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Functional food security, why not just, food security for public health

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Introduction

Some of the journals are considered best in the world, because of writing editorials on most of the current topics that have been trending in the current decade.[1] The WHO and the International College of Nutrition have been eagerly planning conferences, and publications to attract the attention of Food and agriculture Organization (FAO) which has published recently, an Agricultural Outlook.[2] The main purpose has been to persuade the FAO to educate the member countries of the world to produce functional foods to gain Functional Food Security, rather than Food Security. Food Security without emphasis on Functional Foods is the major cause of epidemic of cardio-metabolic diseases (CMDs) and other chronic diseases which is the important message the authors are giving in this view point.[1,3] The other aim is to emphasize that some of the functional foods like millets may be protective against these diseases as well as environmental degradation. Functional food security is also emphasized in a recent volume by Elsevier "Role of Functional Food Security in Global Health.[3] It is noteworthy that both WHO and FAO have also joined hands to educate the world about the utility and necessity of functional foods for prevention of non-communicable diseases (NCDs) which is clear from 2017 websites of these agencies.[4,5] The emphasis on the need for functional food production, labeling of nutrient contents and the need for food biodiversity in the diet are interesting. However, there is overemphasis on under nutrition which is more of political nature, mainly, due to poor distribution and lack of implementation of government policies, despite adequate availability of food in the world. We agree that optimal nutrition is fundamental to human health and total health; social, physical, mental and spiritual health and well being, which can be easily resolved by increased production of functional foods like millets.[6] Millets are rich sources of proteins, fiber, flavonoids, calcium and iron which appears to be a perfect supplement, because it can grow in barren land without adequate water supply solving the problem of environment degradation (6-10). Millets may be protective against obesity, metabolic syndrome and diabetes as well as against under nutrition and related diseases.

FAO estimates

We are surprised from the UN-FAO estimates that about 805 million people which is more than a tenth of the global population, remain chronically undernourished. Despite all the efforts from UN-FAO, only slow progress has been made in the reduction of under nutrition, the world now also faces growing epidemics of overweight, obesity, and diet-related non-communicable diseases (NCDs).[3–5] It should be noted that decline in under nutrition and the emergence of the epidemic of NCDs are natural transitions occurring during poverty to affluence which can be prevented by emphasizing on functional food security, not just food security. In case, there is no such emphasis by the WHO and FAO, the governments and other stake holders (with inappropriate health education on foods), are likely to make such policies supporting increased production of white bread, biscuits, cakes etc to achieve food security. Therefore, all the agencies should interact with honorable FAO and International College of Nutrition, to educate the worldwide food industry and governments for increased production of functional foods. Such efforts have not been made to buy or produce in middle income countries, resulting in to an epidemic of obesity and which needs to be done in all of Africa to prevent obesity. Functional Food Security appears to be adequate to address all the challenges of global malnutrition, including under nutrition and micronutrient deficiencies, as well as overweight, obesity, and diet-related NCDs.[3–6] More specific targets covering all of these issues are needed to galvanize funders, countries, and others to address these fundamental challenges. The sustainable development agenda should include the right to adequate nutrition which should be fully integrated for example, sustainability has to be well enough defined to make such integration meaningful world-widely. It is interesting that the joint OECD-FAO Agricultural Outlook provides market projections for major agricultural commodities, biofuels and fish.[2] It is suggested that this outlook should also include millets and new dairy products, in particular probiotics, and new omega-3 and tea flavonoid rich egg, which may become highly protective but inexpensive functional foods for the next decade.[2–10] Irrigation facilities available to farmers and such lands available to builders have been exploited to maximum by using agricultural land for agriculture and housing, respectively. There is a need to focus on dry lands to further increase grain production and use such lands for housing and industry. Because, the world is facing agrarian as well as nutritional challenges in lower income countries as well as in lower and upper middle income countries. In view of the low fertility of dry lands, utilization of such lands is challenging because it's very difficult to produce sufficient quality grains in such lands.

