Impact of Climate Variability on Household Food Utilization in Nigeria

Okwori, E & Onu, R. O.

Abstract

Climate variability is the year-to-year variations of atmospheric conditions around a mean state or a measure of the frequency distribution of the value of climate variables and range over a given period of time. Changes in climate variability including temperature, rain, flood, drought and sunshine have the ability to damage irreversibly the nutrients in the different food resource bases on which households depend, so much that such households become food insecure. Household food utilization is the use of food and how a person is able to secure essential nutrients from the food consumed. It encompasses the nutritional value of the diet, including its composition, method of preparation and the social values of foods, which dictate what kinds of food should be served and eaten at different times of the year and on different occasions; and the quality and safety of the food supply, which can cause loss of nutrients in the food and the spread of food-borne diseases. Food utilization involves how food is used, how often meals are eaten and of what nutrients these consist. Constraints to food utilization include loss of nutrients during food processing, inadequate sanitation, improper care and storage, and cultural practices that negatively impact consumption of nutritious foods for certain family members. If food production and consumption in Nigeria is negatively affected by climate change, the livelihoods of huge numbers of the rural poor will be put at risk and may become susceptible to hunger and malnutrition. This forms the discourse of the paper which examines climate variability on household food utilization and change with seasonal variation in Nigeria.

Key-words- Climate change, variability, Food insecurity, Food availability, Atmospheric conditions

Introduction

Climate refers to the characteristic conditions of the earth's lower surface atmosphere at a specific location, on the other hand, weather is the day-to-day fluctuations in these conditions at the same location. The variables that are commonly used by meteorologists to measure daily weather phenomena are air, temperature, precipitation (rain, sleet, snow and hail), atmospheric pressure and humidity, wind, and sunshine and cloud cover. Therefore, climate variability refers to the climate changes taking place around the globe (Wheeler and von Braun, 2013).

According to Nelson, Rosegrant, Palazzo, Gray, Ingersoll & Robertson (2010), climate variability refers to the year-to-year variations of atmospheric conditions around a mean state or a measure of the frequency distribution of the value of climate variables and the range over a given period of time. Weather and agricultural scientists have, in recent times, been observing drastic climate changes around the world (World Bank, 2010, Qatzweiler and Von Braun, 2016). Changes in climate variability, for example, temperature, rain, flood, drought and sunshine have the ability to damage irreversibly the nutrients in the different food resource bases on which households depend, so much that such households become food insecure.

Below normal weather, intensity and frequency, rainfall and drought can affect food utilization not only at the household level but global food chain. When conditions like climate, soil, water and land use differ in the environment, it can cause or limit food

production and subsequently food use .If food production in the low-income developing countries of Africa and Nigeria is negatively affected by climate change, the livelihoods of huge numbers of the rural poor will be put at risk and may become susceptible to hunger and malnutrition. Household level resources can be also diverted. For example, resources that might to have been used to support the development of household such as education, health care, and employment, may be diverted to ensure that basic food needs are met.

Household food refers to the existence of food stocks for consumption by the household. Household food is determined by the physical quantities of food that are produced, processed and stored for household use. (FAO, 2007c) defines household food as the net amount of food remaining after production, stocks and imports have been summed and exports deducted for each item included in the food balance sheet. Household food activities such as production, processing, distribution, preparation and consumption of food and the outcomes of these activities contributes to food sufficiency of the household,(Pontifical Academic of Science and Global Alliance for improved Nutrition, 2018).The sum of all the processes in a household food use is sometimes referred to as "from plough to plate" or "from farm to fork". Food sufficiency depends on availability of food, access to food and utilization of food (FAO, 2007c).

