

CIÊNCIAS AGRÁRIAS, ALIMENTARES E VETERINÁRIAS
AGRICULTURAL SCIENCES, FOOD AND VETERINARY
CIENCIAS AGRÍCOLAS, ALIMENTOS Y VETERINARIA

millenium  61

Millenium, 2(2), 61-71.

FIBRA ALIMENTAR: PRÁTICAS ALIMENTARES E CONHECIMENTOS EM DIFERENTES REGIÕES DO GLOBO

DIETARY FIBRE: EATING HABITS AND KNOWLEDGE IN DIFFERENT REGIONS OF THE GLOBE

FIBRA ALIMENTARIA: PRACTICAS ALIMENTARES Y CONOCIMIENTO EN DIFERENTES REGIONES DEL GLOBO

Viktória Szűcs^{1,2}

Raquel P. F. Guiné³

Marcela Leal⁴

Manuela Ferreira³

Paula Correia³

João Duarte³

¹Food Science Research Institute, National Agricultural R&I Centre, Budapest, Hungary

²Hungarian Chamber of Agriculture, Directorate of Food Industry, Budapest, Hungary

³Polytechnic Institute of Viseu, CI&DETS Research Centre, Viseu, Portugal

⁴Maimónides University, Faculty of Health Sciences, Maimónides, Argentina

Viktória Szűcs - szucs.viktoria@nak.hu | Raquel P. F. Guiné - raquelguine@esav.ipv.pt | Marcela Leal - leal.marcela@hotmail.com | Manuela Ferreira - mmcferreira@gmail.com | Paula Correia - paulacorreia@esav.ipv.pt | João Duarte - duarte.johnny@gmail.com

Autor Correspondente

Raquel P. F. Guiné

Dep. de Indústrias Alimentares, Escola Superior Agrária de Viseu,
Quinta da Alagoa, Estrada de Nelas, Ranhados, 3500-606 Viseu,
Portugal

raquelguine@esav.ipv.pt

RECEBIDO: 20 de outubro de 2016

ACEITE: 12 de janeiro de 2017

RESUMO

Introdução: A fibra dietética (FD) é um componente importante de uma dieta saudável e o seu consumo constitui uma ferramenta que pode ser utilizada para diminuir os factores de risco para muitas doenças.

Objetivos: Porque a FD apresenta tantos benefícios para a saúde, este estudo teve como objetivo comparar os hábitos alimentares e atitudes em relação à rotulagem, bem como o conhecimento sobre alimentos ricos em fibras e seus efeitos na saúde em três países situados em diferentes partes do globo (Argentina, Portugal e Hungria).

Métodos: Foi realizado um estudo descritivo transversal usando uma amostra de conveniência não-probabilística de 1525 participantes, mediante inquérito por questionário.

Resultados: Os resultados mostraram que a ingestão de FD ficou, nos três países, abaixo as doses recomendadas, e as pessoas em geral não se preocupam muito sobre a informação nutricional nos rótulos dos alimentos ou o seu conteúdo em FD. A internet surgiu como um meio de comunicação muito importante que as pessoas usam para obter informações sobre FD ou uma alimentação saudável, enquanto os hospitais e centros de saúde parecem ter pouco sucesso naquele que deveria ser o seu papel educativo.

Conclusões: Em geral, os entrevistados mostraram um nível moderado de conhecimento sobre a natureza e as fontes de FD, mas um melhor conhecimento sobre os seus efeitos na saúde humana, sendo este semelhante entre os países em estudo.

Palavras-chave: Alimentos ricos em fibras; fibras alimentares; fontes de fibra; hábitos alimentares; inquérito por questionário.

ABSTRACT

Introduction: Dietary fibre (DF) is an important component in a healthy diet and its consumption constitutes one tool that can be used to lower risk factors for many diseases.

Objectives: Because DF has so many health benefits, this study aimed at comparing the eating habits and attitudes towards labelling as well as the knowledge about fibre rich foods and their health effects in three countries situated in different parts of the globe (Argentina, Portugal and Hungary).

Methods: A descriptive cross-sectional study was carried out on a convenience non-probabilistic sample of 1525 participants, by questionnaire survey.

Results: The results showed that the ingestion of DF was below the recommended dosages in the three countries, and people in general do not care much about the nutritional information in the food labels or the contents in DF. Internet appeared as a very important media that people use to get information about DF or healthy eating, while hospitals and health centre seem to fail somewhat on their educational role.

Conclusion: In general, the respondents showed a moderate level of knowledge about the nature and sources of DF but a better knowledge about its effects on human health, being this similar among the countries at study.

Keywords: Dietary fibre; eating habits; fibre rich foods; questionnaire survey; sources of fibre.

RESUMEN

Introducción: La fibra dietética (FD) es un componente importante de una dieta saludable y su consumo es una herramienta que se puede utilizar para disminuir los factores de riesgo para muchas enfermedades.

Objetivos: Debido a que el FD tiene muchos beneficios para la salud, este estudio tuvo como objetivo comparar los hábitos alimenticios y actitudes en relación con el etiquetado y el conocimiento de los alimentos ricos en fibra y sus efectos sobre la salud en tres países ubicados en diferentes partes del mundo (Argentina, Portugal y Hungría).

