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FUNCTIONAL FOOD MARKET OPPORTUNITIES IN SUDAN

Nahid T. Fawi*[1], Adil M. A. Salman[2]

[1]Associate Professor, Faculty of Animal Production, University of Khartoum.
[2] Professor, Head of The One Health Center, University of Bahri.

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***Corresponding Author**
Nahid T. Fawi
Associate Professor, Faculty of Animal Production, University of Khartoum.

ABSTRACT

Functional foods have been developing for over 30 years and are quickly becoming staples in international markets. The term functional food is credited to have been introduced in 1991 by the Japanese government and refers to a food that is supplemented with extra ingredients which can contribute to human health and wellbeing. A food can be said to be functional if it contains a component, that benefits one or a limited number of functions in the body in a targeted way that is relevant to either the state of well-being and health or the reduction of the risk of a disease. The awareness of consumers on the intake of healthier foods, comprising bioactive compounds has been increased tremendously. For the food industry, the driving force behind the functional food concept is to create a market niche to commercialize innovative products claiming beneficial physiological effects beyond those ordinarily associated with typical nutrients. The objective of this paper is to provide a diversified review of definitions, importance, global markets and consumer preferences of functional food. The article also reviewed functional food sources from animal and plant sources. The review concluded that most food considered as functional food are already indigenous in Sudan and for these products to compete in the global market, strong marketing strategies together with new technological production practices for such products should be incorporated. Functional food market is a promising global market for Sudan, that if handled in well-designed strategies could boost the agricultural economy of the country.

KEYWORDS: functional food – global market – consumer – Sudan.

INTRODUCTION

There is a growing interest among consumers worldwide regarding functional foods specially with the rising consumer awareness about achieving a healthy life and hence consuming healthy diets, in addition to overcoming diseases in a natural mode via food that are known for not causing side effects as artificial medicines.

Functional foods have been developing for over 30 years and are quickly becoming staples in international markets (Siro et al., 2008). The origin of Functional food science came from the collaboration of sciences and the public need. It is the melding on food science, nutrition, and medicine as it produces sustenance that crosses between food and pharmaceuticals, where researchers study food components and their beneficial health effects via measuring changes in health and homeostatic behavior through the use of biomarkers or "indicators" in the body, hence functional food scientists' determine the health effects and proper/safe dosages of functional foods (Dhiman et al., 2014). Nowadays Foods can no longer be evaluated only in terms of macronutrient and micronutrient intake, the analysis of other physiologically active components will be necessary (ADA 1999). The term functional food is credited to have been introduced in 1991 by the Japanese government and refers to a food that is supplemented with extra ingredients such as vitamins, proteins, fibers, probiotic bacteria or other food additives which can contribute to human health and wellbeing (Granato et al., 2010a). Functional foods containing beneficial health related compounds have become a major focus for researchers and the food industry diet is considered to be closely linked with a range of disease conditions and with significant age-related chronic disease states (Manach et al., 2017).

On the other hand, consumers are increasingly seeking holistic solutions to help prevent chronic illness and optimize health (Khan et al., 2013). A new market segment emergence in functional food products is growing by approximately 10% per year, it is estimated that by 2020 the global functional food market will be worth $192 billion US dollars (Euromonitor 2016). In Asia where functional foods have been regarded as an integral part of the culture for many years, there is a firm belief that foods and medicine come from the same source and serve the same purpose, However, scientists and regulators have only recently begun to agree that the functionality of functional foods should be found in

whole foods rather than in their individual components**.** **(**Verschuren 2002**)**

Functional foods may be broadly grouped into the following:

- Conventional food containing naturally occurring bioactive substance. An example could be β-glucan in oat bran to lower blood cholesterol;
- Foods that have been modified, by enrichment or other means, with bioactive substances. An example could be margarine that contains added phytosterol that is known to lower serum cholesterol;
- Synthesized food ingredients, such as some specialized carbohydrates intended to have probiotic effects. (Henry 2010).

