KNOWLEDGE, ATTITUDES, AND PRACTICES REGARDING FUNCTIONAL FOODS AMONG STUDENTS IN UNIVERSITI SAINS MALAYSIA

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ABSTRAK

Makanan fungsional boleh dikatakan berfungsi sekiranya ina bertindak untuk memberi kesan yang baik terhadap satu atau lebih sasaran fungsi dalam badan. Pengetahuan, sikap dan tingkah laku saling berkait dalam memberi kesan terhadap persepsi dalam kalangan pelajar universiti mengenai pengambilan Makanan Fungsional. Kajian ini dijalankan adalah bertujuan untuk mengetahui persepsi mengenai tahap pengetahuan, sikap, dan tingkah laku terhadap makanan fungsional dalam kalangan pelajar universiti. Keseluruhan jumlah responden yang diperolehi untuk mengambil bahagian dalam kajian ini adalah 200 orang pelajar universiti di mana majoritinya adalah dari Pusat Pengajian Sains Kesihatan (PPSK) di Kampus Kesihatan Universiti Sains Malaysia (USM). Para pelajar dipilih secara rawak bagi menjawab borang soal selidik. *Likert-scale* yang digunakan dalam penialaian jawapan borang soal selidik di mana min skor ≥ 50 menunjukkan pelajar tersebut mempunyai tahap pengetahuan, sikap, dan tingkah laku yang tinggi. Hasil daripada kajian menunjukkan pelajar perempuan (n=132; 66%) melebihi jumlah pelajar lelaki (n=68; 34%) yang terlibat dalam kajian ini dan majoritinya adalah daripada pelajar kaum Melayu (n=160; 80%). Di antara ciri-ciri sosio-demografik (jantina, umur, dan tahap pendidikan), faktor jantina menunjukkan perbezaan yang signifikan dengan jumlah skor pengetahuan ($p<0.012$). Manakala, kajian menunjukkan korelasi yang negatif di antara skor pengetahuan dengan skor sikap ($r= -0.049$) dan tingkah laku ($r= -0.006$) diuji dengan menggunakan *Spearmans' Correlation*. Di samping itu, perkaitan di antara persepsi dengan ciri-cir sosio-demografik pula diuji dengan menggunakan ujian *Chi-squared* dan menunjukkan tiada sebarang perkaitan di antaranya. Maka, ia adalah penting untuk kita mengetahui dan menilai kadar pengetahuan, sikap dan tingkah laku iaitu amalan semasa pengambilan makanan untuk mengetahui jika persepsi universiti mengenai Functional Foods adalah betul.

ABSTRACT

Functional foods can be regarded as food that satisfactorily acted to give advantageous effect on one or more target functions in the body. Knowledge, attitude and practices were shown to have an effect on the university perceptions regarding the functional foods consumption. This cross-sectional study aimed to determine the perceptions of the knowledge, attitudes, and practices on functional foods among university students. A total of 200 university students especially among Health Campus University Sains Malaysia (USM) students from the School of Health Sciences (PPSK) was recruited to participate in this study. Students were conveniently selected to complete the validated 'Knowledge, Attitudes and Practices regarding Functional Foods' Questionnaires. Likert scale was used to analyzed the answers, where a mean score $\geq$50 indicated that students have high knowledge, attitudes, and practices levels. There were more female (n=132; 66%) than male (n=68; 34%) students involved and majority were Malays (n=160; 80%). In terms of gender have showed significant difference with the knowledge scores ($p<0.012$) compared to other socio-demographic factors did not show any significant differences with knowledge, attitudes, and practices score. There were negative correlation between the knowledge scores with attitudes ($r= -0.049$) and practices ($r= -0.006$) scores tested by using Spearmans' correlation. Meanwhile, the association between perceptions with socio-demographic characteristics were test using Chi-squared test where the results had shown there is no significant association between it ($p>0.05$). Therefore, it is important to assessed university students' knowledge, attitudes and current practices of food consumptions to know if their perceptions are right about functional foods.

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DECLARATION

I hereby declare that the thesis is my original work except for the quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently submitted for any other degree or purposes in Universiti Sains Malaysiaor at any other institutions.