Métodos: se realizó un estudio transversal con una muestra de conveniencia no probabilística de 1525 participantes de la encuesta de cuestionario.

Resultados: Los resultados mostraron que el consumo de FD fue en los tres países, por debajo de las dosis recomendadas, y la gente en general no les importa mucho acerca de la información nutricional en las etiquetas de los alimentos o su contenido en FD. El Internet se ha convertido en un medio de comunicación muy importante que la gente utiliza para obtener información sobre FD o una dieta saludable, mientras que los hospitales y centros de salud parecen fallar un poco en lo que debería ser su función educativa.

Conclusiones: en general, los encuestados mostraron un moderado nivel de conocimiento sobre la naturaleza y las fuentes de FD, pero una mejor comprensión de sus efectos sobre la salud humana, que es similar entre los países estudiados.

Palabras clave: Alimentos ricos en fibra; encuesta por cuestionario; fibra dietética; fuentes de fibra; hábitos alimentarios.

INTRODUCTION

Dietary fibre (DF) represents a wide spectrum of polysaccharides that escape digestion in the human gastrointestinal tract. However, this definition of dietary fibre as food that is not digested in the upper GI tract has led to research about the roles of fibre on the fermentation processes that occur in the colon and most recently the benefits to the gut have been more generally debated (n.d.). Present definitions of dietary fibre cover an enormous range of divergent indigestible carbohydrate entities which have demonstrated different effects in the human body (Jones, 2014; Macagnan, da Silva, & Hecktheuer, 2016).

DF is an important component in a healthy diet and its consumption constitutes one tool that can be used to lower risk factors for cardiovascular disease and type 2 diabetes mellitus, among other diseases (Ma & Mu, 2016; Mackie, Rigby, Harvey, & Bajka, 2016). The role of dietary fibre as a factor diminishing the risk of obesity is also important and evidence from observational studies consistently demonstrates that frequent increased intake of fruits, vegetables and whole grains is associated with lower body weight increase over time. This is so much important that it was observed that adherence to healthier dietary templates (including incorporation of higher amounts of plant-based foods) in intervention studies also tends to evidence greater weight loss when compared to weight control diets (Brownlee et al., s.d.).

Up to the present there have been a number of studies that unequivocally demonstrate the health benefits of a fibre rich diet, and this fact has become sufficiently recognized to allow health claims relative to some types of fibre like for example beta-glucan (Mackie, Bajka, & Rigby, 2016). In fact, nutritional claims for the dietary fibre content of foods are allowed in many parts of the world, including Australia, New Zealand, Canada, Singapore, Europe and United States (Brownlee et al., s.d.).

Because DF has proven many benefits for the human health, its consumption must be encouraged and its effects should be known by the population. Hence, this work aimed at comparing the eating habits regarding food fibres and labelling as well as the knowledge about fibre rich foods and their effects for the wellbeing of the human body. For a wider coverage of the study this was undertaken simultaneously in three countries situated in different parts of the globe, namely South America, Iberian Peninsula and Central Europe, to compare eating patterns, attitudes and level of knowledge about DF.

THEORETICAL FRAMEWORK

Fibre and Diet

The human diets have been changing during the last century, to including increasing amounts of refined grains, meats, added fats and sugars and decreased consumption of vegetable proteins or lower fiber intake (Hall, Baxter, Fryirs, & Johnson, 2010). This pattern is, however, changing again, with new trends to return to healthier lifestyles, including more natural products and increased amounts of fresh fruits and vegetables, refined cereals and less industrialized ready to eat foods. According to the World Health Organization (WHO, 2004), public interest in healthy eating has increased due to the high incidence of several human health disorders, and so there has been an increasing demand for healthy foods (Tudoran, Olsen, & Dopico, 2009).

According to the American Dietetic Association (ADA) people should consume adequate amounts of dietary fiber from a wide variety of plant food sources. In this way, different types of fibers would be ingested together with other bioactive compounds that would act synergistically on the human body to provide health benefits (Macagnan et al., 2016). The effects of fiber consumption vary according to their solubility and chemical structure, and are manifested over appetite regulation, energy intake and body weight. Some dietary fibers are water soluble and therefore have the ability to increase viscosity and reduce the glycemic response as well as the level of cholesterol in the blood stream. On the other hand, in the digestive tract, this type of fiber is related to the ability to retain water and form gels and also constitutes a substrate for fermentation of bacteria in the colon. These characteristics of DF constitute the starting point for their physiological effects (Martinho et al., 2013).

Fibre and Health

The protective role of consumption of fiber-rich foods, including whole grain cereals, fruits and vegetables, on chronic diseases is well documented in the scientific literature.

Reduced bowel function, predominantly constipation, is a frequent complaint of ill or inactive elderly people (Yen, Tseng, Kuo, Lee, & Chen, 2011). On the other hand, gastrointestinal function can also be compromised in children with a variety of disorders (Khoshoo, Sun, & Storm, 2010). Many studies were implemented to assess the effects of various fiber sources in the prevention or treatment of constipation in different patient groups (Taylor, Northstone, Wernimont, & Emmett, 2016).

High-fiber diets, which help to increase stool bulk and moisture and reduce travel time through the gastrointestinal tract. Increasing the amount of fiber in the diet may reduce the symptoms of diverticulosis and prevent complications, owing to the insoluble fiber, especially the cellulose in fruits and vegetables (Feuerstein & Falchuk, 2016).

