

Research Application Summary

Potential role of traditional African foods in food security, nutrition and health

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Abstract

Nutritional indicators for Africa remain alarming in spite of the positive trend in economic growth on the continent. Undernutrition, iron deficiency anemia and vitamin A deficiency are the most significant nutritional problems among nutritionally vulnerable groups, particularly under-fives and women of child bearing age. Undernutrition and nutritional deficiencies are main underlying causes for morbidity and mortality, accounting for approximately 50% of deaths among under-fives while anemia is highly linked to the poor pregnancy outcomes. The high morbidity and fatality rate among HIV infected persons is also highly associated to malnutrition. Overnutrition and associated health problems including diabetes and coronary heart diseases have in recent decades emerged as major problems in Africa. A number of traditional African foods have been shown to contain high levels of essential nutrients as well as phytochemicals known to positively impact on health. Small seeded cereals, including millets, sorghum, fonio, African rice and teff are good sources of fibre, iron, polyphenols, calcium, B-vitamins, inulin, vitamin E, beta-glucan & lysine. Native fruits and vegetables, including African black olive (*Canarium sweinfurthii*), pomegranate, guava, java plum (*Syzygium cumini*), tamarind, mango, passion fruits *Ipomea eriocarpa*, *Corchorus trilocularis*, *Corchorus* spp., *Acalypha bipartita* and *Hibiscus acetosella* have been reported to exhibit significant levels of antioxidant activity while native mushrooms have been shown in animal studies to lower serum low density lipoproteins. African legumes include marama beans (*Tylosema esulantum*), cowpeas (*Vigna unguiculata* (L.) Walp.), groundnut beans (*Vigna subterranean*) and chick peas (*Cicer arietinum*) are rich in proteins, fibre and zinc. Cichlid fish species traditionally consumed in many parts of Africa are high in vitamin A, calcium and polyunsaturated omega 3 fatty acids while insects widely consumed in Africa, which include grasshoppers (*Ruspolia differens*), termites (e.g. *Macrotermes subhylanus*, *Pseudacanthotermes militaris*, *Macrotermes bellicosus* and *Pseudacanthotermes spiniger*), and caterpillars (*Gonimbrasia belina*) are rich in iron, zinc, selenium, B-vitamins, protein, vitamin E, calcium & omega 3 fatty acids. It is well established that bioactive compounds including carotenoids, tocopherols, flavonoids, terpenoids, isoflavones, tocotrienols, allyl sulfur compounds, and omega-3 PUFA contained in some foods are associated with antioxidant, anticancer, antidiabetic and hypocholesterolemic

properties. Promotion of the production and utilization of these foods should be explored as a strategy for addressing current food security, nutrition and health problems in Africa.

Key words: Antioxidant activity, nutraceuticals, phytochemicals, traditional foods

Résumé

Les indicateurs nutritionnels pour l'Afrique demeurent alarmants malgré la tendance positive du taux de croissance économique observée sur le continent. La sous-nutrition, l'anémie due la carence en fer et la carence en vitamine A sont les problèmes nutritionnels les plus critiques au sein des groupes de personnes les plus vulnérables, que sont les enfants de moins de cinq ans et les femmes en âge de reproduction. La sous-nutrition et les déficits nutritionnels constituent les principales causes qui sous-tendent la morbidité et mortalité qui représentent 50% des cas de décès parmi les enfants de moins de cinq ans pendant que l'anémie est souvent liée à pertes de grossesses. Le taux élevé de morbidité et de fatalité parmi les personnes atteintes du VIH est fortement lié à la malnutrition. La surnutrition et les problèmes de santé parallèles, dont le diabète et les maladies cardio-vasculaires sont devenus de problème majeurs en Afrique, durant ces dernières décennies. Il a été prouvé qu'un bon nombre de mets traditionnels africains contiennent des taux élevés de nutriments essentiels aussi bien que des composantes phyto-chimiques qui sont bénéfiques à la santé. Les céréales à petits grains tels que le mil, le sorgho, le fonio, le riz africain et teff sont de bonnes source de fibres, fer, polyphénols, calcium, vitamines B et E, Inuline, bêta-glucane et lysine. Les fruits et légumes indigènes, tels que l'olive noir d'Afrique (*Canarium swainsonii*), grenade, goyave, prune de java (*Syzygium cumini*), tamarin, mangue, fruit de la passion, *Ipomea eriocarpa*, *Corchorus trilocularis*, *Corchorus* spp., *Acalypha bipartita* et *Hibiscus acetosella* sont connus pour avoir de niveaux significatifs d'activités anti-oxydantes pendant que les champignons indigènes ont été prouvés par des études animales d'avoir le pouvoir de réduire la densité des lipoprotéines dans le sang. Les légumes africains que sont le haricot mamara (*Tylosema esulantum*), niébé (*Vigna unguiculata* (L.) Walp.), voandzou (*Vigna subterranean*) et pois chiche (*Cicer arietinum*) sont riches en protéines, fibre et zinc. Les espèces de poissons fretins, qui sont traditionnellement consommés en dans plusieurs parties d'Afrique, sont riches en vitamine A, calcium, les acides gras polyinsaturés omega 3. Dans le même temps, les insectes largement consommés en Afrique dont les criquets (*Ruspolia differens*), termites (e.g. *Macrotermes subhyllanus*, *Pseudacanthotermes militaris*, *Macrotermes bellicosus* et *Pseudacanthotermes spiniger*), et chenilles (*Gonimbrasia belina*) sont riches en fer, zinc, sélénium, vitamines B et E, protéine, calcium et omega 3. Il est connu de tous que les composantes bioactives telles que caroténoïdes, tocophérols, flavonoïdes, terpénoïdes, isoflavones, tocotriénols, ester sulfurique composantes en, et omega-3 PUFA, qui sont retrouvées dans certains aliments, ont des propriétés anti-oxydantes, anti-cancérigènes, antidiabétiques et hypo-cholestérolémiques. La promotion de la production et de l'utilisation de ces aliments doit être explorée comme une stratégie pour faire face aux problèmes actuels de sécurité alimentaire, nutrition et santé en Afrique.