NURUL AIN BASIRAH BT MOHD SALLEH

Date:

I certify that Ms Nurul Ain Basirah bt Mohd Salleh has carried out her study entitle Knowledge, Attitudes and Practices among University Students regarding Functional Foods as a final year research project in nutrition under my supervision. She has compiled with the ethical standard and regulation in conducting her study and has completed writing her thesis. I am satisfied with her work and have no objections for the thesis to be examined by the appointed examiners by the school of Health Sciences, university Sains Malaysia.

Thank You.

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LIST OF ABBREVIATIONS

BMI	Body Mass Index
ADA	American Dietetic Association
ILSINA	International Life Sciences of North America
FNB	Food and Nutrition Board-Institute of Medicine
FUFOSE	Functional Food Science in Europe

CHAPTER 1: INTRODUCTION

1.0 Introduction

1.1 Background of Functional Foods

Functional foods can be defined as a food that can promote health beyond providing basic nutrition (Sanders, 1998). Furthermore, functional foods are involved in variety of body functions relevant to either a state of well-being and health and/or to reduce of the risk of getting diseases (Roberfroid, 2002). Besides that, functional foods play roles in improving physiological functions such as biorhythms regulations, the neuro-system and the immune system as stated by Japanese ad hoc national project in 1984 (Shimizu, 2003).

The awareness and perceptions towards functional foods among consumers are important as it could greatly benefit the consumers if they include these foods in their daily diets (Vella et al., 2014). The functional foods development reflects this shift in attitudes between diet and health (Alzamora *et al.*, 2005). The origin of the nutrition and health information could potentially influence the acceptance of functional food products by communicating the health benefits of such products but the benefits will not be directly perceived by the consumers.

Therefore, there is an influence in perceptions of functional food products in the information pertaining to health benefits and the ways of the information is communicated by the consumers. Apart of that, the nutrition information sources on food labels, particularly health claims could also influence the acceptance of functional foods

among consumers which will result in more favorable attitudes towards functional foods and has a positive influence on consumer's perceptions on healthiness of functional foods (Vella *et al,* 2014).

During 2009-2010, obesity has become a serious health concern as more than one-third of adults, or about 78 million people, were obese (defined as body mass index (BMI) $\geq$30 kg/m^2). While for youths aged 2-19 years, nearly one of five were obese (BMI $\geq$95th percentile). About half of all adults in the US which about 117 million people in 2012 were diagnosed with one or more chronic health conditions where one of four adults had two or more chronic health conditions. In addition, seven of the top 10 causes of death in 2010 in the US were chronic diseases. Heart disease and cancer are the two chronic disease that together accounted for nearly 48% of all deaths (*Centers for Disease Control and Prevention*, 2015).

Hence, the initiative to develop functional foods is very vital as the goals are to improve or maintain the quality of life and to prevent the life style-related disease before medical treatment is required (Shimizu, 2003) .

1.2 Problem Statement

A variety of lifestyle factors and health related behaviors have an effects on a persons' health such as alcohol consumption, physical activity, and dietary habits where it often resulting in a higher risk of chronic diseases like heart disease, hypertension, hypercholesterolemia, and diabetes (Cheong *et al.,* 2015). In addition, from National Health and Morbidity Survey (2011), have stated that 92.5% which was about 16.4 million of adults aged 18 years and above had reported to consumed less than 5 servings of fruits and vegetables per day, this suggests that the dietary practices among them are not healthy. Moreover, dietary habits are affected by the fast-food market and overweight and obesity have become as a consequences observed among the young (Yahia *et al.*, 2008). According to Faber *et al.* (2002), there are increasing in demands displays among many consumers for convenience foods in order to manage time and work more efficiently, which has become as trend that is likely to continue as young consumers take their habits into their older age. Besides, nutritional knowledge also have a significant impact on consumers' perception and acceptance of functional foods where lack of knowledge about the benefits related to the consumption of a functional ingredient could discourage the consumption of functional foods (Ares *et al.*, 2008). Therefore, it is important to assess the university students as a young consumer regarding their perceptions and level of knowledge about functional foods.