The term inflammatory bowel disease (IBD) relates to different pathologies of the intestine, namely the Crohn's disease (CD) and ulcerative colitis (UC). CD is a chronic inflammatory bowel disease that can affect any part of the gastrointestinal tract. It usually involves the terminal ileum and proximal colon, and its etiology and pathogenesis is determined by both genetic and environmental factors (Van Loo, Dijkstra, Ploeg, & Nieuwenhuijs, 2012). It has been suggested that increased dietary fiber intake, specifically from fruits, may have a protective effect on development of CD. Also studies have examined the role of dietary factors in UC and how these influence the development of the disease (Jowett et al., 2004), even though the studies about the effect of dietary fiber on UC are not always in agreement.

DF has been associated with a protective role against the development of several types of cancer (Kim & Je, 2016). Scientific studies have investigated specific sources of fiber as having a protective roles on oesophageal cancer (Jessri, Rashidkhani, Hajizadeh, Jessri, & Gotay, 2011; Tang et al., 2013; Wu, Tseng, Hankin, & Bernstein, 2007). In vitro and in vivo studies suggest that dietary fiber may prevent gastric cancer by acting as a nitrite scavenger, potentially countering the carcinogenic effects of N-nitroso compounds (Gonzalez & Riboli, 2010; Zhang, Xu, Ma, Yang, & Liu, 2013). Also colorectal cancer benefit from the ingestion of fiber rich foods.

DF has also proven preventive and effective clinical roles in the management of other disease like cardiovascular diseases, high blood cholesterol or diabetes (Martinho et al., 2013).

1. METHODS

A descriptive cross-sectional study was carried out on a convenience non-probabilistic sample of 1525 participants, by questionnaire survey.

1.1 Instrument

The questionnaire used for this study was prepared by Martinho et al. (2013) who applied it only in Portugal. Then the same questionnaire was used for the present work and applied in different countries. The questionnaire included different sections, formulated to evaluate the attitudes and knowledge regarding foods rich in dietary fibre.

The first section of the questionnaire aimed at getting information about the socio-demographic characteristics, namely age, gender, level of education (primary, secondary or university level) and living environment (urban versus rural).

Another section intended to evaluate the eating habits related to different types of foods and also fibre rich foods. The participants were asked to indicate for a typical week (i.e., not including special occasions like celebrations, holidays, or other occasions in which the diet is not constant) how often they eat certain foods using an open-ended question format. The questions asked about eating legumes and/or salads, eating fruit, eating whole cereals, eating out of home or eating fast-food.

A different part of the questionnaire was about the attitudes toward food labelling and particularly about the contents and information regarding fibres. These questions were answered on a 5-point scale, varying from 1 (never) to 5 (always).

The sources of information about dietary fibre and its role in maintaining a healthy body were also investigated in the questionnaire, and in this case a set of dissemination means were gives and the respondents were asked to rate them from the least to the most important.

The knowledge about the relation between dietary fibre and foods was evaluated through another group of questions where the participants were asked to state their accordance measured on a 5-point Likert agreement-scale ranging from 1 (totally disagree) to 5 (totally agree). The same Likert scale was also used to evaluate a set of questions related to the knowledge about the health benefits of a recommended ingestion of dietary fibre.

1.2 Data collection

In each country the sample was selected attempting to reach different sectors of the population, namely in terms of age, literacy, gender or geographical area of residence, including people from different cities and smaller villages in each of the participating countries.

The participation in the survey was voluntary, and the questionnaire was applied by direct interview only to adult citizens, after verbal informed consent was obtained. The questionnaire followed all necessary ethical evaluation steps prior to its application. Furthermore, all the answers were anonymous and no personal data were ever collected or related to any answers, so as to protect the participants.

1.3 Statistical analysis

The exploratory analysis of the data was made by basic descriptive statistics using the software SPSS, from IBM Inc. (version 23).

1.4 Sample Characterization

This study was undertaken in 2015 in three countries situated in different regions of the globe: Portugal, in the Iberian Peninsula, Argentina, in South America, and Hungary, in Central Europe. The total number of participants was 1525 divided as: 847 in Argentina, 296 in Hungary and 382 in Portugal.

The distribution by gender indicated that the majority of the enquired were women, 70.3% (1072 female against 447 male individuals), with 6 participants not indicating their gender.

The enquired were all adults, ranging in age from 18 to 84 years. The variable age was classified into categories as follows: young adults, from 18 to 30 years, accounting for 47.9%; average adults, from 31 to 50 years, representing 35.9%; senior adults, from 51 to 65 years, corresponding to 11.8%; and finally elderly, from 51 to 65 years, corresponding to 4.4%.

The majority of the participants had a high level of education (58.7% with a university degree), while 38.1% had completed secondary school and a minor percentage (3.2%) had completed the lowest level of education (primary school). Four participants did not indicate their level of education.

The great majority of the participants lived in urban areas (91.3%), contrarily to 8.7% who lived in rural areas.

2. RESULTS AND DISCUSSION

2.1. Eating Habits

Table 1 shows the results relatively to the frequency of consumption of certain types of food and/or feeding habits such as eating out of home or eating fast food meals.