Functional food definitions

Functional food is essentially a marketing term and globally, it is not recognized by law, several definitions for functional foods exist these include that given by Health Canada: 'Similar in appearance to conventional food, consumed as part of the usual diet, with demonstrated physiological benefits, and/or to reduce the risk of chronic disease beyond basic nutritional functions' (Health Canada, 2000). A food can be said to be functional if it contains a component, whether or not a nutrient, that benefits one or a limited number of functions in the body in a targeted way that is relevant to either the state of well-being and health or the reduction of the risk of a disease (Bellisle 1998). At a consensus meeting in Madrid October 1998 that was the last activity of a 3 year action supported by the European Union and coordinated by the International Life Science Institute Europe, a group of European experts adopted the following working definition: "a food can be regarded as functional if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body, beyond adequate nutritional effects in a way which is relevant to either the state of well-being and health or the reduction of the risk of a disease" (Diplock 1999).

It is worth mentioning that the designation of functional foods was first introduced in Japan in the 1980s and refers to processed foods containing ingredients that aid specific bodily functions in addition to being nutritious, to date Japan is the only country that has formulated a specific regulatory approval process for functional foods. (ARAI 1996). In Japan, "functional food" has been given a formal legislative food category called FOSHU and in order to qualify, food must satisfy three nutritional requirements: (1) Effectiveness in clinical studies, (2) Safety in clinical and non-clinical studies, and (3) Determination of active/effective components. (Lee et al., 2014, Shimizu 2003). Moreover, in order to obtain a FOSHU designation, manufacturers must complete an application containing scientific evidence supporting the proposed medical or nutritional link, the suggested dose of the functional food, safety of the food, and descriptions of the food's physical/chemical qualities, experimental methods, and composition (Ringel et al., 1999).

When functional food science migrated to Europe, researchers defined "functional food" using the following statement: "Food products can only be considered functional if together with the basic nutritional impact it has beneficial effects on one or more functions of the human organism thus either improving the general and physical conditions or/and decreasing the risk of the evolution of diseases" (Diplock et al., 1999). Currently, the European government categorizes food into: "conventional foods, modified foods, foods for special dietary use and medical foods", (Cara 2014).

The National Academy of Sciences Food and Nutrition Board in the USA believes that a "functional food" is: "Any modified food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains" (Thomas & Earl 1994).

Institute of Food Technologists (IFT) defines "functional foods" as:"[S]substances [that] provide essential nutrients often beyond quantities necessary for normal maintenance, growth, and development, and/or other biologically active components that impart health benefits or desirable physiological effects (Clydesdale 2004). The American Dietetic Association (ADA), a prominent organization of nutrition and dietetics experts, calls "functional foods: "whole, fortified, enriched or enhanced" that should be consumed regularly and at effective amounts in order to derive health benefits. (American Dietetic Association 1999, Hasler 2009).

International Food Information Council (IFIC), defines functional foods as 'foods or dietary components that may provide a health benefit beyond basic nutrition' while the International Life Sciences Institute of North America (ILSI) has defined functional foods as, 'foods that by virtue of physiologically active food components provide health benefits beyond basic nutrition' (Bagchi, 2008, Clydesdale 1999). The Institute of Medicine of the National Academy of Sciences of USA (IMNAS) limits functional foods to "those in which the concentrations of one or more ingredients have been manipulated or modified to enhance their contribution to a healthful diet" (IMNAS 1994).

Although the term functional foods may not be the ideal descriptor for this emerging food category, recent focus group research conducted by IFIC showed that this term was recognized more readily and was also preferred by consumers over other commonly used terms such as nutraceutical or designer foods (Schmidt et al., 1997). According to the wide definitions, unmodified whole foods such as fish and beef represent the simplest example of a functional food since they are rich in such physiologically active components as n-3 fatty acids and conjugated linoleic acid respectively. Modified foods,

namely those that have been enhanced with physiologically active components, from plant (phytochemicals) or animal (zoo chemicals) sources, also fall within the realm of functional foods. In addition, food biotechnology will continue to provide new venues for functional food development. (José & Cristina 2002). The wide applications of functional food are in form containing probiotics and non-digestible carbohydrate known as prebiotics (Fuller and Gibson, 1997).

All in all, Functional foods are normal foods and parts of the daily diet but they contain a component that benefits some particular physiological function and reduce the risk of diseases (Salovaaro, 1999). The wide applications of functional food are in form containing probiotics and non-digestible carbohydrate known as prebiotics (Fuller and Gibson, 1997). Clearly, all foods are functional, as they provide taste, aroma, or nutritive value. Within the last two decades however, the term functional as it is, applies to food that has adopted a different connotation as providing an additional physiological benefit beyond that of meeting basic nutritional needs (Hasler 1998). Recent broad use and acceptance of the term functional foods by media, scientists, and consumers makes it convenient to work within this framework rather than introduce a new more descriptive term because of concern that new terminology could lead to further confusion among consumers. (ADA 1999).

