

The Concept of Functional Foods and Functional Farming (4 F) in the Prevention of Cardiovascular Diseases: A Review of Goals from 18th World Congress of Clinical Nutrition

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ABSTRACT

The objectives of this communication are to make efforts which might ensure that the goals and targets for prevention set are adequate to address the many challenges of global malnutrition. These include both under-nutrition and obesity which are major risk factors of cardiovascular diseases (CVDs); hypertension, coronary artery disease (CAD, stroke and heart failure and other chronic diseases; type 2 diabetes mellitus, cancer, chronic respiratory diseases, bone and joint diseases and neurodegenerative diseases. We also find that

this is an opportunity to develop an international consensus on how to approach the prevention of malnutrition, CVDs and other chronic diseases, so that there is no increase in human susceptibility to these diseases.

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Key words: Heart disease; Nutrition; Mediterranean style diet; Nutrients anti-inflammatory foods

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INTRODUCTION

It is noteworthy, that on Nov 19-21, 2014, government ministers and other participants from around the world gathered in Rome, Italy for the 2nd International Conference on Nutrition organized by WHO and FAO^[1]. On Dec 1-3, 2014, food, nutrition and agricultural scientists as well as physicians and epidemiologists from several countries were also present at the 18th World Congress on Clinical Nutrition (18th WCCN) organized by Ubon Ratchathani University and International College of Nutrition^[2]. It is clear that there is opportunity to make nutrition, a central part of the post-2015 sustainable human and agricultural development agenda to provide slowly absorbed functional foods (FF) and functional farming (FF) that are rich in nutrients (4 F). The objectives of this review are to make efforts which might ensure that the goals and targets set are

adequate to address the many challenges of global malnutrition. These include both under-nutrition and obesity which are major risk factors of cardiovascular diseases (CVDs); hypertension, coronary artery disease (CAD, stroke and heart failure and other chronic diseases; type 2 diabetes mellitus, cancer, chronic respiratory diseases, bone and joint diseases and neurodegenerative diseases. We also find that this is an opportunity to develop an international consensus on how to approach the prevention of malnutrition, CVDs and other chronic diseases, so that there is no increase in human susceptibility to these diseases^[3]. The Sofia declaration also proposed to policy makers, health professionals and the general population, particularly mothers, to learn about functional food and a rich Mediterranean-like diet and then to introduce and promote this specific diet to existing patients, prospective outpatients, and their family members concentrating on pregnant mothers, infants and children as well as the elderly for interventions, particularly in middle- and lower-income countries where CVDs and other chronic diseases are rapidly emerging^[3,4].

DIET, DEVELOPMENT AND CVDs

CVDs emerge in a sequence during the transition from poverty to affluence and the ageing of populations^[3,4,8]. Some of the noncommunicable diseases (NCDs) such as coronary artery disease (CAD) and chronic respiratory diseases related to tobacco consumption are more common among lower-income and lower-middle-income countries, despite a modest increase in overweight and obesity. Modern diets and lifestyles have been adopted by an increasing number of people and populations in the Western world and in the urban populations of middle-income countries in the last few decades^[3,4,8]. These diets are known to predispose the epidemic of NCDs. Cardiovascular disease (CVD), diabetes mellitus, obesity, cancer, autoimmune diseases, rheumatoid arthritis, asthma and depression are associated with an increased production of thromboxane A₂ (TXA₂), leucotrienes, prostacyclin, interleukins-1 and 6, tumor necrosis factor-alpha and C-reactive proteins^[8]. Increased dietary intake of energy rich foods containing high trans fat, saturated fat and w-6 fat and refined carbohydrates in conjunction with physical inactivity are known to enhance all these biomarkers which have adverse pro-inflammatory effects resulting into NCDs^[9-15]. Industrialization and urbanization due to economic development and affluence in association with the greater availability of foods, especially ready- prepared foods, to populations in middle and high income countries have resulted in a rapid increase in CVDs.

