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ECONUTRITION: AN INTEGRATED APPROACH TO SAFE, SUSTAINABLE AND ENVIRONMENTAL FRIENDLY FOOD SUPPLY TO IMPROVE ECONOMIC AND HEALTH STATUS

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Abstract
Econutrition is the interrelationships among nutrition and human health, agriculture and food production, environmental health, and economic development. In Nigeria, agriculture is a major branch of the economy, providing employment for 70% of the population but food insecurity in Nigeria still remained a challenge. Malnutrition is widespread in Nigeria especially in rural areas, which is partly due to inadequate food and nutrient supply. The Nigeria Demographic and Health Survey reported in 2013 that under-five children in Nigeria are stunted (37%), wasted (18%) and underweight (29%). The nutrition system influences the environment, which in turn determines the quality of food produced and supplied. The environmental impact of food production is determined by the agricultural method used and it is an important issue across the globe, with pressure to minimize that impact coming from many sources, including government, trade associations, supply chains and other social and financial stakeholders. Sustainability is the key role integrating with other component in econutrition because econutrition involves eating more pure basic foods that are regional, seasonal, local and low in packaging and processing and this is achieved by practice of organic farming for more production of quality food crop than as would have in conventional farming.

Keywords: *Econutrition, Agriculture, Sustainability, Environment and Economy.*

Background to the Study

Eco-nutrition is defined in terms of the interrelationships among nutrition and human health, agriculture and food production, environmental health, and economic development (Kataki and Babu, 2002). Sustainability is a means of configuring civilization and human activity so that the society, its members and its economies are able to meet their needs and express their greatest potential in the present, while preserving biodiversity and natural ecosystems, planning and acting for the ability to maintain these ideals for future generations. Today more than 6.3 billion humans inhabit the planet. Based on current rates of increase, the population is projected to double more than 12 billion in less than 50 years (PRB, 2003). At a time when the world population continues to expand at rate of 1.3% per year, adding more than a quarter million people daily, providing adequate food becomes increasingly a severe problem. Conceivably, the number of malnourished will reach 5 billion in future decades (Pimentel, 2004).

Food security depends on abundance of food, an even distribution, and an ability to purchase food, as well as political stability. Reports from the Food and Agriculture Organization (FAO) of United Nations and numerous other international organization, further confirm the serious nature of the global supply. For example, the per capita availability of world cereal grains, which make up 80% of the world's food supply, has been declining for nearly two decades. These shortages are not reflected in the price of cereal grains, because the poor people cannot afford to purchase grains despite the fact that prices are relatively low (Pimentel and Pimentel, 1996).

Malnourished people are more susceptible to chronic diseases like malaria, tuberculosis, and AIDS. The World Health Organization reports in 2001 stated that, chronic diseases contributed approximately 60% of the 56.5 million total reported deaths in the world and approximately 46% of the global burden of disease (WHO, 2002). The proportion of the burden of Non Communicable Diseases (NCDs) is expected to increase by 57% by 2020. Almost half of the chronic disease deaths are attributed to cardiovascular diseases; obesity and diabetes are also showing worrying trends, not only because they already affect a large proportion of the population, but also because they have started to appear earlier in life (WHO, 2003).

Statement of Problem

The population of a place is dependent on improved nutrition, specifically for young children and women in their childbearing years (Black et al., 2008). Food and nutrition security remain Africa's most fundamental challenges for human welfare and economic growth. Far too few many people on the continent are unable to acquire and effectively utilize at all times the food they need for a healthy life

(Hoekstra et al., 2009). Because of low food availability and profound poverty, an estimated 200 million people on the continent are undernourished, and their numbers have increased by almost 20 percent since the early 1990s (FAO, 2008). In the same way, the effective utilization of such ability is dependent on a properly nourished population, in which individuals are living a healthy and active life and are able to contribute creatively to their own and the nation's economic well-being. It is only when communities have secured their basic food and nutritional needs that they will begin to experience sustained improvements in their broader welfare.

