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Promoting Non-Animal Protein Sources in Sub-Saharan Africa

An Interdisciplinary Study

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SUSTAINING PROTEIN NEEDS IN SUB-SAHARAN AFRICA THROUGH SELECTED PLANT SOURCES

Emanuel Uzoma Onweremdu
Federal University of Technology, Owerri, Nigeria

Summary

Sub-Sahara Africa is characterized by high fecundity rate, absolute poverty and food insecurity. The region depends largely on animal protein for its protein needs despite adverse nutritional health and environmental implications of such dependence. Potentials for non-animal sources of protein exist in the area known for a variety of plant types including legumes, cereals nuts and seeds, algae, fungi, fruits and vegetables. These non-animal protein sources also have medicinal, agricultural, socio-cultural and ecological values. A great many of small- and medium-scale industries can emerge using these non-animal protein sources as raw-materials. Improving the quality of their non-animal protein sources, a majority of which have anti-nutritional factors will go a long way in sustaining their usage by man as both main and side dishes in sub-Saharan Africa.

Introduction

Food and nutrition security remains African's most fundamental challenges for human welfare and for economic growth for too many people on the sub-Saharan Africa continent traced to acquire and effectively utilize at all times the food they need for a healthy life. Sub-Saharan Africa is associated with a high population growth rate. Africa has contended with populated growth rates of 2.7 percent per year over the past forty years, compared with 2.0 percent in developing Asia and 2.2 percent in Latin America. Africa has to run faster than the rest of the developing world to keep up with its growing population. Currently, a great many of sub-Saharan Africans are suffering from malnutrition resulting from inadequate food consumption or poor biological use of nutrients consumed due to illness, disease or nutrient imbalance. Malnutrition frequently arises from imbalanced diets in which sufficient macronutrients such as protein fats and carbohydrates are combined with insufficient vitamins and minerals. These lead to various physiological disorders and increasing susceptibility to disease (FAO, 1994). Daily per capita protein available from plant origin in selected African foods contain in Nigeria (48.7 grams), Benin (46.7 grams), Burkina Faso (6.4 grams), Mali (42.5 gram), Cote d'Ivoire (38.5 grams), Cameroun (39.3 grams), and South Africa (47.3 grams). Protein food supply in sub-Saharan Africa is grossly inadequate leading to stunted in growth. In sub-Saharan Africa, Burundi, Nigeria, Malawi, Madagascar, Equatorial

Guinea and the Central African Republic lead their region in underdevelopment of children (UNICEF, 2003).

The word ‘protein’ is a Greek derivation meaning "taking the first place", possibly because every cell in the body is partly composed of proteins. There are two broad sources of proteins, namely animal and plant proteins. Animal sources which include meat and fish (myosin), egg white and milk (albumin), milk (casein) and egg yolk (globulin) are highly sought for and expensive, thereby making them unaffordable due to absolute poverty. The poor people resort to cereals especially in urban settlements as the price of livestock products increases while populations and urbanization increase likewise (Fritschel and Mohan, 2001). Although animal proteins except gelatin said to be good sources of essential amino acids, hence complete proteins, plant proteins (incomplete proteins) supply a substantial amount of proteins to man.

Here is a like between source of protein and human health and congruity. Livestock production and consumption can lead to four main types of risks, namely food borne diseases and risks, environmental pollution, diseases transmitted from livestock to humans and diet related chronic diseases.

Protein is needed to help build strong muscles, repair tissues and maintain an effective immune and hormonal system. Protein is vital for those involved in physical active job or people engaged in rigorous sport training. Vegans (computer vegetarians) do not eat meat, egg, milk or any other animal product. If properly planned, a choice of non-animal proteins is as healthful to man. A variety of foods including whole grains, fruits, legumes, nuts, seeds and vegetables give vegans enduring health.

Problems associated with animal protein

Humans are infected through consumption of animal products such as meat. Joneses are diseases that can be transmitted from animals to humans through bacteria, viruses, parasites, protozoa, fungi, rickettsial and unconventional agents. Zonnoes pose significant human health risks as seen in bird flu, hepatitis E virus, bovine spongiform encephalopathy, Rift Valley fever, salmonellosis, brucellosis, adult meningitis, influenza, foot-and-mouth disease and helminthiasis. Presence of zoonoses imply extra costs for their eradication as the depopulation, quarantine, cleaning disinfections, mass culling of animals and food processor often engage in hazard analysis and critical control point program as ways of ensuring animal health for human consumption (Catalo, 2006).