Table 1 – Eating habits of the participants

Weekly frequency	Argentina			Portugal			Hungary		
	Min	Max	Mode	Min	Max	Mode	Min	Max	Mode
Vegetables and/or salads	0	28	14	0	35	10	0	30	7
Pieces of fruit	0	35	7	0	50	14	0	55	5
Whole grains	0	7	0	0	21	0	0	20	0
Eat outside from home	0	15	1	0	36	5	0	20	5
Eat fast food	0	10	0	0	10	0	0	5	0

The values in Table 1 show that there is a great variability in the habits of the participants as to the number of meals in which they include vegetables and/or salads, varying from zero to around 30 in the three countries. Regarding the most frequent answer, mode, it was 14 in Argentina, corresponding to two meals per day with vegetables and/or salads, while in Portugal that consumption tends to be lower, 10 times which corresponds to little over once a day, and in Hungary the scenario is not ideal also, with a consumption of only one meal per day with vegetables and/or salads. To refer that in Hungary the data collection occurred in the autumn-winter time, when the availability of fresh vegetables, and mainly fruits, is somewhat limited. In what concerns the frequency of consumption of fruit, the trends are slightly different in the three countries analysed. In Argentina the maximum number of fruit pieces (or doses) is lower when compared to Portugal or Hungary, although the minimum is in all cases zero, which is preoccupying, given the importance of fruits in the diet. It is well known that vegetables and fruits are much important in the diet, not only because they are the source of DF, but also because they provide vitamins, minerals and many bioactive compounds like phenolic compounds with antioxidant activity (Bhatt, Rawat, Badhani, & Rawal, 2017; Ozkan, Ucar,

Yildiz, & Ozturk, 2016; Vargas-Murga, de Rosso, Mercadante, & Olmedilla-Alonso, 2016). As to the most frequent answer, it was 7 in Argentina, thus meaning the consumption of fruit only once a day, while in Portugal that doubles to 14, i.e., twice a day. On the other hand, the consumption of fruit in Hungary tends to be lower than once per day: 5 times per week.

When it comes to the consumption of whole grains the perspective is not satisfactory at all, since in the three countries evaluated the majority of the participants in the study admitted that they do not eat whole grain foods (mode zero in all cases). Cereal grain kernels are constituted by endosperm, bran, and germ. However, the vast majority of cereal products are traditionally prepared from refined flour after removal of bran and germ, which are the two parts of grain kernels containing most of the dietary fibre and other bioactive components. Hence, when compared to refined grains, most whole grains provide more protein, fibre, and other nutrients, including minerals (calcium, magnesium, and potassium) as well as many phytochemicals (Geng, Harnly, & Chen, 2016).

In regards with the habit of eating out of home, the most frequent answers vary from 1 in Argentina to 5 in Portugal and Hungary. This may indicate that in Argentina people still have the chance to eat at home both at lunch and dinner, and therefore they go to eat out in a restaurant perhaps only once in the weekend. On the contrary, in Portugal and Hungary it might be that the 5 times people eat out of home correspond to the 5 working days of the week, in which case people who work do not have the possibility to go home for lunch.

Regarding the number of times the participants eat fast food meals the result are very encouraging, because the most frequent answer is zero in all countries of the study, thus indicating that people are alert to the lower nutritional quality of those known as fast food meals, associated with high caloric value, high refined carbohydrates, high fat content, particularly in saturated fats, and low amounts of more beneficial nutrients, such as vitamins, fibre or phytochemicals (Lee & Thompson, 2016; Namin, 2017).

2.2. Information Sources

The importance of the different possible sources of information about healthy eating and dietary fibre in particular was investigated also in this study and the results are shown in Table 2.

Table 2 – Sources of information about dietary fibre

Media	Order of importance		
	Argentina	Portugal	Hungary
Health centres and hospitals	3 rd	5 th	4 th
Radio	6 th	6 th	6 th
Television	4 th	3 rd	3 rd
School	5 th	2 nd	5 th
Magazines books	2 nd	1 st	2 nd
Internet	1 st	4 th	1 st

The participants were asked to rate from the more important (1st) to the least important (6th) the following means of dissemination of information: health centres and hospitals, radio, television, school, magazines books or internet. The results evidences that internet is the first choice in Argentina and in Hungary to look for information about dietary fibre and fibre rich foods, followed by magazines and books, being this source the 1st choice for the Portuguese participants. In fact, we must not forget that internet is widely and easily accessible and people rely on the information found on the internet. Nevertheless, the contents of the webpages are not always certified as correct and this means that some work has to be done as to educate people about the consultation of webpages from governmental and official agencies instead of pages from private owners whose reliability is not fully guaranteed. Health centres and Hospitals come in 3rd, 4th and 5th place respectively for Argentina, Hungary and Portugal, which means that still much should be done so as to use these privileged places as sources of dissemination of information about healthy eating habits together with other health information.

Radio has lost its importance perhaps over the last decades due to the rising of more convenient social media as a vehicle for the information about diverse subjects, and particular healthy eating tips. This was evident from the results of this study, since radio came in last for the three countries at study.

2.3. Knowledge about Food Fibres

Table 3 shows the results relative to the knowledge about sources of DF and fibre rich foods in the three countries.

