Harnessing the Potential of Plant-Based Nutrition for Dietary Health in Nigeria

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ABSTRACT

The role of plant-based nutrition for dietary health in Nigeria has been recognized. The nutritional challenges both globally and in Nigeria are increasing while the world is becoming more aware of the impact of malnutrition and global efforts are increasingly concentrating on addressing malnutrition and increasing food security. Diets affect nutrition and health outcomes and thus have social, economic, and environmental impacts. Nutraceuticals are food or food-derived products with additional characteristics to minimize the occurrence and prevention of certain chronic diseases. They include dietary fibre, probiotics, prebiotics, polyunsaturated fatty acids, antioxidant vitamins, carotenoids, polyphenols, spices, fruits, and vegetables that have proven to have potential health benefits. The link between plant-based nutrition and overall health and well-being is already gaining momentum as a diet rich in plant-based foods and with fewer animal-source foods confers both improved health and environmental benefits. At the same time, an increased intake of fruits, vegetables, nuts, and whole grains has been associated with a lower incidence of mortality due to cardiovascular diseases. This study advocates for leveraging plant-based nutrition in Nigeria to address health and nutrition challenges. Recommendations include targeted education and supportive policies for widespread adoption, fostering improved public health.

INTRODUCTION

Nutrition plays a critical role in maintaining the health and well-being of individuals (Kesari and Noel, 2023) while the nutritional status of an individual can be defined as the result between the nutritional intake received and the nutritional demands and should allow for the utilization of nutrients to maintain reserves and compensate for losses (Fernández-Lázaro and Seco-Calvo, 2023). According to the World Health Organization WHO (2024), health is defined as the state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity of an individual. Good nutritional status can only be realized and sustained when individuals within families and communities are food secure.

Humans have used plants for medicinal purposes for thousands of years, with archaeological evidence suggesting that this may date back sixty thousand years (Loedolff *et al.*, 2021). Many of the medicines we use today were first derived from plants, including aspirin, digoxin, quinine, and morphine. While herbal drug preparations have been used for generations, it was only in the 19th century that scientists began to isolate and extract the compounds responsible for these health benefits. This gave rise to the development of synthetic forms of natural products (Loedolff *et al.*, 2021). Plants are important as they represent the largest source of calories (70–80%) and protein (60–70%) intake for mankind (Shahzad *et al.*, 2021).

Humans rely on a diverse array of vitamins, minerals, and phytochemicals for general and preventative health purposes, the latter of which are obtained solely from plant-based foods. Functional plant-based foods and food products contain abundant amounts of health-beneficial phytochemicals, which provide enhanced antioxidant capacity to prevent diseases associated with oxidative damage (Xonti *et al.*, 2020). Data from cross-cultural epidemiological studies reveals that fruit and vegetable consumption has a preventive effect on certain pathologies (Fahrasmane *et al.*, 2007). The analytical knowledge of fruit and vegetables, whole cereals, spices, condiments, aromatic, culinary, and medicinal herbs, vegetable gum, roots, and peel has increased considerably over the past few decades. Fruit and vegetables appear to be relatively rich in antioxidant compounds with health-preserving properties (Gerber, 2004; Scalbert *et al*., 2005).

Basic nutrition is the cornerstone of good health and requires an adequate intake of foods rich in macro-(carbohydrates, proteins, and fats) and micro-nutrients (vitamins and minerals). Functional foods (foods that provide health benefits beyond basic nutrition) contain many biologically active compounds known to be positively associated with human health. These include terpenes, polyphenols, glucosinolates, phytoestrogens and carotenoids (Xonti *et al*., 2020). All these are collectively termed phytochemicals, these biologically active compounds form part of a plant's secondary metabolite profile and often accumulate as part of global stress response (both abiotic and biotic) mechanisms (Forni *et al.*, 2019).

