0		
Educational Level				
No Formal Education	31	20.7		
Primary	37	24.7		
Secondary	55	36.7		
Tertiary	27	18.0		
Total	150	100.0		
Occupation of Household Head				
Part Time Farming	62	41.3		
Full Time Farming	88	58.7		
Total	150	100.0		
Farm size (Hectares)				
< 1.01	38	25.4	2.1307	1.52843

1.01 – 2	55	36.7
2.01 – 3	29	19.3
3.01 – 4	11	7.3
> 5	17	11.3
Total	150	100.0

The table 5, shows the distribution of households according to their household income, off-farm activity and type of off-farm activity.

As presented in table 5, 34.7% of farming household heads have their total monthly income from primary occupation to be between the range $86.81 and $130.22, 27.3% among the household head have an income to be between $43,40-$86.81, 25.3% of the household head have less than and equal to $43.40 as their total monthly income from primary occupation, Also 10.7% of the sampled farming households have their total monthly income between the range of $130.22 – $173.62 and 2% of the household head have monthly income that is greater than $173.62

As presented in table 5, 16.0% of farming household heads have their total monthly income from secondary occupation to be between the range of $43.40-$86.81, 11.3% among the household head have an income less than $43.40**,** 3.3% of the household head their total income to be between $86.81-$130.22. Also, 2.7% of the sampled farming households have their total monthly income between the range of $130.22-$173.62,001and 2.7% of the household head have a monthly income that is greater than $173.62.

As presented in table 5, 56% of the farming households were involved in off-farm activity while 44% were not involved in any off-farm activity. Of the household involved in off-farm activity 31.3% were involved in agro processing, 25.3% were involved in trading, while 18.7% and 14.0% of the farming households were involved in paid job and artisanship respectively.

Table 5: Distribution of Rural Farming Household Heads by their household income, off-farm activity and type of off-farm activity.

Variables	Frequencies	Percentage	Mean	Standard Variation
Income from Primary Occupation ($)				
<=43.40	38	25.3	90.16	48.71
43.40-86.81	41	27.3		
86.81-130.22	52	34.7		
130.22-173.62	16	10.7		
>173.62	3	2.0		
Total	150	100.0		
Income from Secondary Occupation ($)				
<=43.40	17	11.3	83.02	53.62
43.40-86.81	24	16.0		
86.81-130.22	5	3.3		
130.22-173.62	4	2.7		
>173.62	4	2.7		
Total	54	36.0		
Off-farm Activity				
Yes	84	56.0		
No	66	44.0		
Total	150	100.0		
Type of Off-farm Activity				
Agro processing	38	25.3		
Artisanship	21	14.0		
Trading	47	31.3		
Paid Job	28	18.7		
Total	150	100		

5.2 Dietary Diversity Pattern of rural farming households

5.2.1 Frequency of food Consumed by the rural farming households.

The proportion of households who consumed food from each food group in the previous 7 days to the period of this survey (Table 6) revealed that fat and oil constituted the food group consumed by most rural farming households (82.7%) in at least not less than 8 times in a week and this may be due to the fact that fats and oil makes an integral part of the soup, stew and other food components consumed by the rural farming households and as such the level of its consumption. Also, about 79.3% of the rural farming households consumed a type of vegetable at least nothing less than 8 times within the seven-day reference period for the study. This is not far-fetched as most of the rural farming households have farms where they cultivate different types of vegetables like fluted pumpkin, Amaranthus, soko, okra among others and sometimes even some of these vegetables grow on their own like water leaf. Therefore, these food components are easily accessible to the rural farming households in the study area. In addition, 55.3% were found to use seasoning more than 8 times in a week and this can be attributed to the common use of seasoning for spicing foods such as locust beans, bouillon cubes among other spice ingredients. Cereals like rice was consumed by 61.3% (20% - >8 times; 41.3% - 5-8 times) of the rural farming households not less than five times in the last seven days and the level of consumption of this food ingredient when compared to the others is due to the fact that they have to purchase these food items in the market and it is the most common staple that is consumed by the rural farming households. Also, root and tubers such as yam were consumed by 48% of the household within 5-8 times of the last seven days of conducting the study. This cause of this might be due to the fact that the food was out of season as at the period of conducting this survey.