1.3 Significance of the Study

This study will enable to explore the perceptions of university students regarding the importance of functional foods. Functional foods represent foods that could give positive impacts towards our health. Thus, their perceptions could affect their decision in consuming functional foods. Comprehensive research result from this study can be used to support the demands in improving the quality of food productions. Besides, this study will assist the food industry in producing healthy foods as it will enable them to understand the potential in marketing functional food products and the importance of functional foods to the consumer's health. Labeling of functional foods is important as it provide the right information to the consumers about foods they consume besides increasing the public knowledge of health function in consuming functional foods. In addition, from this study we will help to promote or create awareness regarding the importance of functional foods among consumers.

1.4 Research Objective

1.4.1 General Objective

- To assess the perceptions of knowledge, attitudes, and practices on functional foods among university students.

1.3.2 Specific Objectives

- To determine the difference between socio-demographic factors for level of knowledge scores among university students in USM, Kelantan towards functional foods consumption.
- To determine the difference between socio-demographic factors for attitudes scores among university students in USM, Kelantan towards functional foods consumption.
- To determine the difference between socio-demographic factors for practices scores among university students in USM, Kelantan towards functional foods consumption.
- To determine the association between socio-demographic factors and level of knowledge, attitudes, and practices scores among university students in USM, Kelantan towards functional foods consumption.
- To determine the association between level of knowledge and attitudes and practices scores among university students in USM, Kelantan towards functional foods consumption.

1.5 Research Hypothesis

1.5.1 Hypothesis 1

Null Hypothesis (H_0)

- There is no significant difference between socio-demographic factors with level of knowledge scores among university students in USM, Kelantan towards functional foods consumption.

Alternative Hypothesis (H_A)

- There is significant difference between socio-demographic factors with level of knowledge scores among university students in USM, Kelantan towards functional foods consumption.

1.5.2 Hypothesis 2

Null Hypothesis (H_0)

- There is no significant difference between socio-demographic factors with attitudes scores among university students in USM, Kelantan towards functional foods consumption.

Alternative Hypothesis (H_A)

- There is significant difference between socio-demographic factors with attitudes scores among university students in USM, Kelantan towards functional foods consumption.

1.5.3 Hypothesis 3

Null Hypothesis (H_0)

- There is no significant difference between socio-demographic factors with practices scores among university students in USM, Kelantan towards functional foods consumption.

Alternative Hypothesis (H_A)

- There is no significant difference between socio-demographic factors with practices scores among university students in USM, Kelantan towards functional foods consumption.

1.5.4 Hypothesis 4

Null Hypothesis (H_0)

- There is no significant association between socio-demographic factors and level of knowledge, attitudes, and practices scores among university students in USM, Kelantan towards functional foods consumption.

Alternative Hypothesis (H_A)

- There is significant association between socio-demographic factors and level of knowledge, attitudes, and practices scores among university students in USM, Kelantan towards functional foods consumption.

1.5.5 Hypothesis 5

Null Hypothesis (H_0)

- There is no significant association between level of knowledge, attitudes and practices scores among university students in USM, Kelantan towards functional foods consumption.

Alternative Hypothesis (H_A)

- There is significant association between level of knowledge, attitudes and practices scores among university students in USM, Kelantan towards functional foods consumption.