Table 3 – Knowledge about fibres and foods

Statement about fibres & foods ¹	Argentina					Portugal					Hungary				
	Score ²					Score ²					Score ²				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
FF1	31	36	11	17	5	14	31	13	23	19	28	22	13	23	14
FF2	8	22	21	33	16	9	23	18	31	19	23	23	14	23	17
FF3	2	4	44	36	14	2	6	55	28	9	4	6	35	39	16
FF4	29	34	23	11	3	44	31	13	8	4	45	21	16	10	8
FF5	28	34	23	12	3	48	31	13	6	2	45	20	10	16	9
FF6	2	4	18	44	32	1	4	11	47	37	1	4	11	30	54
FF7	10	17	25	38	10	17	24	16	35	8	13	16	19	29	23

¹FF1 = Only plant foods have fibre; FF2 = Foods of animal origin such as meat, eggs and dairy products do not contain fibres (unless added); FF3 = According to the World Health Organization, the average adult should eat 25g of fibre per day; FF4 = Whole foods have less fibre when compared to non-whole foods; FF5 = The unpeeled fruits have less fibre than peeled ones; FF6 = Legumes (peas, beans ...), cereals and fruits are foods that are very rich in dietary fibre; FF7 = Dietary fibres have calories, and so they provide energy to the organism when ingested.

²Score scale: 1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree

In relation to the plant origin of DF (statement FF1), in Argentina 67% of the participants were not aware of this fact (disagree or strongly disagree) and only 22% showed knowledge about this (agree or strongly agree), while in Portugal and Hungary the participants who knew this were 42% and 37%, respectively. In a similar study previously conducted only in Portugal (Martinho et al., 2013), 36% agreed that the statement was true, thus being in relative agreement with the results found in this study also for Portugal. When asked if animal foods did not have DF, the participants showed a mild agreement (49% in Argentina, 50% in Portugal and 40% in Hungary). In the study by Martinho et al. (2013), the percentage of agreement was 42%, thus confirming the trend observed in the present study.

Regarding the dietary fibre recommendations, the exact amounts vary according to the agency and also according to the person, namely in terms of age or gender. Differences may be encountered between the recommendations relative to dietary fibre consumption around the world worldwide. Nevertheless, the World Health Organization (WHO) recommends a daily average of 25g of fibre for adults (WHO, 2003). The knowledge about this recommendation was not satisfactory, and in the three countries the majority of the participants did not even have an opinion (44%, 55% and 35%, respectively for Argentina, Portugal and Hungary).

When asked about the fibre content in whole foods, the majority disagreed that whole foods have less fibre (63%, 75% and 66%, for Argentina, Portugal and Hungary), so they demonstrated knowledge about the whole foods being richer in fibre. In the study by Martinho et al. (2013) also 67% of the enquired were aware that the whole foods have more fibres than the non-integral counterparts.

The peel of certain fruits is edible, like in apples or pears, and in that case added benefits come their consumption together with the fruit because they possess a high fibre content as well as a high concentration of phenolic compounds (Guiné et al., 2010). When asked about this fact, the participants demonstrated a fairly good level of knowledge for all countries (62%, 79% and 66% respectively for Argentina, Portugal and Hungary).

It is well established that legumes, vegetables, cereals and fruits are foods with a high content in DF, and this was also verified in the present work, since for all countries the agreement was very significant 76% for Argentina and 84% for both Portugal and Hungary. In the study by Martinho et al. (2013) in general the respondents agreed that these foods are rich in fibre, with 46% in favour of the statement and 31% strongly in favour, giving a total of 77% agreement.

For many years it was believed that DF did not provide calories when ingested but this was changed relatively recently so that presently it is assumed that 1 gram of DF corresponds to 2 kcal (8 kJ) (DL-54, 2010). Although, this is recent, the general

population already is aware of it, as shown by the results of this study: 48%, 43% and 52 % in Argentina, Portugal and Hungary, respectively.

When the three countries are compared in relation to the knowledge about several aspects related to DF, no substantial differences arise, thus showing that although located in different parts of the world map, the realities are quite similar in those countries.

2.4. Knowledge about Health Benefits of Food Fibres

Table 4 shows the results obtained for the questions related to the health effects of dietary fibre.

Table 4 – Knowledge about the health benefits of consumption of food fibres

Statement about fibres & health ¹	Argentina					Portugal					Hungary				
	Score ²					Score ²					Score ²				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
FH1	1	6	23	45	25	1	4	22	49	24	2	6	22	45	25
FH2	1	3	18	50	28	0	3	22	51	24	2	6	23	42	27
FH3	2	5	28	39	26	1	3	19	45	32	1	7	20	32	40
FH4	1	4	20	49	26	0	2	15	55	28	1	6	20	35	38
FH5	2	4	15	38	41	1	1	6	42	50	2	4	10	23	61
FH6	3	8	35	35	19	2	8	40	38	12	4	12	27	35	22

¹FH1 = Fibres can prevent and/or treat cardio-vascular diseases; FH2 = Fibres can prevent and/or treat cholesterol; FH3 = Fibres can prevent and/or treat bowel cancer; FH4 = Fibres can prevent and/or treat obesity; FH5 = Fibres can prevent and/or treat constipation; FH6 = Fibres can prevent and/or treat diabetes.