Mots clés : Activité anti-oxydante, nutraceutique, élément phyto-chimiques, aliments traditionnels

Background

Undernutrition and nutritional deficiencies are major problems for Africa and are major underlying causes of poor health. The continent's progress towards eradication of malnutrition is slowest in Africa in comparison with other regions. The prevalence of undernutrition in Africa is estimated at 20.5%, which is the highest for any continent. The continent also has high prevalence of micronutrient deficiencies, with iron deficiency (67.6% among pre-school children and 57.1% among women of child bearing age), vitamin A deficiency (44.4% among school age children, 13.5% among women of child bearing age), and iodine deficiency (42.3% among children aged 6-12 years, 42.6% among entire population) as the most widespread (WHO, 2004; 2008; 2009). Undernutrition is an underlying cause of mortality for about half of children whose lives are claimed by the most prevalent diseases in low income countries, which include acute respiratory infections, diarrhoea, measles, malaria, HIV and perinatal cases (Rice *et al.*, 2000). Addressing the issue of malnutrition is therefore essential for public health improvement in Africa. Overnutrition is also on the rise in Africa, rising from 18% in 1980 to 30% in 2008 (Finucane *et al.*, 2011). This increases the risk for non-communicable diseases, including cancers, diabetes and coronary heart diseases. A number of traditional African foods have been documented to exhibit unique nutritional and nutraceutical properties, with potential of contribution to alleviation of nutritional deficiencies and prevention of non-communicable diseases. However, the production and consumption of these foods is on the decline. This paper outlines the current state of knowledge about the nutritional and nutraceutical properties of a variety of plant and animal based traditional African foods and their potential for addressing current nutritional and health problems faced by the continent. Strategies for promoting production and utilisation of traditional African foods are also presented.

Literature review

Several traditional African vegetables are known to exhibit health-protecting properties and have been used for generations for their prophylactic and therapeutic effects (Smith and Eyzaguirre, 2007). Additionally, a number of publications have documented the outstanding nutritional value of many of these vegetables, reporting their high content of fibre, minerals, vitamins and bioactive phytochemicals (Odhav *et al.*, 2007; Uusiku *et al.*, 2010; Kamga *et al.*, 2013; Hamzah *et al.*, 2013; Oulai *et al.*, 2014b).

Like vegetables, traditional African fruits are good sources of health promoting phytochemicals. Jackfruit (*Artocarpus heterophyllus*), sumac (*Rhus natalensis*), guava (*Psidium guajava*), tamarind (*Tamarindus indica*), bush mango (*Irvingia gabonensis*), African plum (*Dacryodes edulis*), bitter cola (*Garcinia kola*) and white star apple (*Chrysophyllum albidum*) (Abukutsa-Onyango, 2011) are among the traditional African fruits documented to contain high amounts of limiting vitamins and minerals. Tamarind fruit have been shown to contain high levels of phenolics and to exhibit high antioxidant activity (Andabati and Muyonga, 2014) while the African bread fruit (*Treculia africana*) has been found to contain high levels of zinc, flavonoids, polyphenols, anthraquinones, saponins and glycosides (Osabor *et al.*, 2009). African elemi (*Canarium scheinfurthii*) and pomegranate

(*Punica granatum*) (Stangeland *et al.*, 2009) and African baobab (Bamalli *et al.*, 2014) have also been reported to exhibit very high antioxidant activities .

