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The Prospect of Grain Amaranth and Bambara Nut for Food Security in Developing Countries. A-Review

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Abstract

The fight against food insecurity in Africa can be achieved through dietary intervention with lots more emphasis on underutilized food crops that has potentials for high yields and improved nutrition. The problem of food insecurity is becoming a burden and serious regional threat due to its attendant malnutrition effect especially on children, rural and poor urban mothers. While the rest of the developed world has made significant progress towards food security among her citizenry, Africa, in particular Sub-Saharan Africa, continues to lag behind. The region is blessed with diverse of underutilized crop species that include nuts, cereals and legume with enormous nutritional and industrial prospects which are yet to be fully explored and optimally utilized. Africa needs to take full advantage of her huge food resources to achieve the Sustainable Development Goal on food security. This review article is looking at the possible potentials of underutilized food grains like Grain amaranth and Bambara nut to combat food insecurity in Africa.

Keywords: Africa; Food insecurity; Amaranth; Bambara nut

Introduction

Achieving food security which has been described as a situation whereby all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs for healthy life has been a major challenge in Africa due to its underdeveloped agricultural sector and gross neglect of some her nutrient rich food crops without taking into consideration their optimal utilization. While the rest of the world has made significant progress towards achieving and sustaining food security, Africa, in particular Sub-Saharan Africa, continues to lag behind. The problem of food insecurity and its attendant consequence of malnutrition is a serious burden in Africa notwithstanding the enormous food resources (nuts, fruits, cereals and legumes) they are blessed with; but which were neglected or regarded as poor man diets [1,2]. This portends a great danger to our social-economic development as a region if concrete measures are not taken to arrest the problem.

The numbers of people estimated to be undernourished due to food insecurity in the year 2019 as reported was 250.3 million, out of which 15.6 million were Northern Africa and 234.7 million from sub-Saharan (SSA). Also, there are projections that by 2050; the impact of climate change would put about 1.7 billion people globally at risk of malnutrition and greater number of people to suffer will come from Africa [3]. This should be a concern to African leader to take proactive plan because of its implications on regional economic growth and development [4].

Thus, the agricultural production system in the region must be strengthened by not focusing only on the traditional food grain of rice, maize and wheat that people are used to but also explore the prospect and dietary relevance of some underutilized food grains like grain amaranth and Bambara nuts [5,6]. The underutilized cereals and legumes are strategically position as alternative option



to improve nutrition and food security in developing countries because they can contribute largely essential nutrients and boost dietary diversity owing to their high tolerant characteristics to harsh weather conditions [7]. Hunger and malnutrition could be fought through production diversification and development of policy programs that will enhance household consumption of

these underutilized food grains [8]. There must be policy priority and determination to remove all constraints as outline below by all stakeholders to strengthening the sustainable production of grain amaranth, Bambara nut and other underutilized food crops of nutritional importance [Figure 1].

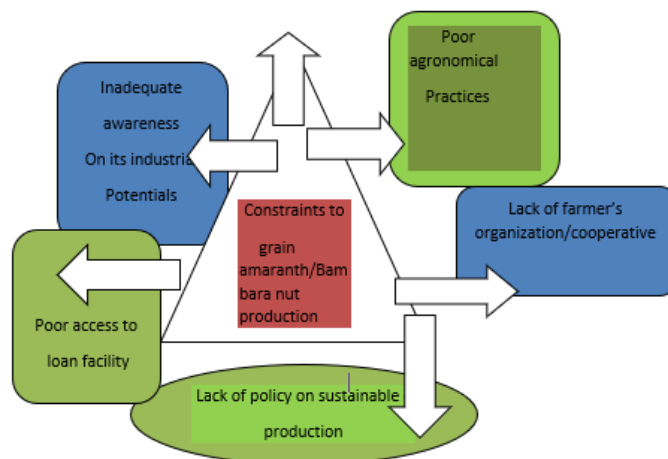


Figure 1: Constraints to sustainable agricultural production of underutilized crops.

Grain amaranth

Grain amaranth (*Amaranthus spp*) is a pseudo cereal consumed in various parts of the world especially in Africa, India, Nepal and some non-native regions. It has attracted increasing interest over the decades due to its rich nutritional potential [2]. It can survive unfavorable weather conditions. Grain Amaranth is an excellent source of quality protein and high mineral content that includes

but not limited to Mg, Ca, K and P [9]. Grain amaranth Protein contents vary between species and varieties, however, on average, it's composed of about 13.1–21.0% crude protein mainly of easily digestible albumins and globulins [10]. It's essential amino acids that are much higher in value than many conventional food grains such as wheat, barley and maize [11].

Possible applications of amaranth grain

Partial inclusion in traditional baby food



Figure 2 (a): Amaranth grain.

Traditional complementary foods are formulated food mixtures designed to be given to infant along with mother breast milk from the first 6 months for optimum growth and development until the baby is completely weaned off breast milk [12]. The common traditional infant foods among rural and poor urban nursing mothers in most

developing countries are gruel made from whole sorghum, millet and maize. The gruel made from these unsupplemented cereals has been found to be low in protein and other essential nutrients for good nourishment. However, partial substitution of cereal with amaranth grain flour has requisites for nutrient improvement

Figure 2 (a).

A typical complementary food was formulated from a blend of pretreated amaranth grain and sorghum at different ratios (90:10, 80:20, 70:30 and 60:40) as reported by [13]. The result of the study indicated that sample with 90% amaranth grain to 10% sorghum combination had the highest protein content (14.4%). This value is adequate for protein needs for 12–23-month- old infant requirement [14]. The partial inclusion of amaranth flour helps to improve nutrients compared to whole sorghum made food.