²Score scale: 1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree

Regarding the cardiovascular diseases, it was found that the majority of the participants were knowledgeable of this effect, 70%, 73% and 70% for Argentina, Portugal and Hungary, respectively, corresponding to the participants who agreed or strongly agreed with the statement. Nevertheless, a still important part did not have an opinion about this, 22-23%, which is significant. In the previous study by Martinho et al. (2013), the agreement was 71%, which is about the same value of those in the present work for the three countries at study.

Regarding the benefits of DF to lowering the blood cholesterol, the results are also encouraging, with 78%, 75% and 69% of expressed agreement, respectively for Argentina, Portugal and Hungary, which indicate that people know about the role of DF in fighting the hypercholesterolemia, as was already observed previously in a similar study applied only in Portugal (Martinho et al., 2013).

The knowledge about the effect of DF in intestinal cancer was also investigated and the results show that 65% to 77% of the participants know this role of DF, depending on the country. Still, some important part of the participants did not reveal an opinion: 19% to 28%, thus indicating that this might be an area where more information should be provided.

The benefits of a fibre rich diet to treat and prevent constipation are well known to the great majority of the participants, 79% for Argentina, 92% for Portugal and 84% for Hungary. This is clearly the most well-known among the general population of the effects of DF, as already evidenced in the study by Martinho et al. (2013).

DF has also an important role in the management of diabetes, helping balancing blood sugar levels. However, this fact is not so well known to a considerable part of the enquired, with 27% to 40% not manifesting any opinion about the subject. Still, from those who responded to the question the majority were in favour: 54%, 50% and 57%, respectively for Argentina, Portugal and Hungary.

Again, the results were quite homogeneous when comparing the different countries at study.

2.5. Fibres and Food Labelling

Food labels constitute a most important way of knowing what one eats and how to supply the body with the necessary nutrient requirements. Hence, the attitudes towards food labelling are of the utmost importance and they were evaluated in this study.

When the participants were asked if when they buy a food product they usually consult the label information, the trends are variable, with about 37% to 60% confirming that they do it frequently; against 14% to 32% who admit they do not (Table 5).

Table 5 – Attitudes regarding food labels and nutritional information about fibre

Statement about fibres & labelling ¹	Argentina					Portugal					Hungary				
	Score ²					Score ²					Score ²				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
FL1	18	14	31	20	17	2	12	31	41	14	4	13	23	36	24
FL2	20	14	28	20	18	5	14	31	36	14	7	21	31	27	14
FL3	42	24	22	7	5	12	28	33	20	7	31	30	25	11	3
FL4	40	21	24	10	5	11	23	36	25	5	38	26	20	10	6
FL5	48	18	16	10	8	13	28	29	20	10	34	21	21	17	7

¹FL1 = When buying a food product I usually consult the label information; FL2 = On the label, I usually consult the nutritional information; FL3 = In the nutritional label of any food I usually check how much fibre it possesses; FL4 = The amount of fibres is a factor to be taken into account in the choice of similar foods; FL5 = If I buy a food product where the packaging refers to "high fibre" or "high in fibre", I check the label for the amount of fibre it has.

²Score scale: 1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Many times; 5 = Always

Also 23% to 32% replied that they consult the label sometimes when buying foods. The nutritional information contained on the label is read frequently by an important part of the participants: 38% for Argentina, 50% for Portugal and 41% for Hungary, while 28% to 31% see the nutritional information only sometimes. The information about the fibre content of foods does not seem to attract so much attention from people, so that those who consult this frequently or always are only 12% for Argentina, 27% for Portugal and 14% for Hungary. The content in DF also does not seem to constitute a factor that clearly influences people's food choices, with 34% to 64% admitting that they never choose food based on the fibre content. Finally, relatively to the confirmation of fibre rich allegations, most people also do not really seem to care about this, with 41% to 66% expressing they seldom or never verify if the contents in fibre supports the allegation.

Finally, comparing the attitudes of the population in the different countries, again no important differences seem to arise, and regardless of the country people still do not care much about the food labelling.

3. IMPLICATIONS AND LIMITATIONS

Some limitations of this work relate to the unequal number of questionnaires answered in each of the countries, being the number in Argentina almost 3 times that of Hungary, which might create some asymmetries when the data are treated as a whole. One interesting aspect of this research is to compare different parts of the globe, namely Latin America, Iberian Peninsula and Central Europe. However, that also poses some difficulties, because the cultural realities in these countries are evidently different. Hence, an interesting challenge might be to try to investigate how the results of this research could be linked to social, cultural or even educational variables in those countries. Another aspect possible to investigate as a continuation of this study might be to apply the same questionnaire to some target groups and evaluate if differences would be observed. Some of those target groups could be for example people with some food restrictions or allergies, people with some chronic diseases, people with professional activities related to health, food or sports, among others.

CONCLUSIONS

This work allowed comparing three countries in relation to the habits, attitudes and knowledge about DF. The results showed that the eating patterns differ slightly in relation to the ingestion of vegetables, salads and fruits, but not in relation to the ingestion of whole cereals. These differences can be related to the availability and traditional diets in each of the countries at study, particularly in what concerns the ingestion of plant foods. Still, in all cases the ingestion is below the recommended dosages so as to get benefits from the ingestion of these types of food.

