1. Introduction

According to World Health Organization (WHO) "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1948). Many criticisms are addressed to this definition of health, so that Saracci (1997) stated that it is utopian, inflexible, and unrealistic, and the word “complete” in the definition makes it highly unlikely that anyone would be healthy for a reasonable period. Many research studies have been aimed to keep people healthier for longer periods, for example, delay the onset of chronic non-communicable diseases (NCD).

WHO (2004) states there are many risk factors associating increase mortality and morbidity with nutrition. The most important are: unsafe water, lack of sanitation, inadequate breastfeeding practices and infant feeding, childhood under-nutrition (22 to 24 % in low-income countries) and
over nutrition (6 to 8% in high-income countries), diabetes (10%), hypertension (25-29%), obesity (10-14%) and harmful consumption of alcohol.

According to the most recent FAO (2013) estimations on food availability 12.5% of the world population (868 million people) are undernourished in terms of energy consumption, and 26% of the world's children are stunted, 2 billion people suffer from one or more micronutrient deficiencies, and 1.4 billion people are overweight, of which at least 500 million are obese (FAO, 2013).

These data reflect the importance of nutrition, science, technology, and food engineering in the quality of life, especially throughout the globalization period, where the nutritional transition appears to be occurring rapidly in many countries.

**Nutritional transition**

The nutrition transition is a term used to address the relationship between demographic change and its impact on the nutritional status of the population, i.e. changes in dietary behavior and its effect on population health. This modification is associated with changes in behavior, lifestyles, physical inactivity, smoking and alcohol consumption (Amuna & Zotor, 2008). In addition, deficits and excesses, accompanied by industrialization, urbanization and economic development are important factors (Shetty, 2002), as lead to NCD.

**Chronic non-communicable diseases (NCD)**

NCDs are considered preventable diseases that cause great economic impact on the health system (Swinburn et al., 2011; Smith & Harvey, 2010). The American Heart Association (Go et al., 2013) states that the total healthcare cost will account for 16% to 18% of US health expenditures if current trends in obesity continue.

Most NCDs are strongly associated and causally linked with four particular behaviours: tobacco use, physical inactivity, unhealthy diet, and the harmful use of alcohol. These behaviours lead to four key metabolic/physiological changes: raised blood pressure, overweight/obesity, hyperglycemia and hyperlipidemia. In terms of attributable deaths, the leading NCD risk factor globally is elevated blood pressure (to which 13% of global deaths are attributed), followed by tobacco use (9%), raised blood glucose (6%), physical inactivity (6%), and overweight and obesity (5%) (WHO, 2004).
Overweight and obesity are considered epidemic diseases. In 2008, about 1.5 billion adults were classified as overweight and one third of these were considered obese (Conroy, Davidson & Warnock, 2011; Swinburn et al., 2011). In addition, an estimated 170 million children and adolescents (<18 years) were classified as overweight or obese (Swinburn et al., 2011).

Obesity treatment includes broader issues of public health, socio-cultural, behavioral, political, and specific dimensions, such as individual biological aspects, including genetic and metabolic factors (Trayhurn, 2005), and the approach must be multidisciplinary, in which doctors, nutritionists, educators and others can act together. According to Lobato, Costa & Sichieri (2009) behavioral and environmental influences are considered the main causes related to the significant increase in the prevalence of obesity. Gee, Mahan & Escott-Stump (2010), Trayhurn (2005) & Lobato, Costa & Sichieri (2009) have reported some examples, as follows:

- Increased consumption of street food, and greater participation of women in the labor market;
- Increased media coverage of food advertisements, increased sedentary lifestyle due to television and computers at home;
- Marked change in the composition of the diet, with increased energy availability per capita, higher consumption of soft drinks, and larger portion sizes, as well as higher consumption of fats and sugars, together with a decrease in the consumption of whole grains and fiber.

As an example, Brazil is experiencing a decrease in consumption of rice and beans, which are part of conventional diet, followed by an increase in consumption of processed products (including soft drinks). From 1974 to 2003, there was a high consumption of sugar, total fat and saturated fat, and insufficient intake of fruits and vegetables. During the same period, the prevalence of obesity among the Brazilian population increased from 2.8% to 8.8% in adult men and from 7.8% to 12.7% in women (Lobato, Costa & Sichieri, 2009).