1.6 Conceptual Framework

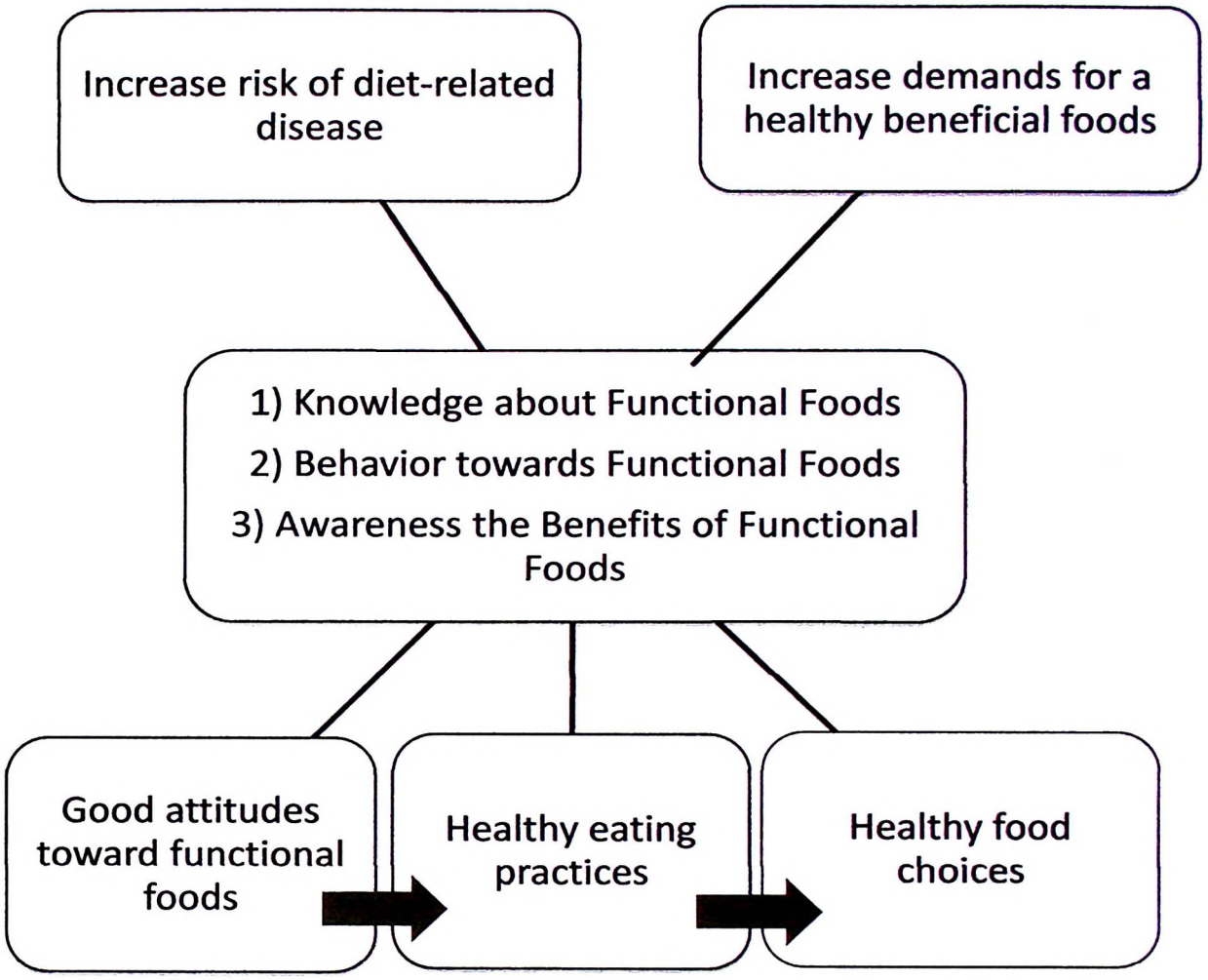

Figure 1.1: Conceptual Framework of the study

CHAPTER 2: LITERATURE REVIEW

2.0 Literature Review

2.1 Definitions of Functional Foods

Functional foods has kind of definitions based on several view from previous studies. The healthiness in food choices can be expressed through new way by providing a functional food (Saher *et al.*, 2004). If the food satisfactorily acted to give advantageous effect on one or more target functions in the body, so it can be regarded as 'functional' (Diplock, *et al.*, 1999). According to Niva (2007), a food marketed was regarded as functional as it contains added, technologically developed ingredients with a specific health benefit.

Besides, a food that is consumed in purpose to promote health beyond providing basic nutrition, it is termed as 'functional foods' where it is defined as a modified food or food ingredients that will give advantages by providing a health beyond satisfying traditional nutrient requirements (Sanders, 1998). International Food Information Council (2013) also admits that these functional foods containing of a variety of food components and could provide beneficial effects on human health which may reduce the risk of getting disease and promote optimal health (Food Insight, 2013).

On the other hand, the European Commission's Concerted Action on Functional Food Science in Europe (FuFoSe), also has defined functional food as follows: "a food product 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 condition or/and decreasing the risk of the evolution of diseases. The amount of intake and form of the functional food should be as it is normally expected for dietary purposes. Thus, functional foods cannot be in the form of pill or capsule just as normal food form", (Diplock *et al.,* 1999). In addition, the General Food Law Regulation is applicable to all foods where legislation on dietetic food, genetically modified organism (GMO), food supplements or on novel foods depending on the nature of the product and on their use (Niva, 2007).