These findings are consistent with the observation that lack of diversity is a particularly severe problem among populations in the developing world where diets are based on staples and often include only a few animal products at most and only seasonal fruits and vegetables (Arimond *et al.*, 2004). The role of cereals, root and tuber crops in the diets of the study populations could result in a high prevalence of protein inadequacy. A low-quality diet may be prevalent in the research area given the declining importance of pulses and animal products, two important sources of protein and micronutrients.

Table 6: Food Groups Consumed by the Rural Farming Households

Food Group	**>8**		**5-8**		**2-5**		**Once**		**None**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Cereals	30	20.0	62	41.3	55	36.7	3	2.0	0	0.0
Root and Tuber	0	0.0	72	48.0	64	42.7	14	9.3	0	0.0
Vitamin A Rich Vegetables	0	0.0	0	0.0	0	0.0	96	64.0	54	36.0
Dark Green Leafy Vegetables	2	1.3	11	7.4	63	42.0	74	49.3	0	0.0
Other vegetables	117	78.0	28	18.7	4	2.6	1	0.7	0	0.0
Vitamin A Rich Fruits	0	0.0	0	0.0	1	0.7	12	8.0	137	91.3
Other Fruits	0	0.0	0	0.0	0	0.0	70	46.7	80	53.3
Organ Meat	0	0.0	0	0.0	0	0.0	45	30.0	105	70.0
Flesh Meat	0	0.0	27	18.0	70	46.7	46	30.7	7	4.7
Eggs	0	0.0	0	0.0	9	6.0	100	66.7	41	27.3
Fish and Seafood	11	7.3	21	14.0	94	62.7	24	16.0	0	0.0
Legumes, Nuts and Seeds	0	0.0	8	5.3	82	54.7	59	39.3	1	0.7
Milk and Milk Products	0	0.0	0	0.0	0	0.0	79	52.7	71	47.3
Oil and Fats	124	82.7	25	16.7	1	0.7	0	0.0	0	0.0
Sweets	0	0.0	14	9.3	60	40.0	62	41.3	14	9.3
Spice, Condiments and Beverages	83	55.3	36	24.0	13	8.7	16	10.7	2	1.3

5.2.2 Source of Food Consumed

The result on table 7 shows that most of the rural farming households purchase most of the food items that they consume. Food items such as spices, and beverages (96.7%); Oils and fats (99.3%); legumes nuts, and seed (3.3%); fish and seafood (94.0%); flesh meat (87.3%) were mainly sourced from the market by the rural farming household. This implies that improving access to the market could help the farming household in getting the required food items in other to get the required level of diversity in their food consumption. In addition, it was observed from the survey that root and tubers (66.75); dark green leafy vegetables (66.7%); cereals (51.3%) are the food mainly produced by the farming households in the study area. This suggests that the farms owned and operated by farming households play a crucial role in their ability to produce a variety of foods. While expanding the farming households' access to the market is beneficial, it is also crucial to encourage them to grow food to meet both their own and other people's dietary needs. Few households in the study area routinely consumed food from other sources, such as gifts or items they exchanged.

Table 7: Sources of Food Consumed

Food Group	Purchased		Produced		Received Gift		Exchanged Items		Others		None	
	N	%	N	%	N	%	N	%			N	%
Cereals	70	46.7	77	51.3	3	2.0	0	0.0	0	0.0	0	0.0
Root and Tuber	50	33.3	100	66.7	0	0.0	0	0.0	0	0.0	0	0.0
Vitamin A Rich Vegetables and Tubers	97	64.7	9	6.0	0	0.0	0	0.0	0	0.0	44	29.3
Dark Green Leafy Vegetables	47	31.3	99	66.0	0	0.0	0	0.0	4	2.7	0	0.0
Other vegetables	106	70.7	39	26.0	0	0.0	2	1.3	0	0.0	3	2.0
Vitamin A Rich Fruits	15	10.0	3	2.0	0	0.0	0	0.0	0	0.0	132	88.0
Other Fruits	72	48.0	2	1.3	0	0.0	0	0.0	0	0.0	76	50.7
Organ Meat	42	28.0	0	0.0	0	0.0	0	0.0	0	0.0	108	72.0
Flesh Meat	131	87.3	8	5.3	9	6.0	0	0.0	2	1.3	0	0.0
Eggs	106	70.7	10	6.7	0	0.0	0	0.0	0	0.0	34	22.7
Fish and Seafood	141	94.0	9	6.0	0	0.0	0	0.0	0	0.0	0	0.0
Legumes, Nuts and Seeds	140	93.3	9	6.0	0	0.0	0	0.0	0	0.0	1	0.7
Milk and Milk Products	82	54.7	8	5.3	0	0.0	0	0.0	0	0.0	60	40.0
Oil and Fats	149	99.3	1	0.7	0	0.0	0	0.0	0	0.0	0	0.0
Sweets	129	86.0	14	9.3	7	4.7	0	0.0	0	0.0	0	0.0
Spice, Condiments and Beverages	145	96.7	3	2.0	0	0.0	0	0.0	0	0.0	2	1.3

