CIÊNCIAS DA VIDA E DA SAÚDE
LIFE AND HEALTH SCIENCES
CIENCIAS DE LA VIDA Y LA SALUD

millenium 49

Millenium, 2(1), 49-62.

ATITUDES DA POPULAÇÃO PORTUGUESA EM RELAÇÃO À FIBRA ALIMENTAR

ATTITUDES OF THE PORTUGUESE POPULATION REGARDING DIETARY FIBRE

ACTITUDES DE LA POBLACIÓN PORTUGUESA EN RELACIÓN A LA FIBRA ALIMENTARIA

Raquel Guiné[1,2]
Manuela Ferreira[3]
Paula Correia[1]
João Duarte[3]

[1] Instituto Politécnico de Viseu, CI&DETS, ESAV, Portugal
[2] CERNAS, Instituto Politécnico de Coimbra, Portugal
[3] Instituto Politécnico de Viseu, CI&DETS, ESSV, Departamento de Enfermagem, Viseu, Portugal

Raquel Guiné - raquelguine@esav.ipv.pt | Manuela Ferreira - mmcferreira@gmail.com | Paula Correia - paulacorreia@esav.ipv.pt | João Duarte - duarte.johnny@gmail.com

Autor Correspondente
Raquel Guiné
Quinta da Alagoa, Estrada de Nelas, Ranhados
3500-606 Viseu, Portugal
raquelguine@esav.ipv.pt

RECEBIDO: 19 de abril, 2016
ACEITE: 02 de setembro, 2016

Guiné, R., Ferreira, M., Correia, P. & Duarte, J. (2016). Attitudes of the Portuguese Population Regarding Dietary Fibre. *Millenium, 2*(1), 49-62.

RESUMO

Introdução: A fibra dietética (FD) tem feito parte da dieta humana desde há milénios, embora os seus benefícios tenham sido reconhecidos, principalmente, nas últimas décadas.

Objetivos: Porque a FD é um componente importante de uma dieta saudável, o objetivo deste trabalho foi avaliar os hábitos de consumo dos Portugueses, bem como o seu conhecimento sobre os alimentos ricos em fibras e as suas atitudes em relação à rotulagem dos alimentos.

Métodos: Foi realizado um estudo descritivo transversal usando uma amostra não-probabilística de 382 participantes.

Resultados: Os resultados mostraram que a ingestão de alimentos ricos em fibras, como frutas, vegetais e cereais, foi muito menor do que a ingestão recomendada. Os resultados também indicaram que a maioria das pessoas não presta a atenção desejada à rotulagem de alimentos ou à informação nutricional.

Conclusões: O nível geral de conhecimento sobre FD foi considerado insatisfatório, e, portanto, é necessário mais educação nutricional e desenvolver esforços para informar as pessoas acerca da importância da FD como parte da sua dieta diária.

Palavras-chave: alimentos ricos em fibra; fibra dietética; fontes de fibra; hábitos de consumo; pesquisa; rotulagem.

ABSTRACT

Introduction: Dietary fibre (DF) has been part of human diet for millenniums although its benefits have been recognized mainly in the last dec ades.

Objectives: Because DF is such an important component of a healthy diet, the objective of this work was to evaluate the consuming habits of the Portuguese, as well as their knowledge about the fibre rich foods and their attitudes towards food labelling.

Methods: A descriptive cross-sectional study was carried out on a non-probabilistic sample of 382 participants. The results showed that the ingestion of fibre rich foods like fruit, vegetables and cereals, was much lower than the recommended ingestion.

Results: The results also indicated that most people do not pay the desired attention to food labelling or nutritional information.

Conclusions: Also the general level of knowledge about DF was found unsatisfactory, and hence more education and efforts are necessary to inform people towards the importance of DF as part of their daily diet.

Keywords: dietary fibre; consumption habits; labelling, fibre rich foods; sources of fibre; survey.

RESUMEN

Introducción: La fibra dietética (FD) ha sido parte de la dieta humana durante miles de años, aunque se han reconocido sus beneficios especialmente en las últimas décadas.

Objetivos: Debido a que el FD es un componente importante de una dieta saludable, el objetivo de este estúdio fue evaluar los hábitos de consumo de los Portugueses, así como su conocimiento de los alimentos ricos en fibra y sus actitudes hacia el etiquetado de alimentos.