Cancer

As reported by Globocan (2012), in 2012 there were 14.1 million new cancer cases worldwide, 8.2 million cancer deaths, and 32.6 million people living with cancer (within 5 years of diagnosis). In addition, 57% (8 million) of new cancer cases, 65% (5.3 million) of cancer deaths, and 48% (15.6 million) of 5-year prevalent cancer cases occurred in the less developed
regions. The cases with the highest incidence were breast, colorectal, prostate and stomach cancer.

After statistical monitoring, it was estimated that 1,660,290 new cancer cases were expected to be diagnosed in the USA in 2013, including 41,380 cases in the oral cavity and pharynx, 290,000 in digestive system and 140,000 in urinary system, thus in similar proportions of breast (234,000) and prostate cancer (238,000). It is also estimated 580,350 deaths occurring mainly due to digestive system, breast, and prostate cancer (Howlader et al., 2014).

These data indicate the importance of cancer cases related to food, so that dietary factors have been thought to account for about 30% cases in Western countries, making diet second only to tobacco as a preventable cause of cancer. In contrast, the contribution of diet to cancer risk in developing countries has been considered to be lower, perhaps around 20% (Howlader et al., 2014).

Key et al. (2004), on a careful review of published studies, reported some factors related to food that increase the risk of cancer, including:

- Overweight/obesity, for cancers of the oesophagus (adenocarcinoma), colorectal, breast (postmenopausal), endometrium and kidney;
- Alcohol causes cancers of the oral cavity, pharynx, oesophagus and liver, and a small increase in the risk for breast cancer;
- Aflatoxin in foods causes liver cancer, although its importance in the absence of hepatitis virus infections is not clear;
- Chinese-style salted fish increases the risk for nasopharyngeal cancer, particularly if eaten during childhood;
- Preserved meat and red meat probably increase the risk for colorectal cancer;
- Salt preserved foods and high salt intake probably increase the risk for stomach cancer;
- Very hot drinks and foods probably increase the risk for cancer of the oral cavity, pharynx and oesophagus.

As reported by the same authors, factors reducing the occurrence of cancer are:

- Fruits and vegetables probably reduce the risk for cancer of the oral cavity, oesophagus, stomach and colorectum, and diets should include at least 400 g/d of total fruits and vegetables; and
- Physical activity, the main determinant of energy expenditure, may reduces the risk for colorectal cancer and breast cancer.
Diabetes mellitus

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion and / or its action. Hyperglycemia is manifested by symptoms such as polyuria, polydipsia, weight loss, polyphagia, and blurred vision or acute complications that can lead to risk of death, including diabetic ketoacidosis and hyperglycemic hyperosmolar nonketotic syndrome. Chronic hyperglycemia is associated with damage, dysfunction and failure of various organs, especially eyes, kidneys, nerves, heart and blood vessels (Gross, 2002).

It is estimated that 347 million people worldwide have diabetes and 80% of people with diabetes live in low- and middle-income countries. Although there are few studies in the literature on quality of diabetes care, some authors suggest that less than half of diabetes cases are diagnosed globally, and, of this, less than half have glycatedhaemoglobin (HbA1c) concentrations below 7% or 53 mmol/mol (indicative of tight control) (WHO, 2011a).

Country-level survey-based surveillance for dysglycaemia and diabetes should use HbA1C as the test of choice, because it does not require fasting blood sample, is readily calibrated against an international reference standard, and is accepted by WHO (2011a) as a diagnostic test for diabetes (cutoff 6·5% or 48 mmol/mol). Currently the classification of diabetes more specific, elucidation of pathogenic process mechanisms, both in relation to the genetic markers and disease mechanisms. In addition to types I, II, and gestational diabetes, new categories have been added to the list of specific types, including genetic defects of beta cell and insulin action, diseases that damage the pancreas, diabetes associated with other endocrine diseases, and cases arising from the use of medicines (Marion, 2010).

The lack of adherence to treatment of diabetes can lead to serious consequences such as (WHO, 2011a):

- Cardiovascular disease, stroke, renal failure, lower limb amputations;
- Visual impairment and blindness;
- People with diabetes require at least two to three times the health-care resources as compared to people who do not have the disease; and
- Increased risk of tuberculosis, being three times higher among people with diabetes.

Metabolic syndrome triggered by diabetes is among the worst consequences of the non-adherence to treatment (Gee, Mahan & Escott-Stump, 2010) and is a cardiovascular risk factor, characterized by the association of hypertension, abdominal obesity, impaired glucose tolerance,
hypertriglyceridemia, and low blood concentrations of HDL cholesterol, in addition to the prothrombotic and proinflammatory states (Santos et al., 2006).