However, even though the term of functional foods has been defined for several times, but so far there is no unitary accepted definition for this group of food (Alzamora *et al.,* 2005). This is because, there is no legislative definition of the term and drawing a border line between conventional and functional foods in most countries and it was challenging even for nutrition and food experts (Mark-Herbert, 2004).

2.2 Functional Foods Background and Concept

Nowadays, the purpose of foods are not only to satisfy hunger and to provide nutrients that are needed by humans, but also to prevent nutrition-related diseases and improve physical and mental well-being of the consumers (Menrad, 2003; Roberfroid, 2002). Therefore, functional foods play an outstanding role as such foods have an increasing in demands and it can be explained by the increasing cost of healthcare, the steady increase in life expectancy, and the desire of older people for improved quality of their later years (Kotilainen, 2006; Roberfroid, 2002).

In Japan, the term "functional food" was first used in the 1980s, for food products fortified with special constituents that possess advantageous physiological effects (Hardy, 2000). Furthermore, functional foods that have attract the Japanese interest have also brought awareness for the need of such products in places like Europe and the United States where they realized that besides being able to lower the cost of healthcare of the aging population, functional food might also give a commercial potential for the food industry as well (Fern, 2007).

The concept of functional foods which is first promoted by the Japanese scientist in 1984 whose studied the relationship between nutrition, sensory satisfaction fortification and modulation of physiological systems. The rule for approval of a specific health-related food category which is called as FOSHU (Food for Specified Health Use) is introduced by Ministry of Health in 1991, which included the establishment of specific health claims for this type of food (Menrad, 2003; Roberfroid, 2002). Besides, in Europe and USA, the concept of functional foods was adding functionality to an existing traditional food product and such food products do not create a separate group (Fern 2007).

The key concept of functional foods is to either improved state of health and well-being and/or reduction of risk of disease which is relevant to adequate nutritional effects by functional foods consumption. It will remain as foods and part of a normal food pattern which are not in form of pills or capsules. It has to reflect their effects in amounts that can normally be expected to be consumed in the diet. Functional foods can either be a natural food, a food which have been added with a component, or a food where a component has been removed by technological or biotechnological means. Otherwise, it

also can be a food where modification of the nature of one or more components is done, or a food where one or more of their components bioavailability has been modified, or any combination of these possibilities (Diplock, et al., 1999).

The Ministry of Education, Science, and Culture in Japan in anticipation have started a project concerning food functionality where the concept of functional food is defined that consists of three functions of foods, which the primary function is a nutritional function, which is essential to human survival. The secondary function is a sensory function that involved both flavor and texture to satisfy sensory needs. While, the tertiary function is physiological functions for instances, the regulations of biorhythms, control of aging, the immune system, and body defense (Shimizu, 2003).

In the context of Malaysian, functional foods can be viewed as food that can be procured like any other food but it has health-enhancing properties which their ingredients can have medicinal value but medicine itself is not a functional food (Siti Hasnah, 2011).

2.3 The Demand of Functional Foods

2.3.1 The Global Market of Functional Foods

Globally, the market of functional foods such as in the US market at the moment is relatively underdeveloped same goes to the market in Europe. Even though, the development of functional foods market has been led in Japan, there are actually fundamental differences between the markets in the West and the East. Furthermore, functional foods in Japan, they are tend to be regarded as a distinct class of product,

whereas in the West they are seen more as incremental developments of existing products to fit the scientific consensus development on how foods may influence health in a positive manner (Hilliam, 1998).

However, although the market development has been rather fragmented, there is a wide and growing range of functional foods on the market in Europe. The consumers have become more familiar with functional foods as the interest in health and diet has arises among them, thus the market positioning as many products has changed where they put the priority on benefits of health. The market of functional foods have been influenced by several factors such as changing in consumers attitudes and expectations, growing understanding of the link between dietary constituents and physiological processes, food science and technology advances and also changes in the regulatory environment (Hilliam, 1998).

It is estimated that at least 33 billion US$ for the global market of the functional food according to definition of functional food by which ingredients with an additional health value have been added to foods (and this is announced to the consumers) (Siro *et al.* 2008). Therefore, in count for total, the market of functional food has a share of around 2-3% in the US food market (Menrad, 2003; Siro *et al.*, 2008) and this percentage are expected to be doubled by 2008 (Benkouider, 2005).