Traditional African cereals generally exhibit superior nutritional profiles to the now more popular cereals, namely rice, maize and refined wheat. The proteins of the traditional African cereals generally contain higher proportions of lysine, which, is the most limiting essential amino acid among cereals (Lukmanji *et al.*, 2008). Fonio, is also rich in methionine and cystine, which are low in wheat, rice or maize (Stone *et al.*, 2011). Finger millet has also been considered to be superior to wheat in terms of its protein digestibility (Stone *et al.*, 2011). Compared to maize, rice and wheat, finger millet, pearl millet, fonio and sorghum contain higher levels of iron (FAO, 2010). Fonio and some sorghum and millet varieties are also excellent sources of calcium and sorghum and millet are rich sources of B-complex vitamins (Obilana and Manyasa, 2002) while teff is high in calcium and iron (FAO, 2015; Gebremariam *et al.*, 2012).

Sorghum and millet have been shown to be high in phenolic acids, flavonoids, condensed tannins, anthocyanins, phytosterols and policosanols (Awika and Rooney, 2004; Awika *et al.*, 2005; Dykes and Rooney, 2006; Mathanghi and Sudha, 2012; Shahidi and Chandrasekara, 2013; Taylor *et al.*, 2014). These phytochemicals exhibit antioxidant activity and bioactivity against several pathophysiological conditions (Shahidi and Chandrasekara, 2013). They are reported to lower serum cholesterol, inhibit cataracts, prevent cardiovascular disease, as well as exhibit anti-carcinogenic, anti-diabetic, anti-inflammatory, and anti-hypertensive properties (Dykes and Rooney, 2006; Taylor *et al.*, 2014).

Up to 250 insect species are used as a food source in Africa, including caterpillars, ants, grasshoppers, locusts, crickets, termites, beetles and cicadas (Van Huis, 2003). The nutritional composition of different edible insects show that they are rich sources of energy, protein, unsaturated fatty acids, copper, iron, magnesium, manganese, phosphorus, selenium, zinc, riboflavin, pantothenic, biotin and folic acids (FAO, 2013). The protein content of insects can range from 13% up to 77% (Xiaoming *et al.*, 2010), which has a good balance of essential amino acids. Edible insects, like caterpillars and grasshoppers, also contain substantial levels of polyunsaturated fatty acids and health-promoting omega-3 fatty acids (Womeni *et al.*, 2009), iron and zinc (Kinyuru *et al.*, 2013). African cichlid species, notably *Rastrineobola argentea* (silver cyprinid) and *Haplochromines cichlids*, are important in traditional African diets. Small fish species are generally high in protein, calcium, omega-3 fatty acids and vitamin A, iron and zinc (Kawarazuka, 2010; Kawarazuka and Be'ne', 2010). *Rastrineobola argentea* has been shown to exhibit antioxidant properties (Mbatia *et al.*, 2014). *Haplochromines cichlids* is traditionally used in Uganda for the management of measles, possibly because of its high vitamin A content (Magala-Nyago *et al.*, 2005).

Traditional African mushrooms are good sources of protein, fibre and minerals (Sadler, 2003; Mshandete and Cuff, 2007). Mushrooms also contain various bioactive compounds, particularly polysaccharides and phenolics, which are associated with a wide variety of health effects (Nabubuya *et al.*, 2010; Oyetayo, 2011; Aina, 2012; Hamzah *et al.*, 2013; Obodai *et al.*, 2014).

African legumes including marama beans (*Tylosema esulantum*), cowpeas (*Vigna unguiculata* (L.) Walp.), groundnut beans (*Vigna subterranean*) and chick peas (*Cicer arietinum*) have high content of protein, fibre, multiple vitamins and minerals plus phenolic compounds (Siddhuraju and Becker, 2007; Holse *et al.*, 2010).

Research application

This paper is based on our research covering selected foods consumed in Uganda and in Cameroon. The rest of the paper is based on review of literature. The declining consumption of traditional foods from the African diet is unfortunate since these foods contain substantial levels of essential nutrients and health promoting biochemicals with potential to make a significant contribution to the nutritional wellbeing and health. Given the potential for traditional African foods to contribute to nutrition and health in Africa and to ensure sustained consumption of traditional African foods, there is need to promote research to elucidate their nutritional and functional properties as well as production and utilisation technologies. There is also need for publicity of the potential value of these foods.

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