Preventive nutrition has recently become one of the aspects of public health policies on a global scale. (Fahrasmane *et al.*, 2007). Adoption of a plant-based diet will not only help an individual but also help the environment. Springmann *et al*., 2018 study concluded that a shift towards healthier diets alone could reduce greenhouse gas emissions and other environmental impacts by 29% and 5–9%, respectively, while the adoption of plant-based diets increased these percentages to 56% and 6–22%, respectively. The Eat Lancet Commission on Healthy Diets from Sustainable Food Systems estimated that a whole food plant-based diet could prevent 11 million deaths annually from diet-related illnesses (Kanwar, 2020).

Background and Context of Nutritional Challenges Globally

Nowadays, the food systems rely on a narrow range of plant species of limited nutritional value such as rice, maize, and wheat which account for more than 50% of calories consumed while we continue to disregard the huge diversity of nutrient-rich plant species utilized by humanity throughout our history (Hunter *et al.*, 2019). One of the monumental challenges currently facing humanity is how to secure universal access to sufficient, nutritious, healthy, and affordable food that is produced in a sustainable manner (Bioversity International, 2017).

In 2017, the number of undernourished people increased to 821 million, signaling a rise in world hunger and a reversal of trends following a prolonged decline (FAO, IFAD, UNICEF, WFP, WHO 2018). Child stunting remains unacceptably high with approximately 151 million children affected and 51 million children wasted. About 2 billion people lack the key micronutrients they need for physical and mental development such as iron and vitamin A (Development Initiatives 2017); more than one in eight adults are obese – over 672 million people worldwide (FAO, IFAD, UNICEF, WFP, WHO 2018), while three out of four deaths are caused by non-communicable, diet-related diseases (e.g., diabetes, hypertension), particularly in emerging economies and in low-to-middle income countries (Forouzanfar *et al.*, 2015). Extremes such as stunting in children and overweight in adults are occurring concurrently while countries that experience multiple forms of malnutrition are increasingly common (Haddad *et al.*, 2016).

Background and Context of Nutritional Challenges in Nigeria

The Nigerian population is growing rapidly at an estimated growth rate of 2.8% per annum (Matemilola and Elegbede, 2017), currently estimated at over 230 million with a life expectancy of 56.05 (56) years (Macrotrends, 2024). Even though urbanization is generally seen as the engine of growth and development, it may also lead to urban health crises when not managed carefully. Evidence shows that urbanization in Nigeria has created urban health crises of "inadequate safe water supply, squalor and shanty settlements, sanitation, solid waste management, double burden of diseases and inefficient, congested, and risky transport system" (Aliyu and Amadu, 2017). The nutrition in Nigeria presents a complex dilemma because the challenge of nutritional deficiencies faced in Nigeria is not only because of insufficient food; but also, because of poor food choices (Caeser *et al*., 2015).

According to Ecker *et al*., (2020), Nigeria faces a growing triple burden of malnutrition:

1.Chronic childhood undernutrition remains stubbornly high. That is, 36.8% of children under five years were estimated to be stunted.

2. Micronutrient malnutrition, including iron deficiency anaemia among young children and women of reproductive age.

3. Overweight and obesity among adults. Obesity significantly increases the risk of diet-related noncommunicable diseases (NCDs) such as type-2 diabetes, cardiovascular diseases (like heart attack and stroke), and hypertension.

Ecker *et al.* (2020) opined that the root cause of malnutrition is poor dietary quality, which is a universal problem in Nigeria, characterized by increased consumption of too many calories from staple foods and far too few calories from vegetables and fruits, pulses, and animal-source foods (including fish, poultry, and eggs; red meat; and dairy products). Among urban households in Nigeria, the average share of total calories consumed at home which comes from staple foods is 52.5% for the highest income quintile (Q5) and 66.8% for the lowest income quintile (Q1) relative to the optimal calorie intake levels of the "EAT diet".

The EAT diet is a global reference diet recommended by the EAT-Lancet Commission that optimizes healthy nutrition and minimizes its environmental footprint (Willett *et al*. 2019). According to this diet, only about one-third of the daily total calorie intake (34.0%) should be obtained from staple foods (including grains and starchy roots and tubers). Meanwhile, Nigeria is experiencing a shift in dietary consumption towards increased intake of foods high in fats, sugar, and salts (HFSS), and decreased caloric expenditure that coincides with economic, demographic, and epidemiological changes. Adegboye *et al.* (2016) summarized evidence of the dietary changes from "traditional" to more processed foods which has been observed in recent years in Nigeria.