In Japan, there are more than 1700 functional food products have been launched between 1988 and 1998 with an estimated turnover of around 14 billion US$ in 1999, whereas in Europe, the market for functional foods were estimated to be between 4 and 8 billion US$ in 2003 depends on the foods which are regarded as functional (Menrad,

2003). In 2006, the value functional foods market has increased to around 15 billion US$ (Kotilainen *et al.* 2006).

There are several countries in Europe such as Germany, France, United Kingdoms and Netherlands that represents the most important countries within the functional food market (Siro *et al.* 2008). In Turkey, although the market of functional food is still in the primary phase, the chance for it for the development is bigger which is increasing day by day where there were increasing in market by 18.3% according to previous year which the market of functional food have reached 420 million TL in 2007 (Bilgic & Yiiksel, 2012).

2.4 Examples of Functional Foods Products

The physiologically active components in foods from both plants and animals (known as phytochemicals and zoo-chemicals, respectively) have been identified by the scientist as it potentially could reduce risk for a variety of chronic diseases (Hasler, 2002). From epidemiological perspective, there is also a large amount of evidence, in vivo, in vitro and clinical trial data, indicating that a plant-based diet can reduce the risk of chronic disease, particularly cancer (Rafter, 2002).

The development of functional foods was in virtually all food categories where the functional property can be included in many different ways such as in types of fortified, enriched altered or enhanced products of functional foods (Siro *et al.*, 2008). Besides, the consumer health concerns and product preferences may differ between markets as functional food products are not homogenously scattered over all segments of the food and drink

market and these products have been launched mainly in the dairy-confectionary, soft-drinks, bakery, and baby-food market (Kotilainen, 2006; Menrad, 2003).

2.4.1 Probiotics

Many research activities have increasing in recent years focusing on one such example of a functional foods which is probiotics that can be defined as live microbial feed supplements that beneficially affect the host animal by improving its intestinal microbial balance (Fuller, 1989). The market of functional foods in Japan and Europe is dominated by gut health products, in particular with 379 products are launched worldwide in 2005 (Alzamora *et al.*, 2005; Siro *et al.* 2008).

According to Charalampopoulos *et al.* (2002), they define the probiotics as "live microorganisms, as they are consumed in adequate numbers confer a health benefit on the host". Therefore, the employed bacteria within the probiotics usually refer to highly selected lactic acid bacteria, such as Lactobacillus spp., Bifidobacterium spp. And Streptococcus spp., with defined gut survival properties and associated biological activities, that can be ingested in fermented milk products or as a supplement (Rafter, 2002).

The key product sector which is probiotic dairy products as it accounted for sales of around 1.35 billion US$ in 1999 and in 2004 the global sales are about 56% of functional foods' total 31.1 billion US$. The main markets of dairy probiotics such as Scandinavia, the Netherlands, Switzerland, Croatia, Estonia, while there are several countries that can be considered as developing markets of dairy probiotics which are Greece, France and Spain (Siro *et al.* 2008). During this recent years, there was an impressive growth of such products, bringing

the market volume in Germany from around 5 million US$ in 1995 to 419 million US$ in 2000, of which 301 million US$ account for pro-, pre-biotic and other functional yogurts and around 118 million US$ for functional dairy drinks (Menrad, 2003).

However, a great number of special new dairy products such as Synbiofir drinking kefir, Synbioghurt drinking yoghurt, HunCult fermented drink, Milli Premium sour cream, Aktivit quark dessert, New Party butter cream, and Probios cheese cream have been produced as a results from an extensive research and development activity concerning probiotics (Szakaly, 2007) and its successful also can be explained by general positive image among consumers about dairy probiotics (Makinen-Aakula, 2006; Szakály *et al.*, 2012). In addition, there are some commercial examples of probiotic products generally such as Yakult, Actimel, ProViva, Snack Fibra and many more (Siro *et al.,* 2008).

2.4.2 Prebiotics

Prebiotics can be defined as non-digestible food ingredients which eventually will give beneficial effect to the host by stimulating the growth and/or activity of one or a limited number of bacteria in the colon, therefore it will improved the health of the host (Charalampopoulos *et al.*, 2002; Stanton *et al.*, 2005). It is estimated that around 167, 000 tons and 390 million Euro the total of demand for prebiotics in the worldwide. The main components of prebiotics were such as Fructo-oligosaccharide (FOS), inulin, isomalto-oligosaccharide (IMO), polydextrose, lactulose, and resistant starch (Bilgic & Yiiksel, 2012). These combinations of prebiotics components containing in the foods are often referred to as symbiotic due to the potential synergy between probiotics and prebiotics (Siro *et al.*, 2008).

