

# Consumption Habits of Low-Fat Plant Sterol-Enriched Yoghurt Enriched with Phytosterols

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**Abstract**—The increasing interest in plant sterol enriched foods is due to the fact that they reduce blood cholesterol concentrations without adverse side effects. In this context, enriched foods with phytosterols may be helpful in protecting population against atherosclerosis and cardiovascular diseases. The aim of the present work was to evaluate in a population of Viseu, Portugal, the consumption habits low-fat, plant sterol-enriched yoghurt. For this study, 577 inquiries were made and the sample was randomly selected for people shopping in various supermarkets. The preliminary results showed that the biggest consumers of these products were women aged 45 to 65 years old. Most of the people who claimed to buy these products consumed them once a day. Also, most of the consumers under antidiabetic therapeutics noticed positive effects on hypercholesterolemia.

**Keywords**—Consumption habits, fermented milk, functional foods, low fat, phytosterols.

## I. INTRODUCTION

**D**IETARY habits as an essential part of the lifestyle play a major role in health and in determining prevalent chronic diseases.

Most of the studies present in literature demonstrate that health, well being and longevity are strictly related with the biochemical diversity of nutrients present in the food that we eat. Several authors have established that specific nutrients (vegetables, fruits, fish and dried fruits) and detailed food standards (Mediterranean foods, vegetarian foods) may have important interactions with genes, proteins and distinct metabolic pathways [1].

In recent decades a new paradigm in nutrition has emerged: foods that claim to provide greater health and wellbeing and prevent the risk of disease, the so-called "functional foods" and "nutraceuticals" beyond their basic nutritional function [2].

The first alleged functional foods were launched in Japan in 1991 with the introduction of a new category food named FOSHU (Food for Specific Health Use) to reduce the growing

costs in the health sector. However, to be classified in this way, it would be necessary to scientifically prove the positive effects of these foods to health. Besides, this food should also be considered as food and not as a supplement.

As there is no official definition for Functional Foods, the Functional Food Science in Europe adopted this definition "A food may be considered functional if demonstrated that it presents physiological benefits to health and/or reduces the risks of chronic diseases, besides its nutritional basic functions".

Cardiovascular system is the main target of these functional foods in which plant sterols are featured. The term nutraceutical is used to describe a component with therapeutic or nutritional action, being part of a food, plant or other substance of natural origin that might have been purified or concentrated and is used for health improvement through the prevention or treatment of a disease. In Europe, security is organized by several scientific evaluations that take place under different rules dealing with quality control.

Any novelty in foods and its procedures regarding to the evolution efficiency implies the application of new rules on health claims or healthy properties.

### A. Plant Sterols as Functional Foods

Plant sterols are considered as an example of functional foods [3] that have been recently evaluated in Europe [4] mainly in terms of security characteristics mentioning very little about the effectiveness and its possible benefits in health.

In order to strengthen these evaluations we may also consider the use of follow-up studies as an additional strategy against uncertainties that will only be undertaken with historical analysis.

Consumers are increasingly concerned about the way food influences health and this is one of the reasons why food industry has reacted with more detailed nutrition information on labels and has responded with increased detailed nutrition information on labels to statements concerning the beneficial effects of some foods or components.

The enrichment of various foods with phytosterols is submitted throw a rigorous scientific evaluation to prove its security and effectiveness, both demonstrated by animal and clinical studies.

Vegetable sterols are naturally present in fruits, vegetables and grains where they play a natural role in the stabilization of cellular membranes [5]. These compounds have similar chemical structure with cholesterol and compete with it in the intestine to form lipid micelles by which the absorption takes place; they also affect the specific transport system through

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the membrane of cholesterol and they also can act in other cellular processes. As they cannot be synthesized by the organism, they are obtained by the consumption of foods rich in these compounds. [6].

Values of 1-3 g/day are considered enough to diminish the LDL cholesterol without affecting the HDL cholesterol but implying also the use of foods rich in liposolubles vitamins and beta-carotene vegetables.

The introduction of new functional products with phytosterols, was initially made in Finland (enriched with stanols) and especially from the release of a novel food margarine enriched with phytosterol esters (8%) for marketing in the European Union in 2000 [4] which gave rise to numerous initiatives to enhance many foods (from bakery products to drinks) with phytosterols. This in turn raised some important issues namely claims or health claims, labels, interactions, cumulative intake of active principles, economic and ethical aspects, etc not only related to this particular case, but also of many possibilities of enrichment in several products.

#### B. Plant Sterols Benefits

Regarding the cardiovascular disease, the European Guidelines on cardiovascular disease prevention in clinical practice [7] recommended the use of omega-3, soluble fiber, nuts, garlic, tea, wine and phytosterols as nutrients to reduce the risk of cardiovascular disease [8].