Objectives of Study

The objectives of the study were to:

1. determine the situation of agriculture in Nigeria
2. determine the spectrum of malnutrition in Nigeria
3. assess an integrated approach to save and sustainable food supply

Literature Review

One common thread in the conventional definition of agricultural sustainability is the notion that sustainable agriculture is a system that makes the best use of nature's goods and services whilst not damaging the environment (Altieri, 1995). Furthermore, sustainable agriculture enhances the productive values of natural, social and human capital (Pretty, 1995). Agricultural sustainability has environmental, economic, and equity ramifications. From an economic standpoint, agriculture is sustainable if farmers are able to generate and sustain output levels that support a decent living standard in ways that are both equitable and protective of natural and human capital (AANS, 2008). From an equity perspective, agricultural sustainability can be perceived in terms of whether a give agricultural system has narrowed or accentuated the inequality between farmers and other sectors of the economy. A wide gap in living standards would induce rural dwellers to migrate to urban areas, which would in turn undermine agricultural production and community viability in the rural sector. Finally, from an environmental perspective, agricultural sustainability must include the management of carbon, nitrogen, and water. Even developing countries must consider the global impacts of their agricultural and industrial practices (AANS, 2008).

Research Questions

1. Are there ways physical and economic access to food will be sustained for economic growth and health status of a nation?
2. Can food supply to individual household be stabilized for sustainable development?

Materials and Methods

This paper was made using literature review which came from different sources consist of the scientific books review, current journal review and internet. Those sources analyzed leads to main idea based on the exposition method. Discussion of this paper consists of 3 areas. On the first area, explains situation of agriculture in Nigeria, secondly; spectrum of malnutrition in Nigeria, and then finally an integrated approach to safe and sustainable food supply for economic and health status and this will cover, agricultural and environmentally sustainable aspect, and nutritional and health aspect, as a basic foundation for econutrition.

Results and Discussion

Situation of Agriculture in Nigeria

The agricultural sector has been described as the engine for economic growth and improved livelihoods in Africa (World Bank, 2006; AANS, 2008). The majority of the population in Sub-Saharan Africa lives in rural areas and depends directly or indirectly on agriculture (AANS, 2008). Despite the great potential for agricultural production in Africa, about 73% of the poor people living in rural areas subsist on less than a dollar a day (Sanchez et al., 2005). About 200 million of the world's hungry people are found in the continent and available statistics suggest that about one third of Africa's population is malnourished (Sanchez et al., 2005: AANS, 2008).

Agriculture is a major branch of the economy in Nigeria. This it does by providing employment for 70% of the population. In 1990, 82 million hectares out of Nigeria's total land area of about 91 million hectares were found to be arable, although only 42% of the cultivable lands were farmed (Olomola, 1998). Much of this land was farmed under bush fallow system, whereby land is left idle for a period of time to allow natural regeneration of soil fertility. Eighteen million hectares were classified as permanent pasture, but had the potential to support crops. Most of the 20 million hectares covered by forests and woodlands are believed to have agricultural potential (Olomola, 1998). Agriculture contributed 32% to Gross Domestic Product (GDP) in 2001 (World Bank, 2006). The country's agricultural products fall into two main groups: food crops produced for home consumption and exports. Prior to Nigerian civil war, the country was self-sufficient in food, but increased steeply after 1973. Bread made from American wheat replaced domestic crops as the cheapest staple food. The most important food crops are yams and manioc (cassava) in the south and sorghum and millet in the north (Olomola, 1998).

Nigeria is exceptionally endowed with multitudes of agricultural potentials. Fortunately, the agricultural resources unlike the oil resources are renewable. However, the performance of the agricultural sector over the years cannot be described as blazing (Onyeagocha, 2006). Olomola (1998) indicated a downward

trend in the share of agriculture in GDP from 63% in 1960 to 35% in 1997. According to the National Bureau of Statistic (NBS), agriculture's share to GDP in 2010 was 41.84% (NBS, 2011). Efforts are currently being made to address these defects through the new national policy on agriculture. The policy focuses attention among other issues on the efforts to promote free trade on agricultural products and inputs in the country and integrate national agricultural programmes in agriculture, fisheries and livestock development with the rest of the world (Okojie, 2003). These are aimed at ensuring food security and repositioning agriculture for the eight sustainable Millennium Development Goals (MDGs) which essentially are to reduce hunger and poverty by half by 2015 while ensuring environmental sustainability (Okojie, 2003). However, agriculture is still an important sector for Nigerian economic growth, especially for rural communities enhancing the economic and health status. Therefore, an integral strategy is needed for maximizing the agricultural production to enhance the economic and health status of rural communities, in other word, the technology used still has a way of sustaining the ecology.