Functional foods from different animal sources

Functional foods are foods that, by virtue of their physiologically active components, provide health benefits beyond basic nutrition. Although the vast number of naturally occurring health-enhancing substances are of plant origin, there are also a number of physiologically active components in animal products that deserve attention for their potential role in health promotion. (José & Cristina 2022). Animal foods contain numerous physiologically-active components that have a significant effect on health promotion (Prates & Mateus 2002).

Dairy products are of no doubt considered as functional foods, they are one of the best sources of calcium, an essential nutrient which can prevent osteoporosis and possibly colon cancer. In view of the former, the National Academy of Sciences of USA recently increased recommendations for this nutrient for most human age groups. In addition to calcium, however, recent research has focused specifically on other components in dairy products, particularly fermented dairy products, known as probiotics. Probiotics are defined as "live microbial feed supplements which beneficially affect the host animal by improving its intestinal microbial balance" (Fuller 1994). Although a variety of health benefits have been attributed to probiotics, their anti-carcinogenic, hypocholesterolemia and antagonistic actions against enteric pathogens and other intestinal organisms have received the most attention. (Mital 1995). The hypocholesterolemic effect of fermented milk was discovered more than 30 years ago during studies conducted in Maasai tribesmen in Africa (Mann 1964) Maasai tribe was found to have low levels of serum cholesterol and clinical coronary heart disease despite a high meat diet while consuming daily 4 - 5 Liters of fermented whole milk. A number of human clinical studies have assessed the cholesterol-lowering effects of fermented milk products (Sanders 1994).

Whey proteins on the other hand were also found to have a putative anti-cancer activity (Macintosh et al., 1998) It was shown that these proteins are efficacious in retardation of colon cancer in young rats, compared with other dietary proteins as meat and soy, which can be a basis for their inclusion as ingredients in functional foods. Additionally, the foods containing whey proteins are generally highly acceptable in taste trials. A recent field of research are biological active peptide sequences of whey, which become effective during digestion and are of importance for secretion of entero hormones as well as for immune enhancing effects (Barth & Behnke 1997.)

Fish oil is well known for containing Omega-3 (n-3) fatty acids which are an essential class of polyunsaturated fatty acids (PUFA) (Simopoulos 1991). Researchers examined the role of n-3 fatty acids in a number of diseases - specifically cancer and cardiovascular diseases (CVD), the role that n-3 fatty acids may play an important role in CVD was first brought to light in the 1970s when Bang and Dyerberg 1972, reported that Eskimos had low rates of this disease despite consuming a diet which was high in fat. The cardio protective effect of fish consumption has been observed in some prospective investigations (Krumhout et al., 1985). As little as one serving of fish / week was associated with a significantly reduced risk of total cardiovascular mortality after 11 years in more than 20,000 USA male physicians (Albert et al., 1998).

Meat and meat products are considered a basic element in the human diet where they provide a series of essential substances for the human body, hence they guarantee the proper development of the human body and limit the occurrence of diseases associated with the deficiency of ingredients in it (Jiménez et al., 2001). Most consumers think that meat is a healthy and important component of the diet where meat and meat products are an important source of wholesome, easily digestible protein in their diet (Pereira et al., 2013). Meat and meat products are commonly considered as good resources of protein, and are considered a rich source of nutrients such as fatty acids, iron, zinc, vitamin B12, and folic acid (USDA/HHS Dietary guidelines Americans, 2010). The study report of (Mann 2000), stated that the diets rich in lean meat may influence the decrease in plasma cholesterol levels. Red meat contains bioactive compounds of a pro-health nature, including linoleic acid (CLA), carnosine, coenzyme Q10, taurine, creatine, which have a beneficial effect on human health. They

help to slow down the aging process through antioxidant properties (carnosine), control the correct work of myocardium (taurine), limit the occurrence in the human body of damage caused by the toxicity of heavy metals. and also help in reducing body fat – L carnitine (Williams 2007).

Eggs are an excellent dietary source of many essential e.g. protein, sphingolipids, choline and n-3 PUFA and non-essentiale.g. lutein / zeaxanthin components which may promote optimal health. Thus, the egg will continue to play an important role in the changing face of functional foods (Hasler 2000). The major food sources of sphingolipids, containing several mmol per kg of edible food, are eggs, dairy products and soybeans (Vesper et al., 1999).