Amaranth grain flour inclusion in bread making

Amaranth flour is used in bakery products, gluten-free and extruded foods. For making a leavened food, amaranth grains must be blended with wheat [15]. The production of bread was done with partial substitution of wheat flour with amaranth up to 30% using standard bread production technology Figure 2(b). After production there was significant improvement in the mineral and protein constituent of the bread samples fortified with amaranth flour. The sample with 10% amaranth had the best sensory and rheological property [16].



Figure 2(b): Amaranth grain flour.

Enriching animal feed production with inclusion of grain amaranth

Animal feed is food developed for livestock and poultry. Quality feeds are made by carefully mixing ingredients that both maintain the health of the animals and quality of end products as meat, milk, or eggs. (Makkar and Beever, 2013). amaranth grain has potential to partially replace maize in poultry diets to improve digestibility [17,18]. It can be included as a raw material in chicken finisher diets for grater egg production by the layers [19,20].

Bambara nut

Bambara nut Figure 3(a) falls into one of the neglected legumes that could contribute significantly to improving global food security. The crop has excellent features such as tolerance to drought, pests and diseases that could encourage high production. Bambara has not been classified as premium commodity in the global trading

ranking [21]. It is cultivated in countries like (Nigeria, Cameroon, Central African Republic and Chad) [22]. They are rich sources of minerals like potassium, magnesium, phosphorus, zinc, and iron [21]. Bambara groundnut serves as an important source of essential nutrients in areas where animal protein is scarce [23]. It contains about 63% carbohydrate, 19% protein and 6.5% fat. As a nutrient-rich legume, Bambara nut is often termed as a “complete balanced diet” [24].

The nut can be processed into flour to complement other raw material in the production of food products with improved nutritional qualities, for instance as composite flour for bakery products and traditional complementary baby foods [24]. The fresh pods are boiled with salt and pepper and eaten as a snack in some West African countries Figure 3(b). In Southeastern part of Nigeria, it is made into steamed-paste called Moi-Moi (bean porridge [25].



Figure 3(a): Bambara nut.



Figure 3(b): Bambara nut flour.

Possible uses of Bambara nut at reducing food insecurity

Inclusion in traditional complementary baby Foods

Traditional weaning foods in Africa are often prepared from low-cost but highly accessible ingredients such as cereals, roots, tubers, and legumes [26]. However, they are often poor in nutrients, characterized by high levels of starch, fiber, and antinutrients, and with inadequate levels of essential amino acids and micronutrients. Traditional complementary food was successfully developed from composite flour of Bambara groundnut mixed with maize to make “Ogi” which is a traditional gruel for infants in many parts of developing countries. The product was reported to show an improvement in protein, ash and fat as reported [27]. Also, banana and fermented Bambara groundnut flours mixed at 60:40 ratio was found to have high nutritional values comparable to commercial infant formula [28]. The low-cost of Bambara nut coupled with its nutrient-dense features make it a viable accessible ingredient in developing enriching infant food products.

Bread making from composite flour with wheat

Bread is a staple food and is consumed in large quantities because it is readily available as instant food for consumption after production and it is a source of nutrients delivery to body [29]. Wheat, the basic ingredient in bread making cannot be grown in all bread consuming regions, which may consequently affect the cost of production [30]. Studies on the utilization of Bambara groundnut as raw material for bread from whole wheat were undertaken by Trial on composite bread of Bambara nut flour with wheat at varied proportion (0, 10, 20, 30 and 40%) had been done and the output was excellent with improved color, texture and taste. Product with 10% partial substitution has the highest desirability [29]. The trial suggested that bread with improved protein and mineral could be produced from composite flour of wheat and Bambara nut.

Biscuit production from blend of wheat and Bambara nut flour

Biscuits are confectionery with very low moisture content, crispy cake made from dough [31]. They are an important baked product in human diet and are usually eaten with tea and as

weaning food for infants. The ingredients are simple, which contain soft wheat flour, sugar, fat, eggs. Efforts have been made to enrich wheat with Bambara groundnut to produce cake. A biscuit production effort was made from blend of wheat flour and Bambara flour. The addition of Bambara nut flour significantly improved the protein content, ash and crude fibre of the product compared with the one made from whole wheat [32].

Bambara nut milk with Cow milk in yogurt production

Yoghurt is a fermented food made from fresh, whole, or skimmed milk with the action of bacteria starter cultures [33]. It is traditionally consumed as a healthy food due to its enormous nutritional composition [34]. Regular consumption of yoghurt with adequate live cultures possesses nutritional benefits that include lowering of serum cholesterol level, improvement in lactose digestion, protection against bowel gut infections and inflammation [34]. It is a nutritious drink good for all categories of people.

Yoghurt was produced from cow milk partially substituted at proportion ranging from (10, 20, 30 and 40%) while with Bambara milk while (100%) cow milk was used as control. Significant improvement was observed in nutrient improvement with sample with 20% Bambara milk was adjudged the best [35]. Bambara nut milk could be taken as a possible alternative for those could not afford commercial processed milk.

Conclusion

The Africa continent is blessed with diverse of underutilized crop species with enormous nutritional and value-added values that could be used as a good intervention to combat the severity of food insecurity in developing countries. grain amaranth and Bambara nut have enormous nutritional potentials and industrial prospect for both food and nutrition security

Authors' contributions

The author Soly responsible for collection of relevant materials and writing of the review.

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Conflicting interests

The authors declared no conflicts of interest with respect to the research and authorship of this article.

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