Spectrum of Malnutrition in Nigeria

Hunger and malnutrition remain the most devastating problems facing the majority of the Nigerian populace, especially the poor. Inabilities to access a good and nutritious food lead to malnutrition. Malnutrition affects all age groups across the entire lifespan. At present, malnutrition includes a spectrum of nutrient-related disorders, deficiencies and conditions that are creating major public health problems: intra-uterine growth retardation, protein energy malnutrition, iodine deficiency disorders, vitamin A deficiency disorders, iron-deficiency anemia, obesity and other diet-related non-communicable diseases (Van de Poel et al., 2008). The prevalence of malnutrition among under-five children is very high in many developing countries of the world. Reducing malnutrition among children under the age of five still remains a huge challenge in the developing countries of the world. An estimated 230 million under five children are believed to be chronically malnourished in developing countries (Van de poel et al., 2008). Similarly, about 54% of deaths among children of this age group are believed to be associated with malnutrition in developing countries (FAO, 2008).

In Sub-Saharan Africa, 41% of under-five children are malnourished and deaths from malnutrition are increasing on daily basis in that region (FAO, 2008). Malnutrition is widespread in Nigeria, especially in the rural areas. This is partly due to inadequate food and nutrient supply. The 2004 Food Consumption and Nutrition Survey reported similar trends with 42% being stunted, 25% underweight and 9% wasted (Ajieroh, 2010). The Nigeria Demographic and Health Survey revealed trend of wasting to be 11%, 14%, and 18% respectively, 2003, 2008

and 2013, while stunting was 41% (2008), 37% (2013) and 29% under-five children were underweight (NDHS, 2013). These surveys indicated significant variation between the rural and urban areas with children from rural areas being worse affected by malnutrition.

Malnutrition is insufficient, excessive or imbalance consumption of dietary energy and nutrients. It manifests in different forms, such as under-nutrition, over-nutrition and micronutrients malnutrition. Malnutrition prevalence, weight-for-age of children under five in Nigeria was 26.7% as of 2008. Its highest value over the past 18 years was 35.1% in 1993, while its lowest value was 25.7% in 2007 (WHO, 2011). Malnutrition prevalence, height-for-age of children under five in Nigeria was 41% as of 2008 with its highest value being 50.5% over the past 18 years in 1990, while its lowest value was 39.7% in 1999 (WHO, 2011). Malnutrition in early childhood is associated with functional impairment in adult life as malnourished children are physically and intellectually less productive when they become adults. Children that are malnourished tend to have increased risk of morbidity and mortality and often suffer delayed mental development, poor school performance and reduced intellectual achievement. Protein-energy malnutrition (PEM) is still a major public health issue in developing countries (WHO, 2011). It is associated with as much as 50-60% of under-five mortality in poor countries and a myriad of morbidities. There are various anthropometric variables for classifying PEM (Gernaat and Voorhoeve, 2000). Acute malnutrition, for instance, is measured by weight-for-height or bilateral edema, while chronic malnutrition is measured by height-for-age (Gernaat and Voorhoeve, 2000).

The World Health Organization (WHO) recently defined Severe Acute Malnutrition (SAM) by a very low weight-for-height (below -3 z-scores of the median WHO growth standards), visible severe wasting, or the presence of nutritional edema (WHO, 2011). Wasting (marasmus) and various forms of kwashiorkor are, therefore, forms of Severe Acute Malnutrition. One of the oldest classifications of PEM, used, weight-for-age and the presence or absence of edema to arrive at a spectrum, with marasmus and kwashiorkor at either end of the spectrum (Gernaat and Voorhoeve, 2000). Besides macronutrient deficiency, deficiencies in iron, iodine, vitamin A, and zinc are the main manifestations of malnutrition in developing countries, and indirect factors such as high rate of unemployment, poverty, illiteracy, and overcrowding contribute to the development of PEM (WHO, 2011).