Functional foods from different plant sources

People tend to consume higher amounts of plant foods having a lesser chance of developing cancer in comparison with the people taking lower quantities of fruits and vegetables as it is believed that plant foods consist numerous bioactive compounds in addition to nutrient constituents, (Block et al., 1992), these health-promoting beneficial constituents from plants were identified and labeled as "phytochemicals." by Steinmetz and Potter (1991).

Gum Arabic is derived from exudates of *Acacia Senegal* or *Acacia seyal* trees. It consists of a mixture of polysaccharides (major component) plus oligosaccharides and glycoproteins (Goodrum 2000). It is used as an emulsifier, thickening agent and flavor stabilizer in both the pharmaceutical and food industries. It is also used in textile, pottery and cosmetics industries. The FAO/WHO Joint Expert Committee for Food Additives defined it as a dried exudation obtained from the stems of A. Senegal or closely related species of Acacia (FAO 1990). Gum Arabic was evaluated for acceptable daily intake for man by the Joint FAO/WHO Expert Committee on Food Additives since 1969 (FAO/WHO 1970). It is indigestible to both humans and animals, not degraded in the intestine, but fermented in the colon to give short-chain fatty acids, leading to a large range of possible health benefits (Phillips & Phillips 2011). One of these benefits is its prebiotic effect It has been claimed that four-week supplementation with Gum Arabic (10 g/day) led to significant increases in Bifidobacteria, Lactobacteria, and Bacteriodes indicating a prebiotic effect (Calame et al., 2008). Two studies undertaken in the Sudan suggest and improvement in the biochemical profile of patients with end stage renal failure treated by haemodialysis following dietary supplementation with GA (50 g/day) (Suliman et al., 2000) (Ali et al., 2008).

Research interest in soy started in the 1990s being known as a very good source of protein, in addition to its role in decreasing the risk of cardiovascular diseases and cancer (Anderson et al., 1995). Different classes of anticancer compounds have been identified in soybeans; protease inhibitors, phytos-terols, saponins, phenolic acids, phytic acid, and isoflavones (Messina and Barnes, 1991). Soy proteins have been found to have a significant role in strengthening the bones (Anderson and Garner, 1997).

Garlic, been one of the most common herbs is considered as a significant herb for its therapeutic roles (Nagourney, 1998). One of the main constituents of garlic is allicin, which is responsible for its chemo preventive role (Reuter et al., 1996). Garlic health effects include cancer chemo preventive, antibiotic, anti-hypertensive, and cholesterol-lowering properties (Srivastava et al., 1995). Garlic contains inulin, a non-digestible polysaccharide, in the levels of 26–30% fresh garlic cloves and 77% in dried garlic a compound responsible for prebiotic activity. (José & Cristina 2000) . Kannar et al., (1998) recommended that the intake of garlic and inulin supplement may influence the growth of microflora, specifically in foods which have higher amounts of fats, carbohydrate, and dietary fiber.

On the other hand, Citrus fruits are rich in vitamin C, folate, and fiber, where the antioxidant properties depend on flavonoids, in addition to vitamin C, citrus fruits are playing a key role in reducing the probabilities of various cancers (José & Cristina 2000) this anti-cancerous property of citrus fruits was related to a group of phytochemicals labeled as limonoids (Hasegawa and Miyake, 1996). Crowell (1997) studied the cancer preventive effect where he found that it was effective against both spontaneous and chemically-induced rodent tumors.

Baobab (*Adansonia digitata*) belongs to the Malvaceae family and is a deciduous tree native to arid Central Africa (Yazzie et al., 1994). In Sudan, the baobab is most frequently found on sandy soils and by seasonal streams `khors' in short grass savannas. It forms belts in Kordofan, Darfur, and Blue Nile (El Amin, 1990). The different plant parts are widely used as foods, medicines; the bark fibers are also used (Gebauer et al., 2002, Sidibe and Williams, 2002). The baobab fruit pulp is probably the most important foodstuff, where it can be dissolved in water or milk and liquid then used as a drink, food source, a fermenting agent in local brewing, or as a substitute for cream of tartar in baking (Sidibe and Williams, 2002). The dry baobab fruit pulp has a slightly tart, refreshing taste and is very nutritious with particularly high values for carbohydrates, energy, calcium, potassium, thiamine, nicotinic acid and vitamin C (Arnold et al., 1985). Dietary antioxidants, including polyphenolics compounds, vitamins E and C, and carotenoid, are believed to be effective nutrients in the prevention of oxidative stress related diseases) such as inflammation, cardiovascular disease, cancer and aging related disorders (Kaur and Kapoor 2001, Willet, 2001). The high antioxidant capacity of products deriving from Adansonia digitata show their therapeutical, nutraceutical and cosmeceutical potential (Vertuani et