Millets for sustainable development goals

Millets are rich in fiber, flavonoids, iron and calcium as well as other vitamins and minerals and essential fatty acids. Since millets have high compliant crops score, over other grains like wheat and rice, in terms of marginal growing conditions and high nutritional

value, they are preferred by the agricultural scientists (Figure 1).[6,7] Increased availability of millets at affordable cost may eradicate the hunger as well as nutritional deficiency diseases as well as provide health promotion. Millets cultivation can keep dry lands productive and ensure future food security, in particular functional food security.[6–10] This approach can also serve the objective of feeding the world sustainably to achieve sustainable development goals.[11]

Phenolic compounds in millets

Recent studies indicate that fiber and flavonoids may be protective against CVDs as well as other NCDs.[12–17] Since all the millets are rich sources of flavonoids, it has been found that millets can protect against NCDs. Table 1 shows the content of flavonoids in various types of millets. Phenolic compounds may be classified into phenolic acids, flavonoids and tannins. These compounds form a very large group which contain the phenol functional group as a fundamental component. Phenolic acids are further sub-classified as hydroxybenzoic acids, hydroxycinnamic acids, hydroxyphenylacetic acids and hydroxyphenylpropanoic acids. The phenolic compounds of millets, were determined and characterized the free, hydrolyzed and bound form by Chandrasekara & Shahidi.[8] The soluble fraction of finger millet had the highest amounts of hydroxybenzoic acid derivatives (62.2μg/g) and flavonoids (1896μg/g). Foxtail millet (171μg/g) and little millet (173μg/g) had the highest amount of hydroxy cinnamic acid and their derivate in soluble form as given in Table 1. The phenols in millets are reported to have antioxidant, anti-mutagenic, anti-oestrogenic, anti-inflammatory, antiviral effects and platelet aggregation inhibitory activity.[9] Total antioxidant capacity of finger, little, foxtail and proso millets is higher due to their high total carotenoid and tocopherol content which varied from 78 to 366 and 1.3 to 4.0 mg/100g, respectively, in different millet varieties.[10] In diabetes mellitus, beneficial effect of phenolics may be due to partial inhibition of amylase and α-glucosidase during enzymatic hydrolysis of complex carbohydrates which may delay the absorption of glucose, leading to decline in the postprandial blood glucose levels. Flavonoids are more prevalent in free form. Only a few flavonoid classes were examined in most of the previous studies. Diets that are high in flavonoids by their nature have higher nutritional quality, characterized with more vegetables, whole grains, fruits, tea, coffee such as the Mediterranean style diets and Japanese diets. In many studies, other nutrients and all classes of phenolic compounds, have not been considered to account for possible confounding by overall diet quality; fruit and vegetable intake, fiber or other nutrients that may track with flavonoid intake with better diet quality as well as health benefits.[8–13]

Table 1 Phenolic compound content) in different types of millets (modified from Chandrasekara & Shahidi.[8]

Values are taken from Dykes & Rooney[10] (expressed as μg phenolic acid/mg samples)

Phenolic compound (μg/g defatted meal in soluble form)	Pearl	Finger	Proso	Foxtail	Barnyard[c]	Kodo
Hydroxybenzoic acid and derivatives						
Methyl vanillate	19.8	–	–	–	–	–
Protocatechuic acid	11.8a,	23.1a, 48.2	69.7	10.2	–	39.7
p-Hydroxybenzoic acid	22a	8.9a, 1.7	55.4	14.6a, 5.63	–	10.5
Vanillic	16.3a, 7.08	15.2a,	85.8	87.1a, 22.1	–	40.1
Syringic	17.3a	7.7a	–	93.6a	–	–
Gentisic acid	96.3a	61.5a	–	21.5a	–	–
Hydroxycinnamic acid and derivatives						
Caffeic acid	21.3a	16.6a, 11	–	10.6a, 34	–	276
p-Coumaric acid	268.9a, 53.5	36	1188	2133.7a, 848	–	767
Trans-ferulic acid	637	331	332	631	–	1844
Cis-ferulic acid	81.5	65.3	18.6	101	–	100
8,8′-Aryl ferulic acid	–	–	–	19.6	–	94.8
5,5′-Di ferulic acid	57	11.8	5.44	62.2	–	173
Flavonoids	7.1	1896	1.9	169	–	179