Regarding the eating outside of home differences were encountered so that while in Argentina most frequently people eat out only once a week, while in Portugal and Hungary the trend is towards eating out 5 times a week, maybe coincident with the 5 working days.

With respect to the sources of information about DF and healthy eating recommendations, internet was recognized as a very important source, maybe due to the high rate of young adults in the sample (~50%), particularly in Argentina and Hungary, with hospitals and health centres having a minor role, which should perhaps be a subject for further analysis and planning of educational actions.

In general, the respondents showed a moderate level of knowledge about the nature and sources of DF but a better knowledge about its effects on human health, being this similar among the countries at study.

However, in what concerns the attitudes towards food labelling it was observed a generalized lack of interest about the label information and the fibre contents in particular.

ACKNOWLEDGEMENTS

This work was prepared in the ambit of the multinational project from CI&DETS Research Centre (IPV - Viseu, Portugal) with reference PROJ/CI&DETS/2014/0001.

The opinions expressed herein and the conclusions of this publication are those of the authors and do not necessarily represent the views of Hungarian Chamber of Agriculture.

REFERENCES

- Bhatt, I. D., Rawat, S., Badhani, A., & Rawal, R. S. (2017). Nutraceutical potential of selected wild edible fruits of the Indian Himalayan region. *Food Chemistry*, 215, 84–91. <https://doi.org/10.1016/j.foodchem.2016.07.143>
- Brownlee, I. A., Chater, P. I., Pearson, J. P., & Wilcox, M. D. (2016). Dietary fibre and weight loss: Where are we now? *Food Hydrocolloids*, xxx, 1-6. <https://doi.org/10.1016/j.foodhyd.2016.08.029>
- Decreto-Lei nº 54/2010. (2010, Maio 28). [Portugal]. *Diário da República*, 1 (104), pp.1842-1847. Acedido em <https://dre.pt/application/dir/pdf1sdip/2010/05/10400/0184201847.pdf>
- Feuerstein, J. D., & Falchuk, K. R. (2016). Diverticulosis and Diverticulitis. *Mayo Clinic Proceedings*, 91(8), 1094–1104. <https://doi.org/10.1016/j.mayocp.2016.03.012>
- Geng, P., Harnly, J. M., & Chen, P. (2016). Differentiation of bread made with whole grain and refined wheat (*T. aestivum*) flour using LC/MS-based chromatographic fingerprinting and chemometric approaches. *Journal of Food Composition and Analysis*, 47, 92–100. <https://doi.org/10.1016/j.jfca.2015.12.010>
- Gonzalez, C. A., & Riboli, E. (2010). Diet and cancer prevention: Contributions from the European Prospective Investigation into Cancer and Nutrition (EPIC) study. *European Journal of Cancer*, 46(14), 2555–2562. <https://doi.org/10.1016/j.ejca.2010.07.025>
- Guiné, R. P. F., Sousa, R., Alves, A., Teixeira, L., Figueiredo, C., Fonseca, S., ... Ferreira, D. (2010). Phenolic, dietetic fibre and sensorial analyses of apples from regional varieties produced in conventional and biological mode. *Agricultural Engineering International: CIGR Journal*, 12(2), 70–78. Acedido em <http://www.cigrjournal.org/index.php/Ejournal/article/view/1490>
- Hall, R. S., Baxter, A. L., Fryirs, C., & Johnson, S. K. (2010). Liking of health-functional foods containing lupin kernel fibre following repeated consumption in a dietary intervention setting. *Appetite*, 55(2), 232–237. <https://doi.org/10.1016/j.appet.2010.06.004>
- Jessri, M., Rashidkhani, B., Hajizadeh, B., Jessri, M., & Gotay, C. (2011). Macronutrients, vitamins and minerals intake and risk of esophageal squamous cell carcinoma: a case-control study in Iran. *Nutrition Journal*, 10(1), 137. <https://doi.org/10.1186/1475-2891-10-137>
- Jones, J. M. (2014). CODEX-aligned dietary fiber definitions help to bridge the «fiber gap». *Nutrition Journal*, 13, 34. <https://doi.org/10.1186/1475-2891-13-34>
- Jowett, S. L., Seal, C. J., Phillips, E., Gregory, W., Barton, J. R., & Welfare, M. R. (2004). Dietary beliefs of people with ulcerative colitis and their effect on relapse and nutrient intake. *Clinical Nutrition*, 23(2), 161–170. [https://doi.org/10.1016/S0261-5614\(03\)00132-8](https://doi.org/10.1016/S0261-5614(03)00132-8)