Métodos: Fue realizado un estudio descriptivo transversal con una muestra no probabilística de 382 participantes.

Resultados: Los resultados mostraron que la ingesta de alimentos ricos en fibra como frutas, verduras y granos era mucho menor que la ingesta recomendada. Los resultados también indicaron que la mayoría de la gente no presta la atención deseada para el etiquetado de alimentos e información nutricional.

Conclusiones: Además, el nivel general de conocimiento de FD se consideró insatisfactorio, y por lo tanto se necesita más educación sobre la nutrición y los esfuerzos para informar a la gente acerca de la importancia de la FD como parte de su dieta diaria.

Palabras clave: alimentos ricos en fibra; fibra dietética; fuentes de fibra; hábitos de consumo; pesquisa; etiquetado.

INTRODUCTION

Dietary fibre (DF) has been consumed since ancient times and in recent decades has been recognized as having many associated health benefits, as evidenced by many scientific studies. At present, plants with DF and bioactive compounds are showing great interest either for the industry or the consumers due to their role in improving human well being (Zhu et al., 2015).

DF has proven to exert different beneficial effects on risk factors associated with the development of many chronic diseases, such as atherosclerosis, haemorrhoids or cardiovascular disease, also helping lowering serum LDL cholesterol and blood pressure. Additionally, many studies have demonstrated a beneficial effect of DF in reducing the incidence of several types of cancer, like colorectal, prostate or breast cancer (Brownlee, 2011; Kendall et al., 2010; Martinho et al., 2013; Russo et al., 2014).

DF also demonstrated major roles in the gut physiology. DF influences the physicochemical characteristics of the digesta and the morphology and microbial ecosystem of the gastrointestinal tract (GIT). Also the maturation and integrity of the mucosa are greatly determined by the adequate ingestion of DF. The functional effects of DF on the previously mentioned variables could be attributed to its physicochemical properties and also, indirectly, to variations in the fermentation pattern as well as to the ability to modify the microbiota profile in the different segments of the GIT (Molist et al., 2014). However, the physiological effects of DF are dependent on its nature, being generally DF divided into two classes, depending on the solubility in water: insoluble and soluble DF. Insoluble DF corresponds to cellulose and lignin, the structural parts of plant materials which are not metabolized by the bacteria in the intestine. Therefore, insoluble DF can also be categorized as unfermentable fibre. In contrast, pectins, gums and mucilages, which exist within and around the plant cells, are soluble in water forming a gel-like structure. This soluble DF is fermentable by the colonic bacteria and hence is called fermentable fibre. In nature, plant foods are formed by a mixture of soluble and insoluble fibres, being both beneficial in different ways for the human health (Ajila and Rao, 2013; Aune et al., 2011; Debusca et al., 2013; Martinho et al., 2013; Phillips, 2013).

Dietary reference intakes (DRI, 2002/2005) recommend an ingestion of at least 25 to 35 g of fibre per day, or more precisely 25 g of fibre for adult women and 38 g for adult men (Russo et al., 2014; Sáyago-Ayerdi et al., 2014).

Fruits, green vegetables and legumes, are all foods typically very rich in DF, besides being also rich in other bioactive components, like phenolic compounds with antioxidant activity or dietary minerals and vitamins (Ajila and Rao, 2013).

Thus, the objective of this study was to evaluate the consuming habits of Portuguese people relating to DF, as well as their knowledge about the fibre rich foods. Furthermore, the attitudes relating to food labelling and the information about DF were also studied.

1. METHODS

1.1. Questionnaire

The questionnaire used in the present work was previously developed and applied (Guiné et al., 2014; Martinho et al., 2013). The questionnaire consisted of seven different sections, designed to evaluate the attitudes regarding the ingestion of foods rich in dietary fibre. The socio-demographic characteristics were addressed in the first section of the questionnaire (age, gender, level of education and living environment).

Another section permitted evaluating the frequency of consumption of different types of foods and also consumption habits regarding 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 focused on eating legumes and/or salads, eating fruit, eating whole cereals, eating out of home or eating fast-food. The attitudes toward food labelling were also addressed, and in this case the respondents were asked a set of questions related to food labelling, and in particular the information about the fibre content. The participants answered on a 5-point scale, varying from 1 (never) to 5 (always), and the questions included the following topics: “When I buy a food I usually consult the label”, “In the label I look for nutritional composition”, “I look for the amount of fibres”, “The quantity of fibres influences my food choices” and “When I buy a food stating fibre-rich, I check what is the amount present”.