Household food utilization encompasses the nutritional value of the diet, including its composition, methods of preparation and the social values of foods, which dictate what kinds of food should be served and eaten at different times of the year and on different occasions; and the quality and safety of the food supply, which can cause loss of nutrients in the food and the spread of food-borne diseases if not of a sufficient standard (Campbell, Vermeulen, Aggarwal, Corner-Dolloff, Girvetz, Loboguerrero, 2016). Constraints to food utilization include loss of nutrients during food processing, inadequate sanitation, improper care and storage, and cultural practices that negatively impact consumption of nutritious foods for certain family members. Ruel, Garrett, Morris, Maxwell, Oshaug, Engele, Menon, Slack, & Haddad (1998) revealed that, utilization of food depends upon behaviour and the health environment (including water and sanitation). Access to safe and clean water and good sanitary conditions are essential for an adequate diet. Water resources are said to be strongly impacted by climate change with people at risk of being exposed to a growing scarcity of water in the future (Thompson and Amoroso, 2014). Water and sanitation play a crucial role in the transmission of diarrheal disease. These environmental factors contribute to approximately 94 percent of the 4 billion cases of diarrhoea that the United Nation International Children's Emergency Fund /World Health Organisation (UNICEF/ WHO, 2006) estimates to occur globally each year. Children under the age of 5 in developing countries bear the greatest burden and account for the majority of the 1.5 million deaths attributed to diarrhoea annually. Diarrhoea can cause severe dehydration and poor absorption of nutrients, which in turn make affected individuals more susceptible to infectious diseases. Diarrhoea in early childhood is associated with impaired growth, physical fitness and cognitive development, which can lead to diminish future school performance and lower economic earning power. Severe diarrhoea that is not cared for appropriately can also lead to death. Safe drinking water and improved sanitation play a significant role in reducing the risk of diarrheal diseases (UNICEF/ WHO, 2006).

According to Usman, Gerber & Braun 2018, the number of people suffering from chronic hunger and malnutrition as a result of inadequate food use has increased from under 800 million in 1996 to over one billion. Adequate nutrition and sound agricultural practices are important to human and environmental well - being. Despite increased world food production in the last

few decades, the world effort to meet the Millennium Development Goal of reducing hunger by half in 2015 appears uncertain. (Aberman and Cohen, 2012)

Understanding climate change, variability, household food, availability, accessibility, the impacts of, as well as the possible changes in this variability on food uses is important to making improvements in household food plan. Climate is specifically an important tool of food classification arrangement at the farm end of the food use, affecting the quantities, types of food and the adequacy of food produced (Smith, Bruce, Balakrishnan, Adair-Rohani, Balmes and Chafe, 2014).

This paper is discussed under distinct sub-headings to show the impact of climate variability on household food utilization in Nigeria.

Impact of Climate Variability on Household Food Utilization in Nigeria

Food utilization refers to the use of food and how a person is able to secure essential nutrients from the food consumed. It encompasses the nutritional value of the diet, including its composition and methods of preparation; the social value of foods, which dictate what kinds of food should be served and eaten at different times of the year and on different occasions; and the quality and safety of the food supply, which can cause loss of nutrients in the food and the spread of food-borne diseases if not of a sufficient standard. Food utility also involves how food is used (Keding, Schneider and Jordan, 2013). This include how often meals are eaten and of what they consist. Constraints to food utilization include loss of nutrients during food processing, inadequate sanitation, improper care and storage, and cultural practices that negatively impact consumption of nutritious foods for certain family members.

Adequate food utilization throughout life ensures good nutrition and long life. This is because there is a relationship between what people eat and their health. Welthungerhilfe & Concern International (2018) report that Africa suffers lack of food amidst plenty of natural resources more than any other continent in the world.

According to Nigeria Food Consumption and Nutrition Survey (IITA, 2004), most households indicated that staple foods were available for 9–12 months and the most available staple foods that are major sources of energy (calories) were rice (14.8%), cassava (12.9%), maize (10.6%), and yam (10.1%). Cowpea, groundnut, and soybean are major sources of plant proteins. Cowpea was the most available, followed by groundnut, and soybean. Nationally, the most available non-staple foods were meat products (14%), non-leafy vegetables (13%), leafy vegetables (9.5%), and fats and oils (8.9%). And the foods most consumed nationally are cassava (16.5%), rice (14.9%), cowpea grain (11.8%), groundnut (11.1%), and yam (10.4%).