Dietary intake describes the food consumption patterns as well as the quality of the foods consumed. Dietary intake of the Nigerian population is dynamic and influenced by several factors: culture, religion, socio-economic, geographical location, prevailing food systems, and the nutrition transition through urbanization, technology, social media, and improved transportation Ene-Obong *et al.* (2013).

Ene-Obong *et al.* (2020) described the nutritional indices in Nigeria to be below global averages, and lack of data to adequately assess the nutrition situation. Inadequate intakes of energy, protein, calcium, iron, zinc, vitamin A and B vitamins, particularly among the vulnerable groups and low-income and rural households in Nigeria have been recognized by several researchers. This predisposes Nigerians to Non-communicable diseases (NCDs) which have become major causes of disease and death in Nigeria.

Globalization, urbanization, affluence, physical inactivity, and nutrition transition are responsible for the trend in non-communicable diseases (NCDs). In 2013, estimates showed that NCDs caused 24% of total deaths that occurred in Nigeria, with 20% of these arising from cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases (WHO, 2024). Hypertension is the most prevalent form of cardiovascular disease in the country with prevalence ranging from 8 – 48% (Oguanobi *et al*., 2013). Obesity is a risk factor for diabetes mellitus, hypertension, and cancer; thus, an increasingly obese population will bear the increased burden of these NCDs (Fernandez *et al*., 2021). The Nigerian population is becoming more overweight and obese as shown by a recent Global Nutrition report which indicates a prevalence rate of 36.1% and 13.1%, respectively in women and 21.7% and 4.6%, respectively in men (Development Initiatives, 2018).

In 2017, Nigeria ranked 145th out of 157 countries, ranked based on progress toward meeting the Sustainable Development Goals (SDGs). The ranking was 159 out of 162 countries in 2019, with a score that is 13.8% less than the regional average. Although the country recorded a moderate improvement towards achieving SDG 2 of ending hunger, achieving food security and improved nutrition and promote sustainable agriculture however, this progress has been insufficient to meet the goal (John *et al*., 2022). Achieving sustainable economic development in Nigeria will continue to be a mirage without well-nourished and healthy people (Matemilola and Elegbede, 2017). Nigeria is thus struggling to meet the 2030 nutrition targets (SDG 2), and there is a need for accelerated progress in tackling malnutrition in all its forms (Ene-Obong *et al*., 2020). According to Aina (2024), "The world is becoming more aware of the impact of malnutrition and global efforts are increasingly concentrating on addressing malnutrition and increasing food security. One of such effort is evident in the sustainable development goals 2 which aims to address malnutrition through action plans geared towards ending hunger, achieving food security, improving nutrition, and promoting sustainable

agriculture. This implies there is potential to nudge consumer behaviour towards healthier and sustainable diets and address nutritional challenges through changes in the food systems. Identifying entry points for interventions requires an understanding of the link between dietary consumption and the components of the existing food systems (Mekonnen *et al*., 2021).

Solutions to Malnutrition in Nigeria (proposed by Enang, 2023)

1. Proper dietary education should be given to all

Most people need to realize that a balanced meal is not an expensive meal but simply a meal that contains all classes of food. Stakeholders in the catering industry should make the education available to all that food does not have to be expensive to be a balanced diet, they just must be rich in nutrients.

2. More jobs should be created so that unemployment can be reduced. Some people in the country cannot afford a square meal in a day, and when starvation sets into a nation, it begets malnutrition by default.

3. The cost of food items should be made affordable. No matter the level of employment in a nation, when the cost of things exceeds the income of a person, malnutrition is inevitable because the victim will just eat anything just to meet up with his daily bread.

Significance of Harnessing Plant Potential for Nutritional Development

Malnutrition has been defined as a pathological condition, brought about by inadequacy of one or more of the nutrients essential for survival, growth, reproduction, and capacity to learn and function in society (Caeser *et al.*, 2015). A principal cause of the multiple burdens of malnutrition is poor diet. Food systems produce large quantities of food, but not enough of the required nutrient-rich, plant-based foods needed for healthier and sustainable diets (Willett *et al.* 2019).