al., 2002; Besco et al., 2007). Due to its potential health benefits, Baobab fruit pulp is granted status in the European Union which will pave the way for its incorporation into several foods. Functional foods can be formulated using potential plant sources with and without probiotics; however, probiotics will enhance the value of the functional food because they aid the existing flora, or help repopulate the colon when bacteria levels are reduced by antibiotics, chemotherapy or disease (Salma 2015).

Global markets of functional food

Due to the differing definitions of functional food, there are specific difficulties in analyzing the development of the Functional Food market hence resulting in strongly varying estimations concerning the market volume of such products. Based on a definition of Functional Food by which ingredients with an additional health-value have been added to foods (and this is announced to the consumers), the global market of Functional Food is estimated to at least 33 billion US$ (Hilliam, 2000c). The functional food and nutraceutical industry represents in excess of a $75.5 billion US industry (Just-food, 2007) with prospects of growing to $167 billion by 2010 (Just-food, 2004). The United States of America (USA) currently possesses the largest and most rapidly expanding functional food and nutraceutical market in the world (World Nutraceuticals, 2006). In 2006 value of the industry was $21.3 billion (Datamonitor, 2007). Its strong domestic market supports major imports from Japan, North and South Korea, China, India, Brazil, the European Union (EU), Australia, New Zealand and other parts of the world (World Nutraceuticals 2006). In 2003 Canadian trade in nutraceuticals and functional foods represented 3% of the global market compared to the USA (35%) and EU (32%) (D'Innocenzo, 2006). According to the available estimations, the market of Functional Food products which make specific health claims on the packaging or in the advertising exceeds the volume of 2 billion US$ in Europe. In case a broader definition is used, it is estimated that the European Functional Food market has a monetary market volume of 4–8 billion US$ (Hilliam, 2000c).

Nutraceutical and functional food markets in the EU have grown over the past eight years, from about $1.8 billion out of a $5.7 billion global market in 1999 (Kleter et al., 2001) to $8 billion (Datamonitor, 2007) out of a global market of $75.5 billion (Just-food, 2007) in 2006.I ndia and China are the two most important countries known for their production of traditional functional food products and nutraceuticals. Both of these countries have large populations, in particular in rural, remote and inaccessible areas which are totally dependent upon herbal remedies and other naturally available bio resources which they use to treat common ailments, and as general preventive and protective medications (Dhanukar, et al., 2000). Japan is the second largest market in the world for nutraceutical products after the United States. Its nutraceutical market has exhibited a steady average growth rate of 9.6% per annum for the past decade, and in 2006 its functional food industry was estimated to have a value of $27.1 billion (Functional Food Japan, Project Report, 2006). Other large, emerging international markets in south and south-east Asia are seen in Taiwan, Sri Lanka, Thailand, the Philippines, Vietnam, Lagos, Kampuchea, Indonesia, Malaysia, North and South Korea (World Nutraceuticals, 2006).

Health and wellness continue to drive growth in the global food and beverage industry. Worldwide sales of naturally healthy foods reached $253 billion in 2017; functional/fortified foods totaled $247 billion, in developing countries, organic food and drink sales grew 9%, and free-from product sales were up 5%. Although the United States is the largest functional food and beverage market, Asia and Eastern Europe are driving sales, (Euromonitor 2018) . In 2017, 76% of adults used dietary supplements, an all-time high Seventy-three percent of adults took a multivitamin, (CRN 2017). Supplement sales reached $49 billion, up 6.2%, driven by increased use among Millennials, sales of functional snacks are projected to reach $8.5 billion by 2020, up 11% per year (NBJ 2018). Six in 10 want snacks that deliver health benefits beyond nutrition, up 8% over 2016; 59% want vitamins/minerals, and 57% seek an energy boost (Wyatt 2017).