For better control of the metabolic syndrome, the nutritional therapy aiming to limit the intake of saturated fats and trans isomeric fatty acids, which are the main components involved in increasing cholesterol has been indicated. The protein intake must be similar to the recommendations for the general population, with emphasis on the consumption of vegetable proteins and fish. Another important factor concerns the glycemic index of foods: diets with high glycemic index promote insulin resistance, obesity and type 2 diabetes mellitus. Regarding dietary fiber, many studies show that a diet rich in fiber reduces the risk of coronary heart disease and type 2 diabetes mellitus, and contribute to better glycemic control (Santos et al., 2006).

Some measures such as encouraging the consumption of grains and whole grain flour can be a viable and sustainable approach, and consists of an effective treatment for the prevention of diabetes, particularly in low and middle-income countries (Mattei et al., 2012).

Cardiovascular diseases

Cardiovascular disease (CVD) is caused by disorders of the heart and blood vessels, and includes coronary heart disease (heart attacks), cerebrovascular disease (stroke), raised blood pressure (hypertension), peripheral artery disease, rheumatic heart disease, congenital heart disease and heart failure (WHO, 2011b).

An estimated 17.3 million people died from CVDs in 2008, representing 30% of all global deaths (WHO, 2011a) Of these, an estimated 7.3 million were due to coronary heart disease and 6.2 million were due to stroke (WHO, 2011b). The number of people who die from CVDs, mainly from heart disease and stroke, will increase to reach 23.3 million by 2030. CVDs are projected to remain the single leading cause of death (WHO, 2011a, Mathers & Loncar, 2006).

The major causes of cardiovascular disease are tobacco use, physical inactivity, an unhealthy diet and harmful use of alcohol (WHO, 2011b).

Mental health and nutrition

Globally, one in four (25%) individuals suffers from mental disorders in both developed and developing countries. Four of the six leading causes of years lived with disability are depression, alcohol use disorders, schizophrenia, and bipolar disorder (WHO, 2001).
Interactions between nutrition and genes play a key role in brain function, and states of malnutrition or undernutrition and overnutrition are related to mental, schizophrenic, and neurological disorders, and dementias (Dauncey, 2012).

The most important risk factor for mental health is deficiency of B vitamins (thiamine, niacin, biotin, B6, folic acid, and B12), lack C vitamin and D, minerals (calcium, iron, magnesium, selenium and zinc) and proteins, carbohydrates and lipids, and very restricted diets in the latter two nutrients may increase the risk (Colbin, 2009).

Proposals for improving the conscious food consumption

With the evolution of the scientific advances that link nutrition and health, food guides have been published, with general and specific guidelines for certain diseases.

- Food guides

These guides have several standards for planning and assessing diets and dietary supplements for individuals and population groups according to food habits, culture, dietary patterns and food availability. They are instruments that guide the variety, proportionality and moderation of foods that should make up the diet, in addition to being instruments of food and nutrition education (Rodrigues, 2012).

FAO and WHO have set international standards in many areas of food quality and safety as well as dietary and nutritional recommendations, and many countries have proper guidelines to the circumstances and needs of their populations. As an example, the Food Nutrition Board - FNB, from the Institute of Medicine - IOM in USA, and the Health Canada, in Canada (Gee, Mahan & Escott-Stump, 2010).

The guidelines from Dietary Guidelines for Americans (2010) are based on two concepts: balance of caloric intake throughout life to maintain healthy weight, and consumption of foods and beverages rich in healthy nutrients, in substitution for foods rich in sodium, saturated fat, added sugars, and refined grains (Americans, 2010).

- Food industry

In this same context, the increase in diseases related to food intake led the food industry to face new challenges, such as removing or replacing
unhealthy ingredients (trans fats, salt and sugar), incorporating healthy or health promoting ingredients, and new products with bioactive compounds, such as vitamins, omega-3 fat, plant extracts, fibers, flavonoids, probiotics (“live microorganisms that when administered in adequate amounts confer a health benefit on the host” (Guarner F., Schaafsma G.J., 1998) and prebiotics (“is a non-viable food component that confers a health benefit on the host associated with modulation of the microbiota” (FAO, 2008) (Lenoir-Wijnkoop et al., 2011).