Interactions between components of the food systems determine diets – quantity, quality, diversity, and safety. Nonetheless, dietary patterns may also act as drivers of change for future food systems (HLPE, 2017). This is because diets affect nutrition and health outcomes and have social, economic, and environmental impacts. This growing demand for food would necessitate sustainability in production, consumption, and enabling conditions such as the future regarding behaviour by the food systems actors. These interlinkages may affect the food systems directly through political or institutional actions or indirectly by influencing the drivers of the food systems including biophysical and environmental, innovation, technology and infrastructure, political and economic, socio-cultural, and demographic drivers (HLPE, 2017).

Overview of existing literature on plant-based nutrition

Nutraceutical was defined by Stephen DeFelice as a food or part of food that renders medical or restorative health benefits along with prevention and curative potential against diseases (Dwivedi, 2023). Nutraceuticals have gripped more attention in recent years; especially during the COVID-19 pandemic and day-to-day health hazards made people more conscious of health-related products (Puri *et al.*, 2022). Many traditional systems of medicine have considered food and diet as important parts of their medical treatment. The basic idea of nutraceuticals is likely to evolve from the extant idea of well-being proposed by the great philosopher Hippocrates (the father of medicine) “Let food be thy medicine and medicine be thy food” who realized the potential of food and explored the medicinal benefit by conscious use of food (Smith, 2004).

Nutraceuticals are food or food-derived products with additional characteristics to minimize the occurrence and prevention of certain chronic diseases. The rational use of these nutraceuticals not merely gives us nutrition and restoration but also supports in fighting against diseases and overcoming illness.

According to Dwivedi (2023) a wide variety of food and dietary supplements, i.e., dietary fibre, probiotics, prebiotics, polyunsaturated fatty acids, antioxidant vitamins, carotenoids, polyphenols, and spices have proven to have potential health benefits and could be used as nutraceuticals.

Dietary fibre: This helps to overcome constipation and hardening of stools, reduce cholesterol and blood glucose levels that might be helpful in the prevention of heart diseases and diabetes, and could be used as an effective weight loss agent, and support the growth of beneficial bacteria.

Probiotics: These are primarily present in fermented products, i.e., curd, buttermilk, yogurt, and other fermented foods. Probiotics do help to digest food, improve immunity to fight against diseases, and secrete vitamins and neutralize toxins.

Prebiotics: These are used to improve digestion, and boost immunity and could be used as weight loss agents. Examples include chicory root, dandelion greens, garlic, onions, leeks, asparagus, bananas, barley, oats, apples, konjac root, flaxseeds, and wheat bran.

Polyunsaturated fatty acid (PUFA): They are useful in the prevention of depression and anxiety, vision impairment, brain growth and development, heart disease, metabolic syndrome, autoimmune diseases, premature aging, and sun damage. Major sources of PUFA are soybeans, flaxseed, sunflower oil, safflower oil, corn oil, cod liver oil, chia seeds, walnuts, fish, meat, and eggs.

Antioxidant vitamins: These could help to reduce the risk of heart disease, cancer, diabetes, cataracts, arthritis and gout, age-related degeneration, and immunity booster. Good sources of Vitamin C are Oranges, kiwi, lemon, grapefruit, bell peppers, strawberries, tomatoes, broccoli, cabbage, and cauliflower while vegetable oils such as wheat germ oil, sunflower oil, safflower oils, and certain nuts, i.e., peanuts, hazelnuts, almonds are among the best sources of Vitamin E.

Carotenoids: Carotenoids are used to reduce the risk of cardiovascular diseases, cancer, diabetes, and age-related degeneration. They have been used to improve eye and skin health and boost immunity. They are well known for their antioxidant, therapeutic, and protective potential against various diseases. Good sources of carotenoids are yams, kale, watermelon, cantaloupe, bell peppers, tomatoes, carrots, mangoes, oranges, spinach, pumpkin, avocado, yellow-fleshed fruits, corn, and egg yolks.