Man's bid to satisfy his animal protein requirements has resulted to high concentrations of curial pollutant gases such as methane, carbon monoxide, sulphur dioxide, hydrogen sulphide and nitrogen dioxide (Okoli et al., 2006). These are potent greenhouse gases (IPCC, 2001) which cause climate change. Again, untreated and ill-disposed livestock wastes become airborne and water born, leading to diseases of the digestive system. Inhalation of methane, hydrogen sulphide and ammonia result in respiratory diseases, while animals on nomadic browse and overgraze lead to different forms of soil erosion.

Animal proteins are associated with zoonotic pathogens, and these constitute a common cause of food borne diseases. Ducks, geese and fowls are implicated in highly pathogenic Arian influenza. Palm civet cats transmits severe acute respiratory syndrome while cattle are vectors of bovine spongiform encephalopathy. Pathogens thrive in the gastro-intestinal tracts of farm animals and spread to other animals, crops, soil and water. Intensive livestock agriculture promotes them proliferation and spread in the absence of adequate health care. Humans are infected along the food chain including indirect contacts with crops treated with poorly composted animal manure. Animal wastes are associated with toxicants such as chromium (Onweremadu and Uhuegbu, 2007) and high concentration in fatty tissues in human body could be responsible for chromosomal damage (Nweke and Epete, 2003). Some of these toxicants reach surface ground water (Onweremadu, 2007) where they contaminate aquatic organisms on which humans depend on for food. In addition to the above, the high toxicants concentration reduces activities of soil microbes (Onweremadu and Nwufo, 2008).

Animal source foods contain high levels of saturated fats, excess of which leads to obesity, diabetes, coronary heart disease and apoplexy. Chronic diseases and obesity are more common in advanced countries with high intakes of animal protein.

Non-animal proteins

Non-animal protein sources include legumes, nuts and seeds, cereals and food grains, algal, algae, fungi (mushroom) and vegetables. Legumes are edible seeds that grow in pods and often referred to as dried beans. Over 13.000 legumes exist in the world but only 40 types are commonly consumed. Legumes are inexpensive source of protein. They are easily grown. They appear as main and not side dishes in some cultures. Legumes have many health benefits.

In sub-Saharan Africa, soya bean (Glycine max) is used extensively in a variety of forms in recent times. Soya beans are the richest plant source of high quality protein. Soya protein helps to conserve calcium in the body and enhance bone health when it replaces animal protein in a diet. It lowers blood cholesterol in people with high levels. The soya bean milk extracted firm the legume is rich

in both protein and oil (Osho et al., 1994) essential vitamins and mineral (Musa et al., 2002). Soya bean protein is processed more easily by the kidneys and may be useful to people who are at the risk of kidney disease when it replaces animal protein. Iron content of soya beans is absorbed readily and well fermented in soya foods. The popularity of soya has caused increased research of the legume, leading in the breeding of improved varieties that are non-shattering and high yielding (Musa et al., 2002). Increased demand and market for soya bean products (Alabi et al., 2006) is transforming soya bean from indirect usage as processed food (Esonu, 2006) to direct human food. Although soya bean is a major protein source for humans and other animals, about 90% of soluble proteins are globulins, implying a need to improve its nutritional quality by increasing the content of glycinin while decreasing B-conglycinin value (Kavaani and Kharabian, 2008).