However these foods are high in energy and fat as well as in trans fat but poor in nutrient density, resulting in a decrease in the consumption of omega-3 fatty acids, vitamins, flavonoids, minerals as well as in essential and nonessential amino acids and a significant increase in the intakes of carbohydrates, (mainly refined), fat (saturated, trans fat and linoleic acid) and salt compared to peasants in the Paleolithic period^[5-7]. The protein or amino acid intake was 2.5 fold greater (33 vs 13%) in the Paleolithic diet of *Homo sapiens* compared to that of the modern Western diet consumed by *Homo economicus* populations^[8-10]. It has been estimated that diets of *Homo sapiens* were characterized by higher intakes of essential and non-essential amino acids, calcium, potassium, magnesium, flavonoids and w-3 fatty acids whereas the modern Western diet of *Homo economicus* has an excess of energy-rich refined carbohydrates, w-6, trans fat and saturated fat and low in protective nutrients. There has been a marked change in food and nutrient intakes during the last 100-160 years causing increased intake of saturated fatty acids (SFA),

trans fatty acids and linoleic acid and meat from grain-fed cattle, kept in farm buildings rather than meat from free-ranging animals^[5-10].

MORTALITY DUE TO CVDs AND OTHER CHRONIC DISEASES

The burden of death and disability attributable to CVDs and other chronic diseases is rising in all middle- and high-income countries because of the rapid changes in the diet and lifestyle patterns^[11,12]. Millions of deaths occur every year due to lack of health education and poor public health policies. CVDs are a great challenge to health care experts and governments and appear to be an underlying cause for poverty as well as a threat to human, social, and economic development. The 36.1 million deaths per year as a result of CVDs and other chronic diseases represent almost two out of three deaths per year worldwide. 22.4 million of these deaths arise in the poorest countries, and 13.7 million in high-income and upper-middle-income countries^[11]. Approximately, two-thirds (63%) of premature deaths in adults (aged 15-69 years), and three of four of all adult deaths are attributable to CVDs and other chronic diseases.

Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: by the Global Burden of Disease Study 2013, has also confirmed the greater burden of CVDs and other chronic diseases^[12]. In the United States, the causes and timing of death in extremely premature infants from 2000 through 2011 revealed that undernutrition and infection and enterocolitis are major causes of death^[13]. However, those who survive are future candidates for the development of Western diseases; CVDs and type 2 diabetes in adult life because poor nutrition during fetal life and infancy is a risk factor for adult diseases. The role of foods in the pathogenesis of these diseases has been reemphasized^[14]. The association of food and Western diseases from an evolutionary point of view indicate that sustainable human development may be difficult due to the conservative mechanisms developed during food scarcity^[14]. Moreover genetically modified foods which are high in energy and low in nutrient density may have greater adverse effects^[15].

FUNCTIONAL FOODS AND FUNCTIONAL FARMING (4 F)

Functional foods (F F) may be defined as foods which contain certain nutrients that can address some physiological mechanisms in our bodies thereby providing benefits. Functional farming (FF) means that foods produced by farming either by appropriate soil, or by genetic engineering or plant breeding should be functional foods. Functional foods are characterized with high nutrient density and low energy which can influence physical and mental performance as well as psychosocial behavior that are characteristics of total health, including cardiovascular health^[3-6]. Functional foods are rich in omega-3 fatty acids, vitamins, polyphenolics, minerals as well as in essential and nonessential amino acids and lower in energy. The production of functional foods and functional farming (4 F) worldwide can increase the dimension of the increased consumption of functional foods and their benefits on total health in general, cardiovascular health in particular, as well as global health^[5-7]. Large scale use of fertilizers and biotechnology for rapid growth of crops for greater yield of foods, refining and processing of foods, storing and distributing them have become widespread in the continuous search for a better economic model in high income and middle

income countries^[5-7]. The challenge facing food manufacturers in the food industry is to develop functional foods; slowly absorbed bread, biscuits, cakes, candies, syrups etc which should also be rich in nutrients and low in density. A similar approach is expected from functional farming to grow foods which should be slowly absorbed and have a low glycemic index with high nutrient content, although functional farming alone cannot serve the demand. Genetically modified foods may be developed rapidly to counteract undernutrition but these foods should be slowly absorbed and rich in nutrients because increased consumption of such foods may predispose obesity and metabolic syndrome^[7-10,15].