2.4.3 Functional Drinks

Functional drinks are another important product category within the functional food segment which is non-alcoholic beverages that fortified with vitamins A, C, and E or other functional ingredients. The market is still small and fragmented in most European countries even though there as a relatively high number of a product available in this segment. The only country in the Europe which is Germany, with a sizeable functional drink market, mainly due to the success of ACE drinks in this country (Hilliam, 1998).

More than 117 million of vitaminized non-alcoholic beverages were consumed in Germany in 2000, which equals to around 1% of the total consumption of these beverages (Menrad, 2003). It is estimated that the European functional drink to be around 7% of the total soft drink market in 2004, with a further increase to 8% in 2005. By the year of 2009, the consumption of functional drink according to the predictions will reach 5.1 billion, which corresponds to 23% increase compared to the year of 2005 (Siro *et al.*, 2008).

According to Keller (2006), examples of other types of functional drinks are those of cholesterol-lowering drinks (with combination of omega-3 and soy), "eye health" drinks (with lutein) or "bone health" drinks (with calcium and inulin). Besides, fortified juices for an example in Estonia, are produced under the trade name of Largo containing inulin, L-carnitine, vitamins, calcium and magnesium as functional ingredients (Tammsaar, 2007).

2.4.4 Functional Cereals

In the production of functional foods, cereals, in particular oat and barley, have offer an alternative options where it can be used as fermentable substrates for the growth of probiotic microorganisms. Some components containing in the functional cereals which are water-soluble fiber, (beta-glucan and arabinoxylan, oligosaccharides) such as galacto- and fructo-oligosaccharides and resistant starch. Besides, some components such as beta-glucan also can be applied in the dairy and bakery industries (Charalampopoulos *et al.*, 2002). In addition, other than promoting several beneficial physiological effects, it also can be applied as sources of non-digestible carbohydrates and can selectively stimulate the growth of lactobacilli and bifidobacteria present in the colon and act as prebiotics (Siro *et al.*, 2008). Recently, other EU research have been performed in order to design different foods with improved functionality and superior health effects using cereal beta-glucans (Poutanen, 2006).

2.4.5 Bakery products

Bakery products are still relatively underdeveloped even though the popularity of functional foods is rapidly increasing in such sectors as dairy products or confectionary. For instances, during 2001 where about 20-21% of the new functional food products were launched in Germany, and only about 13% were from the bakery industry launched (Menrad, 2003). Same as at the Spain where the total dairy products launched was 45% of functional foods to about only 13% of bakery products were launched in 2006 (Siro *et al.*, 2008).

For an example, in late 2003, the bakery store was innovated by Unilever through introducing a white bread called Blue Band Goede Start, which was the first white bread containing the nutritional elements normally available in brown bread including fibers, vitamins B1, B3, and B6, iron, zinc, inulin, a starch that comes out from wheat (Benkouider, 2005). It is an important elements in ensuring the developer of functional bakery products (including bread), to realize that achieving functional food quality does not simply involve delivering the active principle at the appropriate level for physiological effectiveness, but also supplying a product which meets the consumers' requirements in terms of appearance, taste and texture (Alldrick, 2010).

2.4.6 Spreads

Cholesterol-lowering spreads can be assumed to gain increasing relevance in the coming years due to the market introduction of functional variety of Becel margarine of Unilever, those containing phytostanols esters which are supposed to lower the cholesterol level (Siro *et al.*, 2008). In Belgium, since 1992, low-cholesterol butter under the trade name of Balade™ has been produced and marketed over there. About 90% of cholesterol in this case has been removed by the addition of crystalline beta-cyclodextrin to the molten butter. Therefore, other products of low-cholesterol milk such as cheese, cream, or even low0cholesterol egg, are produced by this technolody (Szente and Szejtli, 2004).