5.2.3 Food consumption Score of the Rural Farming Households

The food consumption score classification of the rural farming households is as shown in table 8. Basically, the FCS classify households into one of the following categories: poor (< 21.5), borderline (21.5- 35) and acceptable (> 35). Based on the estimation it was observed that most (87.3%) of the rural farming households are within the borderline of the food consumption framework. This means that the majority of these households are doing just barely enough to meet their consumption needs and any fluctuation in their income or production could lead them to fall into the poor category. However, the results point to the fact that much needs to be done to move the rural farming households to the acceptable limit of the food consumption score as just 4% of them fall within that limit. As such portends danger for the food security of the rural farming households if nothing is done to move these households to the acceptable limit of the food consumption score.

Table 8: Food Consumption Score of the Rural Farming Households

	Frequency	**Percentage**
Poor	13	8.7
Borderline	131	87.3
Acceptable	6	4.0
	150	**100.0**

5.3 Household dietary diversity score distribution of the rural farming household

Household dietary diversity score groups the household into three main groups based on the number of food groups consumed within the reference period used for the study (7 days recall). The three main groups include high dietary diversity (those who consumed more than 6 food groups within the reference period), medium dietary diversity (those who consumed between 4–5 food groups within the reference period), low dietary diversity (those who consume at most three food groups within the reference period).

From table 9, it was observed that 15.3% of the participants consumed up to three food groups (low dietary diversity), 34.0% consumed four to six food groups (medium dietary diversity) and 50.7% of participants consumed seven or more food groups (high dietary diversity) in their diet during the preceding 7 days. The mean dietary diversity score of the rural farming households is 6.99. This implies that the most of the rural farming

households can be said to have a diverse diet. However, this is not surprising as dietary diversity means having the right combination of food but the of volume of this food consumed by the rural households is also another issues that may need to be addressed to be sure that their dietary diversity is translating to sufficient nutrient consumption in terms of the volume and the quality of the food consumed by the rural farming households. This assertion is supported by the findings of Taruvinga *et al.* (2013), among rural households in developing countries which showed that 29.3 % of the households reported a low-level dietary diversity, 35.9% of the households reported a medium-level dietary diversity, and 34.8% households reported high-level dietary diversity (Taruvinga *et. al.*, 2013).

Table 9: Distribution of rural farm household by household dietary diversity guideline

Dietary Diversity Group	Frequency	Percentage	Mean Dietary Diversity Score
High Dietary Diversity	76	50.7	
Medium Dietary Diversity	51	34.0	6.99
Low Dietary Diversity	23	15.3	

5.3.1 Constraints Affecting the Consumption of Diverse Diets by the Rural Framing Households

Using a 5-point Likert scale of strongly agree (SA), Agree(A), undecided, disagree (D), and strongly disagree (SD), table 8 reveals that high-cost food (x = 4.208) is the main constraint that affects the consumption of diverse diets among the rural farming households in the study area. This is actually true because of the rising cost of purchasing food commodity which is occasioned by rising inflation within the country. Low income of the rural farming households was seen as the second major constraint that affects the consumption of diverse diet by the rural farming households. This may be due to the fact that the most rural farming households are low-income earners, and most times are dependent on the market to get their food stuffs and as such when during lean periods they tend to consume less diverse diets.