Polyphenols: They provide efficient protection against certain pernicious chronic diseases such as cardiovascular diseases, cancer, diabetes, neurodegenerative diseases, aging, asthma, and infections. Sources include cereals, dry legumes and chocolate, tea, coffee, grapes, apples, pear, cherries and berries, red onion, spinach, olives, nuts, cloves, cocoa powder, plums, and soy products have substantial polyphenolic compounds.

Spices: Spices have a significant role as carminative, antioxidant, chemoprotective, anti-inflammatory, cholesterol-lowering, anti-diabetic, anti-cancer, and immune stimulant. They include turmeric, fenugreek, garlic, onion, cumin, caraway, fennel, coriander, mint, asafetida, cinnamon, mustard, black pepper, red pepper, clove, and cardamom. Apart from their popular use as spice, they also help to enhance the organoleptic properties of food.

Minerals and trace elements: They help to reduce oxidative stress, abnormal function of various organs, and UV-induced cytotoxicity. Some of them are also helpful in DNA synthesis and repair, cell apoptosis, and wound healing. Good sources of minerals are nuts, seeds, seafood, meat, whole grains, dairy products, eggs, seaweed, legumes, green vegetables, and oats.

Fruit and vegetables: These contain vitamins, three of which are provided primarily by this food group: vitamin C, vitamin B9 or folates, and beta-carotene or provitamin A. In addition to their vitamin function, they fulfil an antioxidant function. At the cell level, antioxidants can oppose the accumulation of free radicals, which leads to DNA and membrane damage, promoting carcinogenesis and atherogenesis. Fruit and vegetables are rich in other antioxidant compounds: lycopene, alpha-carotene, lutein, zeaxanthin, polyphenols, etc.

The link between plant-based nutrition and overall health and well-being: Food as Medicine

Transformation to healthy diets by 2050 will require substantial dietary shifts. Global consumption of fruits, vegetables, nuts, and legumes will have to double, and consumption of foods such as red meat and sugar will have to be reduced by more than 50%. A diet rich in plant-based foods and with fewer animal-source foods confers both improved health and environmental benefits (Willet *et al*., 2019).

Identification Of Potential Challenges of Food Nutrition

Nutrition is the basic need for a healthy life, but one cannot gain optimum benefit from the food consumed without knowing proper dietary guidelines. Identified challenges according to various authors include instability of food supplies**,** poor food choices, policy inconsistencies, corruption, poverty, hunger, and conflicts.

Opportunities For Overcoming Challenges and Promoting Adoption

Avenues to improving dietary diversity may include improving access to markets and roads while also providing nutrition knowledge (Hirvonen *et al*., 2017), improving incomes and production diversity (Ecker *et al*, 2018), through nutrition-sensitive agriculture programs which incorporate nutrition-related behavioural change communication and improvement in the use of social media for promotion and access to nutritional information.

The opportunities for overcoming challenges and promoting the adoption of a plant-based diet in Nigeria lie in a synergistic and concerted effort across various sectors to unlock the full potential of plant-based nutrition, foster a healthier population, and not only improve the overall health and well-being of its population but also contribute to the global movement towards more sustainable and nutritious dietary practices.

CONCLUSION AND RECOMMENDATIONS

In conclusion, the exploration of plant-based nutrition for dietary health in Nigeria reveals a promising avenue for addressing the country's nutritional challenges. With an abundance of diverse plant resources, Nigeria possesses a wealth of untapped potential to improve dietary health and combat malnutrition. Plant-based diets offer numerous health benefits, including reducing the risk of chronic diseases and promoting overall well-being. However, realizing this potential requires a concerted effort from various stakeholders, including policymakers, healthcare professionals, educators, and the public.

However, it is crucial to acknowledge the existing cultural, economic, and infrastructural barriers that may hinder the widespread adoption of plant-based nutrition in Nigeria. Therefore, this study recommends educational campaigns, policy support, and community engagement initiatives to promote awareness and encourage the incorporation of plant-based foods into daily dietary practices.

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