2.4.7 Functional Meat

Functional meat can be considered as functional foods as the meat and its derivatives which contain numerous compounds thought to be functional. By making the health as a priority rather than for nutrition through the use of food, had opens up a whole new field for the meat industry. Furthermore, it can give more opportunities to the meat industry to have an exploration on various possibilities, including the control of the composition of raw and processed materials via reformulation of fatty acid profiles or inclusion of antioxidants, dietary fiber or probiotics, and many more (Siro *et al.*, 2008).

2.4.8 Functional Eggs

Particularly, eggs have become an interest from a functionality point of view, this is because it contains numerous compounds that are relatively rich in fatty acids and the associated fat-soluble compounds. In determinants of human health, the type and ratio of fatty acids is important. VITA eggs are produced by Freshlay Foods (Devon, UK), where the idea of egg enrichment with omega-3 fatty acids simultaneously with antioxidants and other vitamins has been used recently. In addition, they state that their eggs were enriched with several components such as omega-3 fatty acids, Se, vitamins D, E, B12, and folic acid. Furthermore, eggs that is enriched with omega-3 and vitamin e are produced by Belovo that is first appeared in Belgium in 1997, and since then they continually been sold in the UK, the Netherlands, India, Japan, and South Africa (Surai and Sparks, 2001).

2.5 Consumers Acceptance of Functional Foods

The acceptance of the consumers of the concept of the functional foods, and a better understanding of its determinants are widely recognized as key success factors for market orientation, consumer-led product development, and successfully negotiating market opportunities (Weststrate *et al.*, 2002). The consumers are more prominent today than ever before for the need to understanding functional foods for several reasons (Verbeke, 2005).

Furthermore, the acceptance of consumers on functional food products, its central barrier would seem to be constituted by the fact that these foods are assessed on a product by product basis and do not constitute a distinct product category that is operative in the context of shopping (Korzen-Bohr and Jensen, 2006). Some research have shown that, young consumers are a particularly interesting demographic group for researh where they are more likely to accept novel products (Zychowicv, 2009).

According to the previous study, although the young consumers are familiar with the concept of functional foods, they think that the most important functional food attributes are taste and price/quality ratio and rarely pay attention to brands and they are influenced mostly by advertising and labels they read at the point of purchase. Besides, there are three factors that contribute to their attitudes towards functional foods which are health awareness and confidence, lack of trust for functional food and its price and quality (Markovina et al., 2011).

CHAPTER 3: METHODOLOGY

3.0 Methodology

3.1 Overall Study design

This study design for this study is cross-sectional study. Cross-sectional study is the type of research study where either the entire population or a subset thereof is selected, and from these individuals, data are collected to help answer research questions of interest (Olsen and St George, 2004). Through this study design, the knowledge levels, attitudes, and behaviors on functional foods among Universiti Sains Malaysia (USM) in health campus students towards functional foods can be determined. Data collection began in the early March 2016 and completed in the end of April 2016. At least two months are the estimated duration to complete the data collection process. Data collection was done in the health campus USM, Kota Bharu, Kelantan. The participants from PPSK students were randomly selected around health campus USM.

3.2 Study Sample

Study sample involves university students from Universiti Sains Malaysia (USM) Health campus Kota Bharu, Kelantan, with majority were from School of Health Sciences (PPSK). The participants that meet all the inclusions and exclusions criteria have become eligible to join the study. The study population includes students from different religion, ethnic, cultural practices, economic, and social background.

3.5 Sampling Method

This study used random sampling method. In this study, students were randomly approached by the researcher around the health campus of USM, with aim to include students from different academic programs. Briefing regarding the study procedures was given by the researcher to students to make them clear with relevant information as well as the consent forms was given to the students. The study proceed when the participants are willing to participate in this study and return the consent form to the researchers, then all participants were provided with questionnaires to complete the study procedures.

3.6 Sample size

The main purpose of this study was to determine the perceptions of university students in USM regarding the functional foods consumption. Appropriate sample size is required to complete the study. The estimation of population size for students in health campus USM is based on population size of PPSK students. The population size of PPSK students is about 1378 in total. Therefore, the calculation of sample size was done by using Raosoft Software (Raosoft, 2004). By using Raosoft sample size calculation, the margin error is set as 5%, confidence interval is 95% and response distribution 50%. Thus, the recommended sample size is 301 participants. However, only 200 participants are included and completed the study within the study period, whereas 81 participants were dropped from the study due to incomplete data and unreturned questionnaire.