Furthermore, low income as a constraint to dietary diversity was ranked first with mean of (x = 4.217), this implies that low income could be a limiting factor in consuming diverse diets in a household. Furthermore, availability of food was ranked the second position with mean of suggesting that when food is not available in the right quantity and of good quality the ability of a household to access diverse diet will be inhibited. Also, seasonality of food ranked the third position which suggests that it is a constraint to dietary diversity because various food groups have their various seasons while level of awareness and education ranked the 4^{th} and 5^{th} position are not a strong constraint when compared to others. Low income has the second highest mean value amongst the constraint. Distance to market, seasonality of food and availability are also some of the other constraints that this rural farming households face mainly. The implication of this constraints on the consumption on the diverse food consumption include the fact that households may not be able to get some food materials when they are not in season due too high cost and unavailability and also distance to market may also mean that some food materials may not be easily accessible to the households and they have to make do with what they have available within their locality when they cannot access the market. Other constraints that the households face though not as constraining as the previously discussed ones are level of awareness and lack of nutritional information.

Table 10: Constraints affecting Dietary diversity.

Constraints	Strongly Agree		Agree		Undecided		Strongly Disagree		Disagree		Mean (St. Dev)
	N	%	N	%	N	%	N	%	N	%	
Seasonality of Food	39	26.0	26	17.3	15	10.0	64	42.7	6	4.0	3.18 (1.333)
Availability of Food	20	13.3	49	32.7	26	17.3	25	16.7	30	20.0	3.02 (1.356)
Low Income	56	37.3	14	9.3	44	29.3	12	8.0	24	16.0	3.44 (1.459
Level of Awareness	6	4.0	23	15.3	54	36.0	63	42.0	4	2.7	2.76 (0.888)
High Cost of Food	60	40.0	42	28.0	24	16.0	21	14.0	3	2.0	3.90 (1.139)
Lack of Nutritional Information	10	6.7	24	16.0	33	22.0	69	46.0	14	9.3	2.65 (1.069)
Belief about Some certain Foods	51	34.0	28	18.7	53	35.3	15	10.0	3	2.0	3.72 (1.098)
Distance to Market	26	17.3	47	31.3	25	16.7	47	31.3	5	3.3	3.28 (1.177)

5.4 Hypothesis Testing

5.4.1 Hypothesis 1

There is no significant Relationship between socioeconomic characteristics and the dietary diversity of the farming households.

Regression results for agricultural household characteristics and dietary diversity patterns are presented in Table 11. The chi-square test value is 23.73 and the p-value is <0.00 and highly significant at the 1 percent level of significance. It shows that our model is statistically significant. So, we reject the null hypothesis, it means that the model is fit. The ordered logistic regression analysis shows that age of the rural farming household head was an important determinant (P<0.01) of dietary diversity status in the study area. This is because age confers experience and over time the farming household head would have accumulated knowledge on food nutritional values and its importance to well-being. According to Demeke *et al.* (2017), age confers on farming household head experiences in handling issues related to their dietary diversity and through the experience gathered with age they are understanding mitigation strategies in which they can ensure that their diet is diverse.

The variable for farm size is positive and significant at 5% as a factor influencing dietary diversity. This means that as farm size increases, the likelihood of having diverse diet increases This may be as a result of ability to produce more food which the farm size infers on the farming households which as the farm size increases, they tend to have the capacity to produce different types of food crops which are important to the household meeting their basic dietary needs.

Table 11: Ordered logistic regression analysis for factors influencing dietary diversity (N= 150)

	Coefficient	Std. Error	Z
Sex	0.084	0.226	0.37
Age	0.021**	0.011	1.97
Marital Status	-0.182	0.224	-0.82
Household Size	0.078	0.046	1.68
Occupation of Household Head	0.371	0.203	1.82
Farming Experience	-0.022	0.013	-1.70
Farm Size	0.149**	0.074	2.02
Income from Primary Occupation	-3.62e-06	4.70e-06	-0.77
Chi Square	23.73		
Prob>chi square	0.00		
Pseudo R^2	0.0792		
Log likelihood	-162.143		

Source: Field Survey, 2023 *** is significance at 1% ** Significance at 5%

5.4.2 Hypothesis 2

There is no significant difference between the dietary diversity score of male and female headed households in the study area.

To understand the differences between the dietary diversity score of male and female headed farming households in the study area. An independent t-test was conducted on the data as shown in table 12. The findings showed that there were significant differences between the dietary diversity of female and male headed households in the study area. This means that female headed households have the high tendency of being more diet diverse than the male headed households. This is because females are regarded as home

makers, and they have the tendency of balancing the diet needs of the households with limited resources.