Among the staple food crop for the dry savanna, the most frequently consumed staple food crop was sorghum followed by maize and rice and for the moist savanna zone, it was maize followed by sorghum, cassava, and rice. In the humid forest it was cassava, maize, rice, and yam. Among the legume staple food crops (major source of plant protein), in the dry savanna, the most frequently consumed legume was cowpea, followed by groundnut. In the moist savanna it was groundnut, followed by cowpea.

Food usage is sometime affected by seasonal variation or climate variation in Nigeria. Seasonal variations on food usage stresses household's food utilization, which may precipitate the development of severe malnutrition among household (Kalkuhi, vonBraun and Torreo, 2016, Ziervogel, 2004). Climate change has a direct impact on agricultural production, which are projected to decrease crop yields and productivity of livestock and increase risks of crop failure thus affecting food availability and access.

Furthermore, the social values of foods are important determinants of food preferences, with foods that are accorded high value being preferred, and those accorded low value being avoided. In many traditional cultures, feasts involving the preparation of

specific foods mark important seasonal occasions, rites of passage and celebratory events. The increased cost or absolute unavailability of these foods could force cultures to dump their traditional practices, with unforeseeable secondary impact on the cohesiveness and sustainability of the cultures. In many cultures, the mutual giving of gifts or sharing of food is common. It is often regarded as a social responsibility to feed guests, even when they visit without prior notice. In conditions of chronic food insufficiency, households' ability to honour these responsibilities will breakdown, and this trend is likely to be reinforced in locations where the impact of climate change contribute to increasing incidence of food shortages, (FAO, 2003b).

According to FAO (2004), climate impacts will affect all forms of agricultural production and the livelihoods of the poor and their access to food more severely. Seasonal climatic variation may represent a significant risk factor in terms of household survival in Nigeria. In the rural areas in Nigeria, the rainy season is accompanied by food shortages, increased labour demands, and a high prevalence of under nutrition (Cline, 2007). In arid or semiarid savannah regions in Nigeria, the critical period in terms of adult and child under nutrition is most frequently the dry season, characterized by reduced milk production, high temperatures and aridity and increased energy expenditure associated with planting and watering of the crops (Haile, Wossen, Tesfaye & vonBraun, 2017). Another major contributory factor in Nigeria communities is distribution made difficult by poor road networks and underdeveloped communication channels. As such food distribution to poor people living in rural and informal urban areas continues to be a barrier to proper utilization of food and nutrition at household, regional, national level (Garrett and Ruel, 2003, Rakib and Matz, 2016).

Shocks in relation to seasonality are an important source of stress in the lives and livelihoods of poor communities, and are worsened by changes in climate, such as lack of rain, even drought, rapid changes in temperatures from hot to cold, and changes in seasons, which are the main climatic changes in Nigeria. Climatic conditions are likely to bring both negative and positive changes in dietary patterns and new challenges for food safety, which may affect nutritional status in various ways. Food utility changes with seasonal variation and food availability changes throughout the year. The hungry season is the time before the planted crops are ready to be eaten. Similarly, at harvest time, there might be festivals and a lot of food consumed. If there has been a drought and food availability is low, the range of food available often decreases and so the meal frequency can decrease, and the balance of nutrients can be inadequate. This can lead to malnutrition in children. It is also important to note that climate can have an impact on food utility indirectly. For example, if there are hot dry days, crops and vegetables may be dried so that they can be used later in the year. At the same time as seasonal crop production, many households face fluctuations in cash and in-kind income both within a single year and from year to year.

The main impact of climate change on nutrition is to be felt indirectly, through its effect on income and capacity to purchase a diversity of foods. The physiological utilization of foods consumed also affects nutritional status, and this – in turn – is affected by illness. Climate change will cause new patterns of pests and diseases to emerge, affecting plants, animals and humans, and posing new risks for household food use, safety and human health. Increased incidence of water-borne diseases in flood-prone areas, changes in vectors for climate-responsive pests and diseases and emergence of new diseases could affect both food utilization and people's physiological capacity to obtain necessary nutrients from the foods consumed. Vector changes are a virtual certainty for pests and diseases that flourish only at specific temperatures and under specific humidity and irrigation management regimes (Smith, Stoltzfus and Prendergast, 2012). Malaria in particular

is expected to change its distribution as a result of climate change (Cline, 2007). In coastal areas, more people may be exposed to vector- and water-borne diseases through flooding linked to sea level rise. Health risks can also be linked to changes in diseases from either increased or decreased precipitation, lowering people's capacity to utilize food effectively and often resulting in the need for improved nutritional intake (Webb and Kennedy, 2014)