The knowledge about the relation between dietary fibre and foods was accessed 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). Hence, they were asked to indicate their extent of agreement towards statements, such as: “Dietary fibres are original from plant foods”, “Dietary fibres are original from animal foods”, “Dietary fibres have calories, i.e., they provide energy to the body when ingested” and “Legumes (beans, peas,...), cereals and fruits are foods rich in dietary fibre”.

Guiné, R., Ferreira, M., Correia, P. & Duarte, J. (2016). Attitudes of the Portuguese Population Regarding Dietary Fibre. *Millenium, 2*(1), 49-62.

1.2. Statistical analysis

For the exploratory analysis of the data basic descriptive statistics was used. Also the crosstabs and the chi square test were used to assess the relations between some of the nominal/ordinal variables under study. For evaluating the differences between the quantitative variables (scale) among groups, the non-parametric tests were used due to non-homogeneity of the groups (U-Mann Whitney for comparisons between two groups and Kruskal-Wallis for comparisons between three or more groups).

For all data analysis the software SPSS, from IBM Inc. (version 22) was used. The level of significance considered was 5%.

1.3. Sample characterization

This study was undertaken during the year 2015 in Portugal. The total number of participants was 382, from which 233 were female and 143 were male, with 6 participants not indicating their gender. The average age of the participants was 37.8±10.6 years, ranging from 19 to 65 years, being the average age of the male participants (40.0±10.5 years) higher than that of the female (36.4±10.5 years) (Table 1). The enquired were all adults, thus not including elderly people. Still, the variable age was classified into categories according to: • young adults, from 19 to 30 years, accounting for 26.7%; • average adults, from 31 to 50 years, representing 58.9%; • senior adults, from 51 to 65 years, corresponding to 14.4%.

The majority of the participants had a high level of education (82.0% with a university degree), while 18.0% had competed secondary school. Among the participants only one had not completed secondary school. Most of the participants lived in an urban environment (80.4%), while 19.6% lived in rural areas.

Table 1. Age distribution of the participants according to gender.

Gender	%	Minimum	Maximum	Median	Mean age	Standard deviation
Female	62.0	19	62	35	36.4	10.5
Male	38.0	23	65	38	40.0	10.5
Total	100.0	19	65	35	37.8	10.6

RESULTS AND DISCUSSION

2.1. Consuming habits

In Table 2 are presented the results obtained for the consumption of meals including vegetables in a typical week. It was observed an average number of meals per week of 8.66±4.55, corresponding to just slightly more than one meal per day that includes vegetables. It was observed that 33.1% of the respondents admitted eating less than 7 portions of vegetables per week, or less than once a day. This average consumption of vegetables is in fact lower than the recommended ingestion, which stands on 3.5 to 6.5 cups of fruits and vegetables per day for adults, although varying according to age, sex, and level of physical activity (USDHHS, 2010; USDHHS/USDA, 2015). McSpadden et al. (2016) suggest that both friends and family might have a decisive role in the motivational processes that lead to an adequate ingestion of fruits and vegetables. Also Godinho et al. (2016) postulate that the success motivation for an adequate consumption of fruits and vegetables is related to the each person's characteristics, like motivational orientation, baseline intentions or cultural background.

The consumption of vegetables was higher for people in the range of 31 to 50 years (9.32±4.70) and lower for the young adults (7.17±4.24), indicating that this age group might have less concern about a healthy diet. The differences between age groups were statistically significant, as the results of the Kruskal-Wallis test showed ($p = 0.000$) (Table 2). Also the differences between gender and level of education were significant, being the consumption of vegetables higher for women (9.06±4.69) than for men ($p = 0.011$). This might be due to a higher concern in women about a healthy diet, so as to obtain a better looking body. The consumption of vegetables was also higher for people with more education, i.e., with a university degree (9.03±4.35), which might be due to educational factors, better economic status and higher income. The consumption of vegetables among people living in rural or urban areas was not significantly different ($p = 0.382$) (Table 2).

Table 2. Consu mption of meals including vegetables per week.