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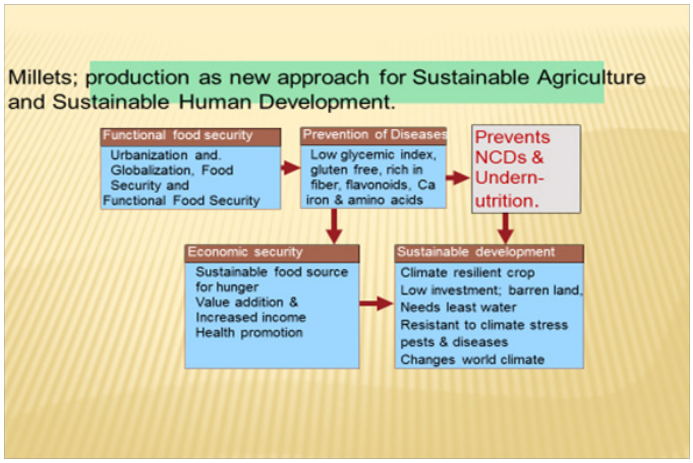

Figure 1 Millets production as a new approach for sustainable agriculture to advance the sustainable development goals.

Clinical benefits of phenolic compounds

The relationship between incident CVD and CAD and long-term intake of individual flavonoid classes based on a more complete flavonoid database was examined.[13–17] Most flavonoids are found in plant based foods; hence the overall diet quality of those who ingest more flavonoids is likely to be better than those consuming fewer flavonoids. Flavonoid-rich foods are also rich in certain nutrients, i.e., potassium, magnesium, fiber, lignans, phytosterols and isoflavons, which are known to reduce CVD risk. These foods may be lower in other nutrients having adverse effects, such as saturated fat, trans-fat and omega-6 fat and salt, that may increase CVD risk. Potential confounding by overall dietary quality or other specific dietary factors may be associated with flavonoid intake and may bring about false-positive associations. Findings from the epidemiological studies are inconsistent regarding the association between flavonol intake and risk of stroke. A meta-analysis of cohort studies that provided relative risk (RR) estimates with 95% confidence intervals (CIs) for the association between flavonol intake and risk of stroke included eight studies, with 5228 stroke cases among 280,174 participants.[14] A significant association was observed between highest flavonol intake and reduced risk of stroke (RR=0.86; 95% CI: 0.75-0.99). An increase in flavonol intake of 20 mg/d was associated with a 14% decrease in the risk of developing stroke (RR=0.86; 95% CI: 0.77-0.96). A higher consumption of flavonol was associated with a reduced risk of stroke among men, but no such association was noted in women. The results support recommendations for higher consumption of flavonol rich foods to prevent stroke. A more recent study of 2880 subjects, mean age 54 years, examined the association of long-term consumption of six flavonoid classes and the incidence of CVD and CAD, using a comprehensive flavonoid database and repeated measures of intake.[15] After an average follow-up of 14.9 years, there were 518 CVD and 261 CAD events. The results from this study indicate that the observed association between flavonol intake and CVD risk may be a consequence of better overall diet. The strength of this non-significant association was also consistent with relative risks observed in previous meta-analyses, and therefore a modest benefit of flavonol intake on CVD risk cannot be ruled out. Only flavonol intake was significantly associated with a lower risk of CVD incidence (hazard ratios (HR) per 2•5-fold flavonol increase =0•86, P trend=0.05). A further adjustment for total fruit and vegetable intake and overall diet quality attenuated this observation (HR=0.89, P trend=0.20 and HR=0.92, P trend=0.33, respectively). Clinical evidence for the association of dietary flavonoid intake with CVD risk factors is still scarce. The National Health and Nutrition Examination Survey (NHANES) 2007–2012 included 4042 US adults aged 19 years and older in a cross-sectional survey.[16] This study showed that higher flavonoid intake was associated with improved CVD risk factors but these associations were moderate in strength. After adjusting for covariates, increased HDL cholesterol was associated with higher total flavonoid intake (0.54% change). TAG and TAG:HDL cholesterol ratio were inversely associated with anthocyanidin (−1.25% change for TAG; −1.60% change for TAG:HDL-cholesterol ratio) and total flavonoid intakes (−1.31% change for TAG; −1.83% change for TAG:HDL-cholesterol ratio), respectively. Insulin and homoeostasis model assessment for insulin resistance (HOMA-IR) were inversely associated with flavone (for insulin, −3.18% change; 95% CI −5.85, −0.44; for HOMA-IR, −3.10% change; 95% CI −5.93, −0.19) and isoflavone intakes (for insulin, −3.11% change; 95% CI −5.46, −0.70; for HOMA-IR, −4.01% change; 95% CI −6.67, −1.27). Body mass index (BMI) was negatively associated with anthocyanidin intake (−0.60% change). The results of these observational studies emphasize the association between dietary flavonoid intake and CVD risk. A systematic review of fourteen prospective cohort studies was conducted in a meta-analysis.[17] The consumptions of anthocyanidins (RR = 0.89, 95% CI: 0.83, 0.96), proanthocyanidins (RR=0.90, 95% CI: 0.82, 0.98), flavones (RR=0.88, 95% CI: 0.82, 0.96), flavanones (RR=0.88, 95% CI: 0.82, 0.96) and flavan-3-ols (RR=0.87, 95% CI: 0.80, 0.95) were inversely associated with the risk of CVD when comparing the highest and lowest categories of intake. A similar association was observed for flavonol intake and CVD risk. The summary RR for CVD for every 10 mg/d increment in flavonol intake was 0.95 (95% CI: 0.91, 0.99). This study indicates that the dietary intake of six classes of flavonoids, namely flavonols, anthocyanidins, proanthocyanidins, flavones, flavanones and flavan-3-ols, significantly decreases the risk of CVD.[17]