In vitro studies suggested that vegetable sterols (sitosterol and campesterol) can affect atherosclerotic plaque formation diminishing the circulating of lipids and also delaying the growth and proliferation of the smooth muscle cells [9].

Literature also reports [10] the protective effect of plant sterols against colon, breast and prostate cancers and cholesterol levels [11].

Some positive references were also encountered respecting to the immune system [12].

This work was mainly focused on the characterization of the consuming habits of raw fermented yoghurts with phytosterols in the population of Viseu, Portugal, in order to assess the need for the consumption of enriched foods as a complement to their diets. Specifically it was aimed to:

- assess the consumer habits of these yoghurts by gender and age group;
- establish the age groups who consume these foods;
- find out the reasons for not consuming these products according to gender and age;
- verify whether if the respondents have high values of cholesterol;
- determine the frequency of consumption of yogurts.

## II. EXPERIMENTAL PROCEDURE

#### A. Sample

The population in this study consisted of a total of 577 inquiries randomly selected for people shopping in supermarkets of both sexes. Data were collected between January to March of 2013. Inquiries were informed that by

completing the questionnaire they were providing their informed consent to participate.

#### B. Food Record

This study involved the use of two types of surveys using closed and open questions, randomly applied to a sample of individuals that were making their grocery shopping in the city of Viseu.

Participants were asked to indicate their consumer habits (consumption and frequency), the motivation to buy these products, preferences and cholesterol individual levels.

#### C. Statistical Analysis

The data collected were analyzed using the software Statistical Package for the Social Sciences (SPSS), version 20.0, 2011.

Descriptive and frequency analysis were made in order to interpret and analyze the data and present the results.

The chi-square test with Monte-Carlo simulation was used.

The significance level was set at 5% ( $p \leq 0.05$ ).

## III. RESULTS

The results obtained in our study allowed the characterization of the consumer habits of a sample of population of Viseu (Portugal) respecting the phytosterols consumption.

#### A. Characterization of Sample by Gender and Age

For this study, 577 inquiries were made questioning people about their use of low-fat plant sterol-enriched yoghurt enriched with phytosterols. 67.9% of the inquiries were female and 32.1% were male (Fig. 1).

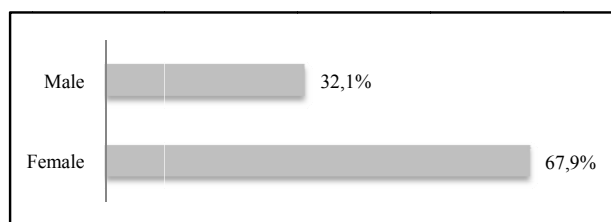


Fig. 1 Global characterization by gender of the participants

In order to facilitate the processing of data, 4 groups were formed as detailed in Table I.

TABLE I  
GLOBAL CHARACTERIZATION OF INQUIRIES BY AGE

G1	Individuals with less than 20 years old
G2	Individuals between 20-40 years old
G3	Individuals between 40-65 years old
G4	Individuals with more than 65 years old

Fig. 2 shows the distribution of the participants by age classes and by gender. It can be seen that the possibility of consuming yoghurt enriched with phytosterols is mainly present in G2 and G3 groups (45% and 37%, respectively). The older age group (G4) and the younger group do not present representativeness.



Fig. 2 Distribution of the participants by age classes and by gender

In the same group, it was seen that there were no significant statistically differences between the two genders distribution by various groups of age classes. This difference was only marked in G4 because the number of male inquiries was approximately the double of female inquiries.

The consumer habits of these evaluated yoghurts are reflected on Table II. We can observe that a large number of the inquiries answered that they did not consume these foods (about 77.9%).

The age groups who reported to consume these foods (22.1%) are above the age of 20 years, with positive answers essentially in G3 and some in G4.