Variable		(Min;Max)	Mean±St. Dev.	p-value
Age	Young adults (19-30)	(0;21)	7.17±4.24	0.000[a]
	Average adults (31-50)	(1;35)	9.32±4.70	
	Senior adults (51-65)	(2;16)	8.75±3.83	
Gender	Female	(0;35)	9.06±4.69	0.011[b]
	Male	(0;24)	7.96±4.30	
Level of Education	Secondary school	(0;35)	6.87±5.15	0.000[b]
	University degree	(0;34)	9.03±4.35	
Living Environment	Rural	(1;34)	8.47±5.10	0.382[b]
	Urban	(0;35)	8.68±4.43	
	Total	(0;35)	8.66±4.55	

[a] Kruskal-Wallis test

[b] U-Mann Whitney test

Table 3 presents the results for the consumption of fruit portions per week, corresponding to a global average of 11.66±7.80. From the participants in this study, 62.4% ate less than 14 doses of fruit per day (corresponding to one at each of the main meals) and 25,7% ate less than 7 (one dose of fruit per day). The differences in the amounts of fruit ingested were not statistically significant between rural or urban people, or even between people showing different levels of education. However, significant differences were found for age (p = 0.000) or for gender (p = 0.028), being the consumption of fruit higher for senior adults (14.06±8.63) and for women (11.67±7.62), being this last in accordance with what was previously seen for vegetables.

Table 3. Consumption of meals including fruits per week.

Variable		**(Min;Max)**	**Mean±St. Dev.**	**p-value**
Age	Young adults (19-30)	(0;48)	9.01±7.15	
	Average adults (31-50)	(1;50)	12.17±7.50	0.000[a]
	Senior adults (51-65)	(3;49)	14.06±8.63	
Gender	Female	(0;49)	11.67±7.62	0.028[b]
	Male	(1;50)	10.21±8.00	
Level of Education	Secondary school	(0;48)	9.93±7.26	0.655[b]
	University degree	(0;50)	11.97±7.83	
Living Environment	Rural	(0;49)	10.97±9.13	0.061[b]
	Urban	(0;50)	11.74±7.39	
	Total	(0;50)	11.66±7.80	

[a] Kruskal-Wallis test

[b] U-Mann Whitney test

The results for the weekly intake of whole cereals are shown in Table 4, corresponding to a global average of 3.11±0.38, thus corresponding to approximately once every two days, being therefore low. There are many studies that corroborate the thesis that increased ingestion of whole grains reduces the risk of developing chronic diseases like type 2 diabetes or cardiovascular diseases (Giacco et al., 2014; Ye et al., 2012)2014; Ye et al., 2012. Whole grain foods have a much higher nutritional value when compared to refined cereals, being important sources of DF, as well as numerous micronutrients, minerals, and phytochemicals (Wu et al., 2015).

Again the results in table 4 reveal that the living environment did not significantly influence the ingestion of meals including whole cereals (p = 0.575), and the same was observed for age (p = 0.359). However, variables like gender or level of education produced significant differences regarding the consumption of whole cereals. In this way, the consumption of whole cereals was higher for women (3.63±3.58) and for people with more education (3.32±3.47).

Table 4. Consumption of meals including whole cereals per week.

Variable		(Min;Max)	Mean±St. Dev.	p-value
Age	Young adults (19-30)	(0;12)	2.90±2.86	0.359[a]
	Average adults (31-50)	(0;21)	3.12±3.60	
	Senior adults (51-65)	(0;14)	3.56±3.45	
Gender	Female	(0;21)	3.63±3.58	0.000[b]
	Male	(0;14)	2.30±2.87	
Level of Education	Secondary school	(0;8)	2.26±2.86	0.010[b]
	University degree	(0;21)	3.32±3.47	
Living Environment	Rural	(0;14)	3.37±3.60	0.575[b]
	Urban	(0;21)	3.06±3.33	
	Total	(0;21)	3.11±0.38	

[a] Kruskal-Wallis test; [b] U-Mann Whitney test

Eating out of home is at times associated with a lower quality of the meals, and this is the reason why this particular aspect was also investigated in this study. The results in Table 5 show that, on average, the participants ate out of home 2.80±2.86 times per week (Table 5), which corresponds to a low incidence of meals out of home. The results further indicate that only gender is significantly related to the frequency of eating out (p = 0.000), so that men eat out more times per week (3.52±3.56). This might be related to the fact that still more women like to prepare the meals at home than men, although this is clearly changing over the last years, with an increasing number of men interested in cooking their own meals. The differences between age groups, level of education or living environment were not statistically significant (p = 0.431, p = 0.420 and p = 0.627, respectively).