Climate Variability and Food Availability

Adequacy is assessed through comparison of availability with the estimated consumption requirement for each food item. High market prices for food are sometimes a sign of inadequate availability; steadily high prices force poor people to reduce consumption below the minimum required for a healthy and active life and may lead to food riots and social unrest. Growing scarcities of water, land and fuel can also put increasing pressure on food prices. Most of the time scarcities are compounded by the outcome of climate change and a general increase in the cost of an average food basket for household consumption (Qadir, Wichelns, Raschid-sally, McCormick, Drechsler, Bahar 2010). Other climate variables such as rainfall, soil moisture, temperature and radiation can affect crops thresholds beyond which growth and yield are compromised (Porter and Semenov, 2005, Masset, Haddad, Cornelius, Isaaza-castro, 2012).

Cereals and fruit tree yields can be damaged by a few days of temperatures above or below a certain threshold (Smith et al., 2012) and limit household utilization. Guinea savanna ecological Zone of Nigeria recorded very low yield / changes in tuber (crops) in response to rainfall and temperature variability between 1970 and 2000 (Adejuwon, 2006). A change in the geographic distribution of wild foods such as African star apple (chrysophyllum albidum G.Don, hog plum (spondias mombin Linn), bush mango (lrvinga gabonensis Baill) and monkey cola (Cola millenii.Schum) resulting from changing rainfall and temperatures could therefore, have effect on the availability of food and therefore, household consumptions. Webb & Kennedy (2014), reported that changes in climatic conditions will lead to significant decline in the provision of wild foods by a variety of ecosystems and other impact can be expected as the world climate continues to change. About 5000 plant species examined in a sub-Saharan African (Nigeria inclusive), is predicted that 81 to 97 percent of the suitable habitats will decrease in size or shift owing to climate change and concluded that by 2085, between 25 and 42 percent of the species' habitats are expected to be lost altogether (Adejuwon, 2006). The implications of these changes are expected to be particularly great among communities that depend on plants as food or medicine.

Climate Variability and Food Accessibility

Individuals can have sufficient access to food only when they have adequate income or other resources to purchase appropriate foods needed to maintain consumption of an adequate diet (UNICEF/WHO, 2006, FAO, 2003a). Food access depends on the ability of households to obtain food through purchases, gathering, current production, or stocks, or through food transfers from relatives, members of the community, the government, or donor. The mere presence of an adequate supply does not ensure that households can obtain and consume food, households must first have access to food through affordability or purchasing power (Balz, Heil, and Jordan, 2015). Increased risk exposure resulting from climate change will reduce people's access to food and undermine their food sufficiency. After food is produced, it will be moved from where it was produced to where it can be utilized or consumed. These processes involve transportation, for example, increased heat stress may reduce the shelf life of certain foods, besides, windstorms can damage on infrastructure and transportation systems, which may lead to delays (Fan and Pandya, 2012). Again, in droughts, people move into marginal lands,

some of these marginal lands may not have good road access and transporting food from such marginal land can cause a huge problem (Van et al 2018). In African countries including Nigeria, inefficient and ineffective transport systems reduced effective delivery and increase the price of food and limit use.

Food preferences determine the kinds of food households will want to obtain more, changing climatic conditions may affect both the physical and the economic availability of certain preferred food ingredient, which might make it difficult to meet some food needs of the different people in the household. A family might reduce the daily amount of food consumed equally among all household members, or allocate food preferentially to certain members, often the able-bodied male adults, who are assumed to need it the most to stay fit and continue working to maintain the family(Ruel, Garrett, Morris, Maxwell, Oshaug, Engele, Menon, Slack, Haddad, 1998, Aberman and Cohen, 2012). In Nigeria, many households eat maize as the staple crop, but when there is less rainfall, sorghum becomes food for every household and people can consume more of it (FAO, 2007c). When households cannot afford food, households adjust by eating less of the preferred foods or reducing total quantities consumed and because less food is consumed, there may be a nutritional deficit (Smith et al, 2014).