TABLE II  
CONSUMER HABITS OF RAW FERMENTED MILKS BY GENDER AND AGE CLASSES

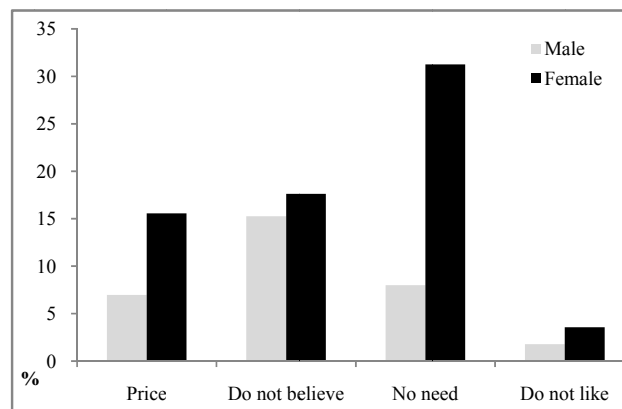
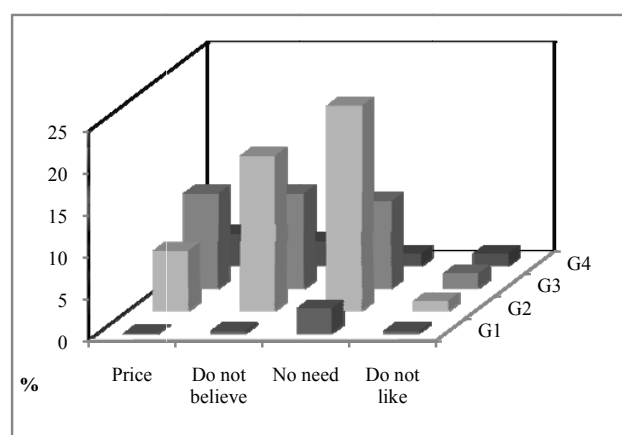
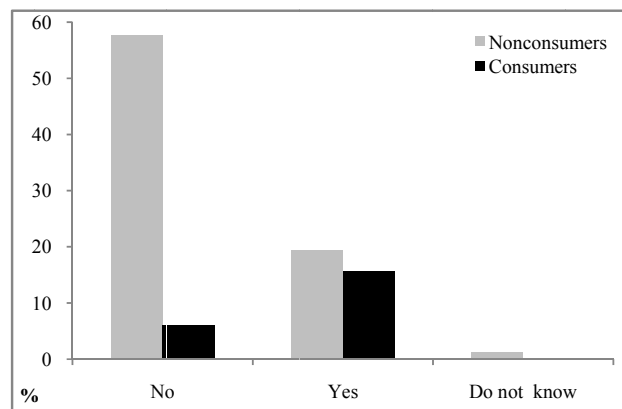
	Nonconsumers	Consumers	P-value
<i>Gender</i>			
Female	309 (53.6)	83 (14.4)	0.395
Male	140 (24.3)	45 (7.8)	
<i>Age classes</i>			
G1	20 (3.5)	3 (0.5)	0.000
G2	228 (39.7)	31 (5.4)	
G3	155 (27.0)	59 (10.3)	
G4	44 (7.7)	35 (6.1)	

In brackets are the percentage values.

From those who consumed this kind of foods, the majority of them were women (14.4%).

Considering the fact that greater part of the inquiries did not consume plant sterol-enriched yoghurt, then they were asked the reasons of not consuming these products. Especially men pointed that they had the opinion that they "did not believe" that these foods really work (48%). By the contrary, women had the opinion that they did not need these foods (46%). Only 23% of the woman considered that these foods had no effect on human body (Fig. 3). The factor price was not significant to reject these kind of foods but it was considered as "high".

It was also part of the study to ask the participants if they had an idea about their cholesterol levels (Fig. 5). It is evident that there are significant differences between consumers and non consumers about their knowledge of the cholesterol limits ( $p \leq 0.05$ ).

Fig. 3 Causes of no consumption of raw fermented milks containing phytosterols between gender ( $p \leq 0.05$ )Fig. 4 Causes of no consumption of raw fermented milks containing phytosterols between age groups ( $p \leq 0.05$ )Fig. 5 Information about high cholesterol by consumers and non-consumers ( $p \leq 0.05$ )

The majority of the individuals had no knowledge of their cholesterol levels. Those who responded positively to the previous question confirmed the knowledge about their cholesterol levels and affirmed that they had values higher than 180 mg/dL. Group G4 (more than 65 years old) had the

highest percentage (93.5%), followed by G3 (individuals between 40-65 years old) with values of 75% and finally G2 (individuals between 20-40 years old) with 27.8%, reported in Fig. 5.

#### IV. CONCLUSION

This work was helpful to recognize the knowledge that Portuguese consumers have about raw fermented milks enriched with phytosterols.

Another important factor was the fact that these enrichment foods have higher prices than the traditional ones and this is one of the important reasons why the majority of people do not choose a concomitant use of drugs and phytosterol supplements.

Although having in consideration that this is still a preliminary study we can conclude that the consumption of these foods may result from the growing concerns of population about health and by its positive direct relationship with cholesterol. There is a new consumer present in the market: better informed and conscientious, concerned about health and able to change the buying habits seeking healthy foods. Moreover, the increased prescription of drugs allied to the fear of possible side effects leads consumers to seek more natural solutions. The present work tried to explore a new field, in order to preview the attitude of a population towards an emerging and specific market.

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