Table 5. Number of meals out of home per week.

Variable		(Min;Max)	Mean±St. Dev.	p-value
Age	Young adults (19-30)	(0;10)	2.47±2.28	0.431[a]
	Average adults (31-50)	(0;36)	3.01±3.19	
	Senior adults (51-65)	(0;10)	2.85±2.51	
Gender	Female	(0;10)	2.41±2.27	0.000[b]
	Male	(0;36)	3.52±3.56	
Level of Education	Secondary school	(0;8)	2.59±2.40	0.420[b]
	University degree	(0;36)	2.90±2.98	
Living Environment	Rural	(0;10)	2.96±2.59	0.627[b]
	Urban	(0;36)	2.81±2.95	
	Total	(0;36)	2.80±2.86	

[a] Kruskal-Wallis test; [b] U-Mann Whitney test

In Table 6 are presented the results for the number of meals of fast food eaten over a period of 7 days. On average, the consumption of fast food meals was very low (0.62±1.00), thus indicating that the inquired revealed a tendency for more healthy eating habits. The results were significantly different among age groups (p = 0.001), with the young adults eating fast food more frequently (0.76±0.91) than the other age groups. Still, even for that age group the number of times they eat fast food per week is less than once, thus indicating some concern for a healthy eating.

Table 6. Number of fast food meals per week.

Variable		(Min;Max)	Mean±St. Dev.	p-value
Age	Young adults (19-30)	(0;5)	0.76±0.91	0.001[a]
	Average adults (31-50)	(0;6)	0.59±0.93	
	Senior adults (51-65)	(0;10)	0.46±1.42	
Gender	Female	(0;6)	0.57±0.90	0.388[b]
	Male	(0;10)	0.69±1.17	
Level of Education	Secondary school	(0;6)	0.79±1.31	0.665[b]
	University degree	(0;10)	0.58±0.93	
Living Environment	Rural	(0;2)	0.56±0.62	0.342[b]
	Urban	(0;10)	0.63±1.09	
	Total	(0;10)	0.62±1.00	

[a] Kruskal-Wallis test; [b] U-Mann Whitney test

2.2. Attitudes towards food labelling

Food labels include information relating to both safety and nutritional content of the foods, and therefore, they have proven increasingly important for consumer protection (Rimpeekool et al., 2015). Table 7 reveals that globally the participants consider the consultation of the food label as a mildly important issue (average score of 3.52±0.96, on a scale from 1=never to 5=always look at the label). Although the differences between age groups or living environments were not significant (p = 0.301 and p = 0.657, respectively), variables like gender or level of education were associated with the consultation of the label. Statistically significant differences were found between gender and levels of education (p = 0.000 in both cases) with the highest score for consultation of the food labels occurring for women (3.68±0.92) and more educated people (3.63±0.89).

Table 7. Statistics for the consultation of the label.

	Statement evaluated: *"When I buy a food I usually consult the label"* (scale from 1=never to 5=always)		
Variable		**Mean ± St. Dev.**	**p-value**
Age	Young adults (19-30)	3.44±1.05	0.301[a]
	Average adults (31-50)	3.53±0.88	
	Senior adults (51-65)	3.68±1.05	
Gender	Female	3.68±0.92	0.000[b]
	Male	3.28±0.96	
Level of Education	Secondary school	3.07±1.09	0.000[b]
	University degree	3.63±0.89	
Living Environment	Rural	3.47±0.97	0.657[b]
	Urban	3.54±0.95	
	Total	3.52±0.96	

[a] U-Mann Whitney test; [b] Kruskal-Wallis test

Although according to Kim et al. (2016) the nutrition information in the food label constitutes an easy way to help people making healthier food choices and therefore improving their nutrients intake, it was observed in the present study that the participants did not reveal a very marked tendency to look for nutritional information in the label of foods (average score of 3.40±1.05) (Table 8). The differences between age groups or living environments were not significant (p = 0.604 and p = 0.318, respectively) but between genders or levels of education were significant (p = 0.000 in both cases). Again, being a women or having a higher level of education proved to influence the behaviour towards a more pronounced interest in the nutritional information about the food consumed.

Table 8. Statistics for consultation of the nutrition information in the label.