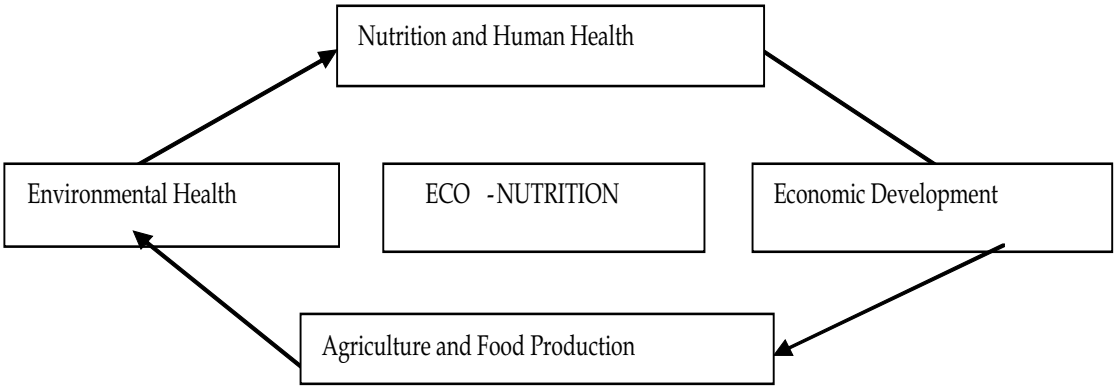
In addition, natural disasters are increasingly contributing to food shortage in Africa as the continent is not immune to the effects of climate change. According to a report published by the World Food Programme in mid 2011, an estimated 9 million

people in the horn of Africa alone need humanitarian assistance as severe drought combines with conflicts to push the poorest and weakest, especially children, to the edge of survival (WFP, 2011).

Econutrition: An Integrated Approach to Safe and Sustainable Food Supply Concept and Rationale

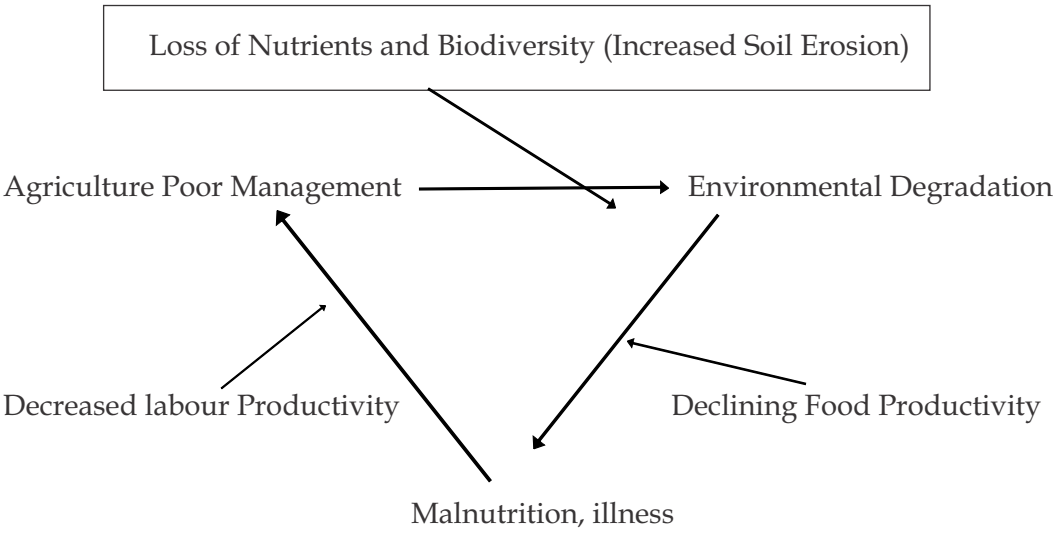
In the field of nutrition, the concept of integrating the terms ecology and nutrition into econutrition is relatively recent. It was stated earlier in this paper that, econutrition is an interrelationships among nutrition and human health, agriculture and food production, environmental health, and economic development (Deckelbaum et al., 2006).

Figure 1: Interrelationships among Nutrition and Human Health, Agriculture and Food Production, Environmental Health, and Economic Development



Source: Deckelbaum et al. (2006)

Figure 2: The Cycle of Agricultural Mismanagement, Agricultural Degradation, and Malnutrition



Source: Deckelbaum et al. (2006)

The vicious cycles that lead to loss of nutrients, soil erosion, and decreasing biodiversity link into environmental degradation that results in decreased food production. Lack of food is associated with malnutrition and illness and especially with declining labour productivity, which exacerbates poor agricultural management (Deckelbaum et al., 2006). Although under-nutrition in developing regions such as Southeast Asia, East Asia, and Latin America is predicted to decrease substantially by the year 2015, estimates for Sub-Saharan Africa indicate an increase in both the percentage and the absolute number of undernourished people. According to a 2001 report from the Food and Agriculture Organization, there is evidence that "46 million years of productive, disability-free life were lost in 1990. The result of lost social productivity was caused by four types of malnutrition: stunting and disorders related to iodine, iron, and vitamin A deficiency" (FAO, 2001).