- Khoshoo, V., Sun, S. S., & Storm, H. (2010). Tolerance of an Enteral Formula with Insoluble and Prebiotic Fiber in Children with Compromised Gastrointestinal Function. *Journal of the American Dietetic Association*, 110(11), 1728–1733. <https://doi.org/10.1016/j.jada.2010.08.011>
- Kim, Y., & Je, Y. (2016). Dietary fibre intake and mortality from cardiovascular disease and all cancers: A meta-analysis of prospective cohort studies. *Archives of Cardiovascular Diseases*, 109(1), 39–54. <https://doi.org/10.1016/j.acvd.2015.09.005>
- Lee, M. S., & Thompson, J. K. (2016). Exploring enhanced menu labels' influence on fast food selections and exercise-related attitudes, perceptions, and intentions. *Appetite*, 105, 416–422. <https://doi.org/10.1016/j.appet.2016.06.007>
- Ma, M., & Mu, T. (2016). Anti-diabetic effects of soluble and insoluble dietary fibre from deoiled cumin in low-dose streptozotocin and high glucose-fat diet-induced type 2 diabetic rats. *Journal of Functional Foods*, 25, 186–196. <https://doi.org/10.1016/j.jff.2016.05.011>
- Macagnan, F. T., da Silva, L. P., & Hecktheuer, L. H. (2016). Dietary fibre: The scientific search for an ideal definition and methodology of analysis, and its physiological importance as a carrier of bioactive compounds. *Food Research International*, 85, 144–154. <https://doi.org/10.1016/j.foodres.2016.04.032>
- Mackie, A., Bajka, B., & Rigby, N. (2016). Roles for dietary fibre in the upper GI tract: The importance of viscosity. *Food Research International*, 88, 234–238. <https://doi.org/10.1016/j.foodres.2015.11.011>
- Mackie, A., Rigby, N., Harvey, P., & Bajka, B. (2016). Increasing dietary oat fibre decreases the permeability of intestinal mucus. *Journal of Functional Foods*, 26, 418–427. <https://doi.org/10.1016/j.jff.2016.08.018>
- Martinho, C., Correia, A., Goncalves, F., Abrantes, J., Carvalho, R., & Guine, R. (2013). Study About the Knowledge and Attitudes of the Portuguese Population About Food Fibres. *Current Nutrition & Food Science*, 9(3), 180–188. <https://doi.org/10.2174/1573401311309030002>
- Namin, A. (2017). Revisiting customers' perception of service quality in fast food restaurants. *Journal of Retailing and Consumer Services*, 34, 70–81. <https://doi.org/10.1016/j.jretconser.2016.09.008>
- Ozkan, Y., Ucar, M., Yildiz, K., & Ozturk, B. (2016). Pre-harvest gibberellic acid (GA3) treatments play an important role on bioactive compounds and fruit quality of sweet cherry cultivars. *Scientia Horticulturae*, 211, 358–362. <https://doi.org/10.1016/j.scienta.2016.09.019>
- Tang, L., Xu, F., Zhang, T., Lei, J., Binns, C. W., & Lee, A. H. (2013). Dietary fibre intake associated with reduced risk of oesophageal cancer in Xinjiang, China. *Cancer Epidemiology*, 37(6), 893–896. <https://doi.org/10.1016/j.canep.2013.08.012>
- Taylor, C. M., Northstone, K., Wernimont, S. M., & Emmett, P. M. (2016). Picky eating in preschool children: Associations with dietary fibre intakes and stool hardness. *Appetite*, 100, 263–271. <https://doi.org/10.1016/j.appet.2016.02.021>
- Tudoran, A., Olsen, S. O., & Dopico, D. C. (2009). The effect of health benefit information on consumers health value, attitudes and intentions. *Appetite*, 52(3), 568–579. <https://doi.org/10.1016/j.appet.2009.01.009>
- van Loo, E. S., Dijkstra, G., Ploeg, R. J., & Nieuwenhuijs, V. B. (2012). Prevention of postoperative recurrence of Crohn's disease. *Journal of Crohn's and Colitis*, 6(6), 637–646. <https://doi.org/10.1016/j.crohns.2011.12.006>
- Vargas-Murga, L., de Rosso, V. V., Mercadante, A. Z., & Olmedilla-Alonso, B. (2016). Fruits and vegetables in the Brazilian Household Budget Survey (2008–2009): carotenoid content and assessment of individual carotenoid intake. *Journal of Food Composition and Analysis*, 50, 88–96. <https://doi.org/10.1016/j.jfca.2016.05.012>
- World Health Organization. (2003). *Diet, nutrition and the prevention of chronic diseases: Report of a Joint WHO/FAO Expert Consultation*. Genève, World Health Organization. Acedido em <http://www.who.int/dietphysicalactivity/publications/trs916/en/>
- World Health Organization. (2004). *Food and Health in Europe: a new basis for action*. Genève, World Health Organization. Acedido em <http://www.euro.who.int/en/publications/abstracts/food-and-health-in-europe-a-new-basis-for-action>
- Wu, A. H., Tseng, C.-C., Hankin, J., & Bernstein, L. (2007). Fiber intake and risk of adenocarcinomas of the esophagus and stomach. *Cancer Causes Control*, 18(7), 713–722. <https://doi.org/10.1007/s10552-007-9014-8>
- Yen, C.-H., Tseng, Y.-H., Kuo, Y.-W., Lee, M.-C., & Chen, H.-L. (2011). Long-term supplementation of isomalto-oligosaccharides improved colonic microflora profile, bowel function, and blood cholesterol levels in constipated elderly people—A placebo-controlled, diet-controlled trial. *Nutrition*, 27(4), 445–450. <https://doi.org/10.1016/j.nut.2010.05.012>
- Zhang, Z., Xu, G., Ma, M., Yang, J., & Liu, X. (2013). Dietary Fiber Intake Reduces Risk for Gastric Cancer: A Meta-analysis. *Gastroenterology*, 145(1), 113–120.e3. <https://doi.org/10.1053/j.gastro.2013.04.001>