The value of the global enriched food market (in minerals, vitamins and other nutrients) is estimated at USD 258.8 billion, including the functional one at USD 129 billion. In 2020, according to forecasts, it can grow up to 377.8 billion dollars. The Asian functional products market is worth USD 51 billion 40% of the global market. Almost 33 % goes to the US market and 20% to Europe, mainly to Great Britain, France and the Netherlands. Due to demographic trends in 2020 there are to be 723 million people in the world aged 66 and over, hence functional products that delay the effects of aging and strengthen the structure of bones and joints are becoming popular. It is mainly about products enriched with omega acids their market is expected to double in the coming years and functional chocolate. According to analysts, the sales of bitter chocolate in 2016-2021 will increase by 27%, mainly due to increased awareness and pro-health effects of polyphenols. Among the Asian countries, India is still a small but growing market. According to Frost & Sullivan's estimates, the sales of functional foods are expected to grow at a rate of 17.1 per cent. annually to reach 4 billion dollars in 2020. (Maciej 2018)

Demographic and lifestyle characteristics of functional food consumers

The awareness of consumers on the intake of healthier foods, comprising bioactive compounds has been increased tremendously. Those foods are termed as functional foods, designer foods, or nutraceuticals there has been recently an explosion of consumer interest in the health enhancing role of specific foods, containing

physiologically/biologically active components in addition to the nutrients, so-called functional foods, designer foods or nutraceuticals (Hasler, 1998). As the food industry has responded to consumer demand for a more healthful food supply, the variety of functional foods that are currently available to consumers has grown tremendously, and functional foods are becoming an increasing percentage of all new products. (American Food Institute, 1999).

In the United States nearly two-thirds of adults said that healthfulness had a significant impact on their food and beverage purchase decisions last year (IFIC 2017). More than half (55%) of adults said they lived a healthier lifestyle last year; feeling good was the top motivation for doing so (Mintel 2017a). Seven in 10 Millennials say they're taking a more holistic approach to their health; 60% of Gen Xers and 64% of Baby Boomers are doing so (Wyatt and Levin 2018). Members of the maturing Millennial generation are having children of their own and about 45% of U.S. adults are aged 50 and older, with the oldest Boomers aged 73. Given these demographics, it is expected that consumer emphasis will begin to shift toward fortified, functional foods and naturally nutrient-dense fare. Concerns about getting older, a new health condition, lack of energy, and having a baby are among the top motivators for taking action for health (Hartman 2015).

For the food industry, the driving force behind the functional food concept is to create a market niche to commercialize innovative products claiming beneficial physiological effects beyond those ordinarily associated with typical nutrients. Consequently, in the next few decades a range of newly developed functional foods will be introduced, accompanied by media messages and advertisements on the need to 'optimize' nutrition, health and quality of life (Jacobson & Silverglade, 1999; Sparling & Anderson, 2001). In addition, population aspects such as the increasing wealth of the developed world inhabitants, the ageing of the population and the accompanying increase in health problems contribute to the increasing interest in functional foods (Hasler, 2000). Individuals might actually use functional foods and/or dietary supplements as a means to compensate for an unhealthy lifestyle (Radimer et al., 2000).

Functional food is intended for people living under stress, elderly, metabolic and digestive disorders, athletes, pregnant and lactating women and infants. The functional food market is developing in fast pace around the world. (Arihara 2006). Different functional foods for different segments of the population have been marketed but it is not known who is using the foods, how frequent those foods are used and what characterizes these consumers. For general education purposes (Childs & Poryzees,1998). Stress and sleep are other emerging functional food and drink opportunities. A majority of adults in USA have trouble sleeping at least once a week. Expect more late-night snacks and calming drinks, especially teas (Packaged Facts 2017d). The reasons for the expansion of functional food in the XXI are: aging of societies, increase in the cost of medical and social care, an increase in the incidence of chronic diseases related to nutrition, the development of knowledge about biologically active, so-called nonnutrient food ingredients and their physiological impact on the human body, increase of consumer affluence in developed and developing countries, development of techniques and technologies of food processing, availability of nutraceuticals (Pereira 2013)

CONCLUSION

Functional food market is a promising market for the future, taking into consideration the changing consumer lifestyle specially in the internet era. Rising consumer awareness together with the global concern for food security and food safety resemble strong opportunities for Sudan to participate in the market of functional food. Most food considered as functional food is already indigenous in Sudan and for these products to compete in the global market, strong marketing strategies together with new technological production practices for such products should be incorporated. Functional food market is a promising global market for Sudan, that if handled in well-designed strategies could boost the agricultural economy of the country.

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