In econutrition, sustainability aspect is the key role integrating with other components. The use of nitrogen-fixing plants in agricultural systems provides an example understood by all disciplines. Nutritionists and vegetarians know that peanuts, tofu, and beans are important sources of protein that can replace animal sources. This comes as no surprise to Agronomists or Ecologists, who recognizes

that all three of these foods come from a unique plant family, the legume family, which are major drivers of nitrogen cycling in terrestrial ecosystems and are tied to increased productivity in natural systems (Tilman et al., 2001).

A unique association with bacteria found in the roots of most legumes allows the plant to convert atmospheric nitrogen into ammonium, a form usable by plants. This ability to capture and convert atmospheric nitrogen (N_2) to ammonium (NH_4^+) is the foundation of amino acids and thus of proteins, is what makes legumes desirable from a nutritional perspective, as well as from the agricultural and ecological perspectives. The incorporation of legumes into the agricultural systems can add up to 200kg of nitrogen per hectare, restoring nutrients to depleted soils, boosting agricultural productivity and providing human populations with plant based protein (Deckelbaum et al., 2006). It argued that individuals and families which are caught up in the poverty trap find themselves in a negative feedback loop, unable to practice productive agriculture because of lack of access to resources leading to environmental degradation through unsustainable agricultural practices.

Environmental degradation leads to low yields which further provoke problems of malnutrition which leads to increased incidence of disease, or simply insufficient caloric intake to provide the human energy needed for labour-intensive sustainable field management (Deckelbaum et al., 2006). Central to eco-nutrition is that reversing this negative feedback requires integrated and targeted solution that simultaneously addresses the agricultural; nutritional and environmental dimensions of the problem, that is, human nutrition in subsistence communities cannot be resolved without addressing agricultural problems which in turn cannot be resolved without addressing environmental degradation in order to achieve sustainable agricultural practices.

Agricultural and Environmental Sustainable Aspect

The nutrition system influences the environment, which in turn determines the quality of food. The environmental impact of food production is determined by the agricultural method used (Carlson-Kanyama, 1998). Conventional farming method relies on extensive use of natural resources and result in higher levels of food contamination. In contrast, the environmental impact of organic farming is lower. Organic farming practices include controlling pests naturally, rotating crops, and applying legume plants as manure, in contrast to the use of synthetic pesticides and fertilizers in conventional farming. In integrated farming, organic and conventional methods are combined, resulting in an intermediate environmental impact (Reganold et al., 2001).

Agricultural development, a subset of economic development, implies a sustained increase in the level of food production and productivity over a reasonable length of time and the subsequent improved wellbeing of farmers as reflected in their higher per capita income and standard of living. The typical forms of agricultural related environmental degradation often observed in Nigeria are deforestation, and soil erosion. In few places, deforestation has been cause by the demand for new land for farming, building needs and timber harvesting and collection of non-tuber forest products; while erosion is caused by the farming systems adopted, inappropriate road construction and maintenance methods associated with the farming systems (Idris, 2006). The impact of agricultural environmental degradation frequently transcends the agricultural areas. The general impact includes loss of flora and fauna, decline surface and underground's water supply and food security. Agricultural production derives its existence from the use of land. Without productive land resources, no meaningful agricultural activity can take off (Idris, 2006). Similarly, profitable crop and livestock production can thrive only if the elements of sunshine, water and soil nutrients, as well as plant nutrients contained in chemical fertilizers are present in the right proportion and quality. Furthermore, increased agricultural and industrial output thrives best where a favourable man-made socioeconomic environment exists (Idris, 2006).

Natural resources must, therefore, be managed in ways to provide a basis for sustained development. In discussing the relationship between ecological deterioration and economic decline, IFAD (2006), reviewed evidence from soil scientists, agronomists, meteorologist and economists. The conclusion was that sustained overuse of biological systems can set in motion changes that are self-reinforcing and in which each stage of deterioration hastens the onset of the next. At the final stage, however, biological production is destined to collapse. Families will no longer be able to provide enough food for themselves and their livestock. A massive exodus from rural areas begins. Famine becomes widespread and peasant's lack of income is compounded by absolute shortage of food.