Conclusion and Recommendations

In conclusion, there are clearly many pathways through which climate change impact food availability, access and utilization. Climate forces changes food production, which affect the income earned and the food prices faced by poor households, with the major effect on food quality and safety of the food supply. Climate variables can impact on physical/ human capital– such as roads, storage and marketing infrastructure, houses, productive assets and human health, which indirectly changes the economic and socio-political factors that govern food access and utilization. Based on the conclusion, the following recommendations are made:

1. International community, Non-Governmental Organizations (NGO) and Home Economists should expand coverage of and increase access on climate change interventions especially at household and community level where knowledge on climate change is limited.
2. Government should come up with detail and multi-sector programming to face climate change approaches, integrate the climate dimension into existing initiatives, ensure the inclusion of nutrition specialists in the process of knowledge-building, provide researchers with adequate funding and expand nutrition interventions which successfully and sustainably tackle the direct and basic causes of inadequate food supply and use.

References

Aberman, N. & Cohen, M.J (2012) The impact of climate change and bioenergy on nutrition. Dordrecht: Springer

Adejuwon, J.O. (2006). Food Crop Production in Nigeria. Potential effects of climate change. *Clim.Res.32: 229 - 245*

Balz, A. G., Heil, E. A., & Jordan, I. (2015). Nutrition-sensitive agriculture: New term or new concept? *Agriculture & Food Security, 4*, 6. https://doi.org/10.1186/s40066-015-0026-4

Campbell, B. M., Vermeulen, S. J., Aggarwal, P. K., Corner-Dolloff, C., Girvetz, E., Loboguerrero, A. M. (2016). Reducing risks to food security from climate change. *Global Food Security, 11*, 34–43.

Cline, W. R. (2007). *Global warming and agriculture: Impact estimates by country*. Washington, DC: Center for Global Development, Peterson Institute for International Economics.

Fan, S., & Pandya-Lorch, R. (2012). *Reshaping agriculture for nutrition and health. An IFPRI 2020 Book*. Washington, DC: International Food Policy Research Institute (IFPRI). Retrieved on November 16, 2020

FAO. (2003a). *World Agriculture: Toward 2015/2030, Chapter 13*. Rome: Earthscan.

FAO. (2004b). Globalization, Urbanization and Changing food systems in developing countries. In The State of Food Insecurity in the World. Rome.

FAO. (2007c). Food Outlook November 2007: High prices and volatility in agricultural commodities Working Paper No. FP/ 39. Rome

Garrett, J.L. & M.T. Ruel, (2003). Are determinants of rural and urban food security and nutritional status different? Some Insights from Mozambique. International Food Policy Research Institute (IFPRI) FCND discussion papers, 65.

Haile, M. G., Wossen, T., Tesfaye, K., & von Braun, J. (2017). Impact of Climate change, Weather extremes, and price risk on global food supply. *Economics of Disasters and Climate Change, 1*, 1–17.

Inter Academy Partnership (2018). *Opportunities for future research and innovation on food and nutrition security and agriculture: The Inter Academy Partnership's global perspective*. Trieste: Schaefer Druck und Verlag GmbH. Retrieved on November 20, 2020

Kalkuhl, M., von Braun, J., & Torero, M. (Eds.). (2016). *Food price volatility and its implications for food security and policy*. Cham: Springer. Retrieved on November 30, 2020.

Keding, G. B., Schneider, K., & Jordan, I. (2013). Production and Processing of Foods as Core Aspects of Nutrition-sensitive Agriculture and Sustainable diets. *Food Security, 5*, 825–846.

Masset, E., Haddad, L., Cornelius, A., & Isaza-Castro, J. (2012). Effectiveness of Agricultural interventions that aim to improve Nutritional Status of Children: Systematic review. *BMJ, 344*:8222.