Table 12: Significant Difference between dietary diversity score of male and female headed farming households (t-test)

Sex	N	Mean	Std. Deviation	Std. Error Mean	Df	T	Mean	Sig
Male	100	5.70	2.149	.215	148	11.852	-3.86	0.000
Female	50	9.56	1.163	.165				

5.4.3 Hypothesis 3

There is no significant relationship between the dietary diversity and the frequency of consumption of food items in the study area.

Correlation analysis in Table 13 reveals that the frequency of consumption of main staple has a significance ($P<0.05$) on the dietary diversity of the rural farming households in the study area. This means that the more the rural farming households have access to this food components the more likely they are to be dietary diverse. This is because staples are a major component of the foods of the rural farming households in the study area.

Furthermore, the frequency of consumption of vegetable was found to be positive and significantly correlated to the dietary diversity of the rural farming households in the study area. This implies that the more the households consume vegetables the more likely they are to have diverse diets. Also, the availability of different types of vegetable cultivated by the rural farming households in the study area may also contribute to its significance as a major determinant of the dietary diversity of the farming households in the study area.

Table 13: Relationship between the Dietary Diversity and the Frequency of Consumption of Food Items

Variable	R	P value
Main Staple	0.185*	0.023
Vegetable	0.602*	0.000
Fruit	0.134	0.103
Meat/ Fish/ Eggs	-0.010	0.900
Pulses	0.077	0.347
Milk	0.020	0.806
Oil	-0.055	0.503
Sugar	0.054	0.511

Source: Field Survey, 2023. Level of Significance (P<0.05), r: correlation coefficient
***Significant variable**

5.4.4 Hypothesis 4

There is no significant relationship between the sources of food consumed and the dietary diversity of the farming households in the study area.

The relationship between the sources of food consumed and the dietary diversity of the rural farming households is shown in table 14. The analysis was done using a chi-square test to see if there is a significant difference. As shown in the table the main staple source (P<0.05) and vegetable source (P<0.05) were the significant variables which had impact on the source of food consumed in the study area. The implications of these result are that main staple sources and vegetable sources have impact on the dietary diversity construct. This is because the source determines the availability of the food and also determines if the farming household will be able to access the food in the required quantity and combination.

Table 14: Relationship between sources of Food Consumed and Dietary Diversity

Variables	χ^2	P value
Main Staple Source	86.58*	0.000
Vegetable Source	134.96*	0.000
Fruit Source	8.06	0.886
Meat/Fish/Egg Source	3.95	0.785
Pulse Source	8.57	0.857
Milk Source	10.49	0.726
Oil Source	5.034	0.656
Sugar Source	10.19	0.748

Source: Field Survey, 2023. Level of Significance (P<0.05), χ^2: correlation coefficient

***Significant variable**

6.0 Conclusions and Recommendations

The Study provided information on the dietary diversity of rural farming household in Odeda local government area of Ogun state in Nigeria. The findings from the study points to the fact that most of the farming households in the rural area have access to diverse diets but what is not yet clear is to what extent they have success to the diet in terms of the quality and the quantity of the diet. Also, further engagement to check the food consumption score of the households shows that in that construct most of the households are within the borderline and they are likely to fall below the line if care is not taken to help the households in maintain their livelihoods.

The study also pointed to the fact that age, farm size, and gender of the household head has significant impact on the dietary diversity of the rural farming household and that these variables can help in policy interventions that would help in encouraging the households and further improve their level of dietary diversity. Further the sources of the various food items and frequency of consumption could help the rural farming household's diet and could help in supporting them in further improving their diet. From this study, the following recommendations are necessary for intervention:

1. Access to nutritional information should be encouraged by the community nutritionists so as to improve rural farming household knowledge, attitude and practices towards their dietary patterns.
2. More research findings should be carried out among the farming households since they play vital roles in food production, availability and supply so as to improve their dietary pattern and also contribute to the nutritional goal of the nation.
3. Rural farming households should be encouraged to cultivate different crops which on their farm plots apart from their main crops in other to aid dietary diversity among them.
4. There is the need to press further among the rural farming households and look beyond dietary diversity to further investigate areas of food consumed among the households to see if the dietary diversity pattern is truly translating to better nutrition for the rural farming households in the study area.

5. Also, there is the need for government to pay more attention to the welfare of the farmers in relation to their health in policy formulation and enlighten farmers on the need to stay healthy for greater productivity.

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