As policy makers, the Nigeria government should create a pro-farmers sustainable agriculture strategy (organic farming) through several policies:
Encourage resource-conserving technologies and practices

1. Establish a national strategy for integrated pest management.
2. Prioritize research into sustainable agriculture.
3. Promote farmer to farmer exchange.
4. Provide better information for consumers and the public.

Support local groups for community action

1. Encourage formation of local groups.
2. Foster rural partnership.
3. Support training and field schools for farmer.
4. Provide incentives for on-farm employment.
5. Permit groups to have access to credit.

Reform external institutions and professional approaches

1. Foster stronger NGO-government partnership.
2. Develop capacity in planning for conflict resolution and mediation.

Nutritional and Health Aspect

In the past decade, rapid expansion in a number of relevant scientific fields and, in particular, in the amount of population-based epidemiological evidence has helped to clarify the role of diet in preventing and controlling morbidity and premature mortality resulting from non-communicable diseases (NCDs). Some of the specific dietary components that increase the probability of occurrence of these diseases in individuals, and interventions to modify their impact, have also been identified (WHO, 2003).

Furthermore, rapid changes in diets and lifestyles that have occurred with industrialization, urbanization, economic development and market globalization have accelerated over the past decade. This is having a significant impact on the health and nutritional status of populations, particularly in developing countries and in countries in transition. While standards of living have improved, food availability has expanded and become more diversified, and access to services has increased, there have also been significant negative consequences in terms of inappropriate dietary patterns, decreased physical activities and increased tobacco use, and a corresponding increase in diet-related chronic diseases, especially among poor people (WHO, 2003).

The trend of food demand increase by years both in rural and urban areas. Therefore, to maintain or retain good health, the consumption of an individually optimal diet is recommended. The term preventive diet has been used recently to underline the possibility of avoiding nutrition-based diseases (Krauss et al., 2000). The aggregate of most studies suggest that the consumption of plant-derived foods (grains, vegetables, fruits, legumes, nuts) should be increased and that the intake of animal-derived foods (meat products, dairy products, and eggs) should be reduced. This principle applies particularly to sedentary individuals. Plant foods should be consumed when they are as fresh as possible, should be minimally processed, and should be eaten partly as raw food (Leitzmann and Hahn, 1996).

From a nutritional point of view, sustainability also deals with the fair distribution of food through ecologic and preventive eating behaviour. To achieve sustainability, a comprehensive rethinking of common values is needed to attain a new understanding of the quality of life. The question as to the adequate amount of food needs to be addressed at all social levels with the goal of achieving nutrition security for all. To fulfill the demands concerning ecologic, economic, social, and health compatibility, the following 7 principles have been formulated:

1. Foods should be predominantly plant derived (decrease on meat consumption, or replace protein sources from meat to legume and fisheries product).
2. Foods should originate from organic farming.
3. Foods should be produced regionally and seasonally.
4. Foods should be minimally processed.
5. Foods should be ecologically packaged.
6. Foods trade should be fair.
7. Foods should be tastefully prepared (Leitzmann and Hahn, 1996).

Conclusion

The eco-nutrition has the goal of attaining sustainability of food and nutrition security worldwide and it is practicable in Nigeria to achieve food security and sovereignty in each person. To achieve this goal, government and professionals involved in the nutrition ecosystem must inform the public about the principles of eco-nutrition and implementing the strategy of pro-farmer sustainable agriculture through several policies. In this manner, people can be motivated to practice sustainable eating behaviour. Interested and well-informed consumers will be able to weigh the arguments and make the necessary decisions. The vision of a sustainable future depends upon individuals who feel responsible for the environment and health. One of the most effective ways to achieve the goals of eco-nutrition, including healthy and sustainable food choices, is by consuming food originating from organic farming, predominantly plant derived (decrease meat consumption to avoid the further impact on NCDs), foods should be produced regionally and seasonally, minimally processed, food trade should be fair, and foods should be tastefully prepared.

Recommendations

1. Foods should be produced regionally and seasonally for an even distribution across individual household in order to reduce the prevalence of food insecurity in the country.
2. Foods should be processed minimally in order to reduce the problem of non communicable diseases (NCDs) in the country.

3. Government, policy makers, professionals and other developmental agencies should put hands together to achieving an integrated approach in farming system which will help minimize high production of artificial (conventional based) food with the view of combating NCDs in the country and maintaining a safe and sustainable environmental friendly food supply.

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