PREVENTION OF CVDs

The prevalence of a healthy lifestyle among individuals with CVDs in high-, middle- and low-income countries revealed that only little is known about adoption of healthy diet and lifestyle behaviors among individuals with these problems^[16]. A large, prospective cohort study involving 153 996 adults, aged 35 to 70 years, from 628 urban and rural communities in 3 high-income countries (HIC), 7 upper-middle-income countries (UMIC), 3 lower-middle-income countries (LMIC), and 4 low-income countries (LIC) is excellent^[16]. Among 7,519 individuals with self-reported coronary disease {past event: median, 5.0 [interquartile range (IQR), 2.0-10.0] years ago} or stroke [past event: median, 4.0 (IQR, 2.0-8.0) years ago], 18.5% (95% CI, 17.6%-19.4%) continued to smoke; only 35.1% (95% CI, 29.6%-41.0%) undertook high levels of work- or leisure-related physical activity, and 39.0% (95% CI, 30.0%-48.7%) had healthy diets; Overall, 52.5% (95% CI, 50.7%-54.3%) quit smoking [by income country classification: 74.9% (95% CI, 71.1%-78.6%) in HIC; 56.5% (95% CI, 53.4%-58.6%) in UMIC; 42.6% (95% CI, 39.6%-45.6%) in LMIC; and 38.1% (95% CI, 33.1%-43.2%) in LIC]. Levels of physical activity increased with increasing country income but this trend was not statistically significant. The lowest prevalence of eating healthy diets was in LIC (25.8%; 95% CI, 13.0%-44.8%) compared with LMIC (43.2%; 95% CI, 30.0%-57.4%), UMIC (45.1%, 95% CI, 30.9%-60.1%), and HIC (43.4%, 95% CI, 21.0%-68.7%). About 14.3% (95% CI, 11.7%-17.3%) did not undertake any of the 3 healthy lifestyle behaviors and 4.3% (95% CI, 3.1%-5.8%) had all 3.

It is clear that among a sample of patients with CVDs, from countries with varying income levels, the prevalence of healthy lifestyle behaviors was low, with even lower levels in poorer countries thus indicating that health education via changing a policy could be important. However these low income populations continue to have occupational, cultural and traditional health behaviors which have been protective against CVDs. However, the threat of policies from the Western world is rapidly emerging because of the lack of government policies in changing the health behavior in these countries. A Greek epic prospective heart study revealed the anatomy of health effects of Mediterranean diets showing the beneficial effects of fruits, vegetables, whole grains, nuts, fish and olive oil^[17]. Effects of fat-modified and fruit and vegetable-enriched diets on blood lipids among 600 subjects with high cardiovascular risk in the Indian diet heart study showed that subjects eating Mediterranean diet had a significant decrease in all the risk factors compared to those eating a low fat diet^[18]. Randomized, controlled intervention trials with Mediterranean style foods such as the Indian Experiment of Infarct Survival^[19,20], The Lyon diet heart study^[21] and the Indo-Mediterranean diet heart study^[22] revealed that consumption of Mediterranean style diets caused significant declines in CVDs in the intervention group compared to control group. The effect of low w-6/

w-3 fatty acid ratio Paleolithic style diet in 404 patients with acute coronary syndromes revealed that after 2 years, there was a significant decline in all causes of mortality and cardiovascular events compared to the low-fat diet group^[23]. The PREDIMED study among 7,747 subjects, aged 55-80 years, with high cardiovascular risk revealed that after 4.8 years, there was a significant decline in the cardiovascular events in intervention groups receiving Mediterranean style foods with olive oil or with nuts, compared to those with a low-fat diet^[24]. In clinical practice, this approach for individual patients as well as for populations and other methods, may be a roadmap for the future^[25], in a clinical situation when antioxidant vitamin supplementation has failed to provide any benefits^[26]. The role of functional foods has been also demonstrated among 38 healthy volunteers in a 2-week intervention study which included a daily portion (300g) of black and red cabbage. Plasma lutein and β -carotene levels and total antioxidant capacity were significantly increased after dietary intervention. The results revealed that Brassica supplementation favourably influenced the serum lipid profile with a significant decrease in total cholesterol, LDL-cholesterol and oxidized LDL. These findings strengthen the hypothesis that the effect of functional food intervention could be modulated by baseline conditions of the subjects which could be useful for sustainable human development^[28].

This approach appears to be beyond a traditional payer and beyond CMS's role in improving the health of the population^[29]. Wearable devices could be facilitators for compliance with but not the drivers of change in health behavior which would depend on the social, mental and spiritual health of the population and on the public health policies of governments^[30].

In brief, it is clear that there is robust evidence in favor of 4 F in the prevention of CVDs by eating Mediterranean style foods rich in polyphenolics, omega-3 fatty acids, vitamins, minerals as well as essential and nonessential amino acids.

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CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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