Nelson, G. C., Rosegrant, M. W., Palazzo, A., Gray, I., Ingersoll, C., Robertson, R., et al. (2010). *Food security, farming, and climate change to 2050: Scenarios, results, policy options*. Washington, DC: IFPRI. Retrieved on November 20, 2020

Pontifical Academy of Sciences and Global Alliance for Improved Nutrition (GAIN) (2018). Final statement of the workshop on food safety and healthy diets. *The Vatican*. Retrieved on November 20, 2020

Porter, J.R. & Semenov, M.A. (2005). Crop responses to climatic variation. Philosophical Transactions of the Royal Society B: Biological Sciences, 360, 2021 2035.

Qadir, M., Wichelns, D., Raschid-Sally, L., McCormick, P. G., Drechsler, P., Bahri, A., (2010). The challenges of wastewater irrigation in developing countries. *Agricultural Water Management, 97*, 561–568.

Qatzweiler, F. W., & von Braun, J. (Eds.). (2016). *Technological and institutional innovations for marginalized smallholders in agricultural development*. Cham: Springer. Retrieved on November 30, 2020

Ruel, M.T., Garrett, J., Morris, S., Maxwell, D., Oshaug, A., Engele, P., Menon, P., Slack, A. & Haddad, L. (1998). Urban Challenges to Food and Nutrition Security: A review of Food security, Health and Caregiving in the cities. IFPRI FCND Discussion Papers No. 51. Washington, DC, IFPRI. IITA, (2004.) Nigeria food consumption and Nutrition survey assessment of the full cost of the UK weekly food basket. Food Policy, 30 (1): 1 19.

Rakib, M. & Matz, J. A. (2016). The impact of shocks on gender-differentiated asset dynamics in Bangladesh. *The Journal of Development Studies, 52*, 377–395.

Smith, K. R., Bruce, N., Balakrishnan, K., Adair-Rohani, H., Balmes, J., Chafe,

Z. (2014). Millions of dead: How do we know and what does it mean? methods used in the comparative risk assessment of household air pollution. *Annual Review of Public Health, 35*, 185–206.

Smith, L. E., Stoltzfus, R. J., & Prendergast, A. (2012). Food chain mycotoxin exposure, gut health, and impaired growth: A conceptual framework. *Advances in Nutrition, 3*, 526–531.

Thompson, B. & Amoroso, L. (Eds.). (2014). *Improving diets and nutrition: Food-based approaches*. Croydon, UK: FAO

UNICEF/WHO. (2006) *Meeting the MDG Drinking Water and Sanitation Target: The Urban and Rural Challenge of the Decade* (New York: UNICEF & WHO: 2006); and The World Bank, *World Development Report 2006: Equity and Development* (Washington, DC: The World Bank, 2006).

Usman, M. A., Gerber, N., & von Braun, J. (2018). The impact of drinking water quality and sanitation on child health: Evidence from rural Ethiopia. *The Journal of Development Studies, 55*, 2193–2211.

van Meijl, H., Havlik, P., Lotze-Campen, H., Stehfest, E., Watzke, P., Pérez Dominquez, I., et al. (2018). Comparing impacts of climate change and mitigation on global agriculture by 2050. *Environmental Research Letters, 13*.

Webb, P., and Kennedy, E. (2014). *Impact pathways from agricultural research to improved nutrition and health: Literature analysis and research priorities*. Rome: Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO).

Welthungerhilfe and Concern International. (2018). *Global Hunger Index*, Bonn and Dublin. Retrieved on November 20, 2020.

Wheeler, T., and von Braun, J. (2013). Climate change impacts on global food security. *Science, 341*, 508–513.

World Bank. (2010). *World Bank development reports 2010: Development and climate change*. Washington, DC: World Bank.
FAO. (2000a). The energy and agriculture nexus. Environment and Natural Resources Working Paper No. 4. Rome.

Ziervogel, G. (2004). Targeting seasonal climate forecasts for integration into household level decisions: the case of smallholder farmers in Lesotho. *Geography. Journal.170:6–21.*