Cowpea (Vigna ungiculate L. Walp) contains appreciable amounts of proteins (20-25%) (Standton et al., 1965), minerals, vitamins, and is widely consumed in West Africa (Dovlo et al., 1976). The importance of this legume crop will continue to grow as costs, available arable land and human population growth tend to reduce the availability of animal proteins (Abu and Carew, 2007). Cowpeas, which are important sources of proteins, vitamins B and C in West African diet are consumed pounded with millet flour, rolled into balls and fried or green seeds boiled and eaten as vegetable (Agusiobo, 1976). Pigeon pea (Cajanus cajan) is a neglected source of plant protein in most areas of the sub-Saharan Africa. It is called fiofio in Igbo language in Nigeria. Raw pigeon pea contains 27.15% crude protein with boiled and toasted form given 26.02 and 26.20% cruse protein, respectively (Onu et al., 2006). Humans consume pigeon pea mixed with vegetables and maize as a side dish. Its cooking is enhanced when boiled with potash. Internal organs are not affected when treated with potash, which accelerated it readiness for consumption. Bambara groundnut (Voandzeia suberranean Thours) is an indigenous legume. Bambara pudding contains 22.3% protein (Ifeanyi and Obiekezie, 2006). In sub-Saharan Africa, bambara is the third most important legume after groundnut (Arachis hypogen) and cowpea Vigna ungucalata (Ngoddy, 1985).Children and adults in Eastern Nigeria cherish its commonest form referred to as ‘OKPA’.

Cereals and food grains include seeds of fruit of cereal plants used as food by man and lower animals. In sub-Saharan Africa rice, millet and maize are very popular, and commonly used as staple foods. Using 52 local varieties in southeastern Nigeria, Okporie and Oselebe (2007) reported appreciable percent protein (2.0-11.0%) in maize. Maize grains contain 9.69% protein (Mgbemena et al., 2006) and constitute 15.3% total protein intake for mankind (Obi, 1991). In addition, cereal grains contain lysine (Oei, 2003).

Nuts are fruits that have outer shell that encloses a kernel (seed). An important source of nutrition, nuts and seeds are staples and protein source in many cultures. One of such is Balanite aegyptiaca, which is a will plant rich in protein (Gambo et al., 2007). The kernel cake from Balanite after extraction of oil is a rich source of proteins and carbohydrates. Many nuts and seeds are available both in and out of shell, whole, halved, sliced, chapped raw or roasted. Example of nuts and seeds in sub-Saharan Africa are casher, peanuts, walnuts, fruits such as Irbingia gabonenssis (bush mango), Bactris gasipaes (peach palm), Uapaca kirkiana, and Dacryodes edulis (African plum). These and others hold great potentials as alternative sources to animal protein.

Vegetables are loaded with vitamins and minerals essential for varied body processes and general body protection. Yet, some vegetables, especially those belonging to the legumes, are very rich. Blue-green algae (cyanobacteria) of which spirulina is a well-known example is group of 1500 species of microscopic aquatic plants rich in proteins. Mushrooms (Fungi) are good sources of non-animal protein and there was controversy over the consumption of mushrooms as food (Oei, 2003). Mushroom protein can be a valuable addition to dishes, since it contains abundant lysine. Protein content of mushroom depends on the type. Crude protein content varies among and they include Agaricus hisporus, Auricularia polytricha, Flammulina velutipes, Lentinula edodes, Pleurotus djamor, Pleurotus ostreatus, Pleuntus ostreatus van florida, Pleurotus sajor-caju and Volvariella volvacea. However, highest and least protein values are obtained from Pleurotus ostreatrus and Agaricus hisporus, respectively. These edible mushrooms have tonic qualities in addition to protein (Chiang, 1993). However, Garcia et al. (1993) recommended the use of mushrooms as supplements as main dishes in order to prevent malnutrition.

Other benefits of non-animal protein sources

Apart from protein supply, the enumerated non-animal protein sources play a great role in agriculture, environment and health. The legumes are wonderful nitrogen fixers, thus they improve soil fertility. Legumes such as Gliricidia and Sesbania are used as improved fallows to replace the long gestation tropical bush fallows. Again, legumes are used as livestock feedstuffs. Spent mushroom substrate is used a as a soil amendment, reducing early drying of potato by *Verticillium dahliae* and inhibit conidal germination of *Ventura inequalis in vitro* and in growth chamber assays. The *Pseudomonas aeruginosa* isolated from spent mushroom substrate is known to suppress *Pyricularia grisea*, a causal agent of grey leaf spot of perennial ryegrass (*Lolium perenne*). In mycofiltration, the oyster mushroom (*Pleurotus ostreatus*) accelerates decomposition, being an aggressive primary saprophyte with extensive mycelia networks.