You are what you eat

Recently Tomar and co-workers have re-emphasized that "You are, what you Eat", which depends on available food and agriculture as well as on available environmental factors? Hence prevention of environments is the basic requirement for total health. FAO's latest estimates indicate that the proportion of the world's population suffering from undernourishment is around 12.5 percent, down from almost half of the world's population in 1947.[2,4,18] This is a remarkable achievement, yet 868 million people remain hungry, an estimated 2 billion people suffer from one or more micronutrient deficiencies and an estimated 1.4 billion people are overweight, of whom 500 million people are obese. Today, 90% of the world's food supply is from 17% of plant species, which is mainly contributed by grains produced by fertilizer based on rapidly grown crops. Wheat, corn and rice account for three fourths of the world's grain production on which humans are dependent for their food supply.[2,4,19,20] There are fundamental contributions of agriculture to human nutrition through production, prices and incomes. However, agriculture and the broader food system including post-harvest processing, distribution and retailing, can contribute much more. Food systems as a whole, from production through consumption, can be made more nutrition-enhancing and more environmentally sustainable through a number of specific actions that are identified in the report[20]

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In brief, FAO of the UNO emphasizes the persistence of under nutrition and micronutrient deficiencies and the emergence of overweight and obesity in many parts of the world. Multiple forms of malnutrition can coexist within the same country, household and individual. Functional food security, in particular increased production and consumption of millets can enhance the potential of food systems to become both more sustainable and more supportive of good nutritional outcomes. It can also advance the need for a multi-sectoral approach that includes agriculture and food systems, health, sanitation, social protection, employment, education with better economic security. There is a need to collaborate all relevant stakeholders; health care professionals, food and Agricultural scientists to make a concerted effort to close the gaps that remain regarding basic data on diets and on nutritional status and development of health or prevention of diseases. Further studies are needed to conduct to find out the impact of agricultural food-based interventions on nutritional and health outcomes. Encouragement of management practices and technologies to improve sustainability and nutrition and evaluation of the impacts of markets, trade and market structure on environmental sustainability and human nutrition are quite important. Finally, recognition of the roles of consumer choice in the world television advertisements by the food industry, in achieving nutritional and sustainability objectives are fundamental for universal health and sustainable human development.

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Conflicts of interest

Author declares that there is no conflict of interest.

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