Food label carry information that help consumers to make good food choices, such as reduced sodium, fat-free, low calorie, etc. and must be in accordance with the settings established by the government agency. Moreover, the health claim is allowed only for specific foods, satisfying certain standards (Gee, Mahan & Escott-Stump, 2010).

Regulation on nutrition and health claims on foods was introduced in the European Union in 2007 (Regulation EC 1924/2006). This regulation provides the opportunity to develop and use nutrition and health claims on foods in Europe, including function claims and reduction of disease risk (European Union, 2006).

- **Functional foods or nutraceuticals**

  With respect to the healthy foods, functional foods and nutraceuticals have been highlighted. Currently, this is subject the most active research area related to nutrition, especially its relationship with diet, dietary constituents, and health benefits (Hasler, 2014). For industry, this market is growing worldwide. Innovative products have been introduced continuously. The motivation of consumers with respect to functional foods may be mediated by several factors, including relation to health, effectiveness of the diet, and nutrition knowledge. For example, prevention of NCDs, is strongly associated with the consumer demand for functional foods targeted at the prevention of these diseases (Canada, 2009).

- **Food education**

  Food and nutrition education in childhood is also a strategy used by most countries for training healthy eating habits and disease prevention. According to WHO, few countries achieve the recommendation for infant feeding, i.e. for exclusive breastfeeding until 6 months, and continued breastfeeding with appropriate complementary foods up to 2 years (Smith & Harvey, 2010).
**Consumption of organic foods**

Organic food provides direct health benefits, since they are free of pesticides benefits and decrease the environmental impact. The market in the USA for this food group has grown from $3.5 billion in 1996 to $28.6 billion in 2010, according to *Organic Trade Association* (Forman & Silverstein, 2012).

Among health benefits, some studies have found lower levels of nitrate in organic food, which is potentially desirable because of the association of nitrates with an increased risk of intestinal cancer and children's risk of developing methemoglobinemia. In addition, higher concentrations of vitamin C were found in organic vegetables, such as spinach, lettuce, and others. Other studies have found higher concentrations of total phenols in organic products against conventionally grown products, and postulated health benefits from antioxidant effects (Forman & Silverstein, 2012).

**Nutrigenomics and metabolomics**

Nutrigenomics has been defined as the science that studies the interaction between nutrients and human genes, studying the way in which the DNA and the genetic code determine the nutritional requirements and nutrient metabolism of the individual. It assumes that the different components of diet play different roles in each individual functions according to its heritage or genetic code (Afman & Müller, 2006).

Metabolomics is an emerging field of “omics” research focused on high-throughput characterization of small molecule metabolites in biological matrices, thus it is essentially applied to molecular nutrition, food components analysis, food quality, and physiological monitoring of dietary intake by intervention studies and dietary modifications (Whisart, 2008).

**Conclusion**

The close connection between health and nutrition in this chapter points to the main perspectives in social and scientific areas:

- Improving the early diagnosis of diseases to provide an adequate diet throughout life;
- Expanding knowledge in nutrigenomics to open the prospect on prescription and preparation of personalized diets, according to individual genetic composition, expanding the available strategies in health promotion system to prevent and treat diseases, such as diabetes
mellitus type 2, obesity, cardiovascular disease, certain types of cancer, and innate errors of metabolism, including phenylketonuria, congenital hypothyroidism, cystic fibrosis, and hemoglobinopathies (sickle cell disease) (Afman & Müller, 2006).

- Expanding the dissemination and adherence of more countries to the program initiated in 2004 by the WHO, "Global Strategy on Diet, Physical Activity and Health", with the purpose of prevention and control of chronic non-communicable diseases (WHO, 2004);
- Encouraging changes in production and food processing, such as reducing levels of sodium, additives, simple sugars, saturated fats and cholesterol, and use of healthier formulations in processed products;
- Reducing production costs dietary food for special purposes to facilitate adherence;
- Developing training programs for health professionals, patients and caregivers to raise awareness of the need for adherence to diet;
- Increasing the dissemination of the effects of short, medium and long-term chronic diseases, to improve the quality of life and prevent serious consequences generated by the non-adherence to treatment;
- Improving communication in developing countries on morbidity / mortality from NCDs, and planning measures to prevent these diseases from statistical analyses as already exists in developed countries;
- Stimulating scientific research in nutrition and health to improve information chain between academia, industry, government and population.

References