Statement evaluated: *"In the label I look for nutritional composition"* (scale from 1=never to 5=always)			
Variable		**Mean ± St. Dev.**	**p-value**
Age	Young adults (19-30)	3.61±1.17	0.604[a]
	Average adults (31-50)	3.39±0.95	
	Senior adults (51-65)	3.46±1.19	
Gender	Female	3.60±1.00	0.000[b]
	Male	3.06±1.04	
Level of Education	Secondary school	2.87±1.14	0.000[b]
	University degree	3.51±0.99	
Living Environment	Rural	3.30±0.98	0.318[b]
	Urban	3.42±1.07	
	Total	3.40±1.05	

[a] U-Mann Whitney test; [b] Kruskal-Wallis test

Presently there are several food products marketed as fibre rich, however, it is important to have an attitude towards confirming this content. It is, therefore, important to guarantee that the claims are true and help consumers making better choices to improving their diet (Ruffell, 2016). Table 9 refers to the results obtained for the frequency with which the participants look for the amount of fibres in the food labels. Globally, the score obtained was 2.84±1.10, corresponding to a low interest in knowing the amount of fibres present in the foods that people buy. The differences between people living in urban or rural environments were not statistically significant (p = 0.740). Nevertheless, in the case of age, gender or level of education, the differences were significant (p = 0.021, p = 0.000 and p = 0.000, respectively). People who tend to look more at the label to get information about dietary fibre are senior adults (3.20±1.17), of the female gender (3.03±1.06) and with higher education level (2.94±1.06).

Table 9. Statistics for the consultation of the fibre content in the label.

Statement evaluated: *"In the label I look for the amount of fibres"* (scale from 1=never to 5=always)			
Variable		**Mean ± St. Dev.**	**p-value**
Age	Young adults (19-30)	2.66±1.08	0.021[a]
	Average adults (31-50)	2.82±1.06	
	Senior adults (51-65)	3.20±1.17	
Gender	Female	3.03±1.06	0.000[b]
	Male	2.52±1.07	
Level of Education	Secondary school	2.37±1.13	0.000[b]
	University degree	2.94±1.06	

Living Environment	Rural	2.85±1.02	0.740[b]
	Urban	2.83±1.11	
	Total	2.84±1.10	

[a] U-Mann Whitney test; [b] Kruskal-Wallis test

In the past years consumers have become more preoccupied with a healthy diet and so the wholegrain-based and fibre-rich products have become more popular (Van der Kamp and Lupton, 2013)and have consequently (re. Nevertheless, in this study, the participants gave little importance to DF as being a reason to influence their buying options (average score 2.88±1.06) (Table 10). In this case, only the differences according to age or gender were significant (p = 0.001) and (p = 0.002), respectively. Senior adults and women seemed to be more influenced by the amount of fibres when buying food (average scores of 3.28±1.12 and 3.02±1.02, respectively).

Table 10. Statistics for the influence of fibre in the food choice.

Statement evaluated: *"The quantity of fibres influences my food choices"* (scale from 1=never to 5=always)			
Variable		**Mean ± St. Dev.**	**p-value**
Age	Young adults (19-30)	2.62±1.03	0.001[a]
	Average adults (31-50)	2.90±1.02	
	Senior adults (51-65)	3.28±1.12	
Gender	Female	3.02±1.02	0.002[b]
	Male	2.65±1.08	
Level of Education	Secondary school	2.73±1.18	0.256[b]
	University degree	2.91±1.02	
Living Environment	Rural	2.97±0.97	0.376[b]
	Urban	2.86±1.08	
	Total	2.88±1.06	

[a] U-Mann Whitney test; [b] Kruskal-Wallis test

It is important to ensure that the advertised claims about fibre rich foods are is accordance with the food's composition (Viebke et al., 2014). The frequency with which the participants in this study confirm the claims about fibre rich foods through the label was low (2.86±1.17) (Table 11), which confirms some lack of interest by the matters relating to food labelling. The differences between gender and level of education were statistically significant (p = 0.001 for both), so that women (3.02±1.17) and people with higher education (2.97±1.15) showed more interest to confirm the claims about fibre-rich foods.

Table 11. Statistics for confirmation of the alleged fibre rich content.

Statement evaluated: *"When I buy a food stating fibre-rich, I check what is the amount present"* (scale from 1=never to 5=always)			
Variable		**Mean ± St. Dev.**	**p-value**
Age	Young adults (19-30)	2.81±1.26	0.169[a]
	Average adults (31-50)	2.82±1.12	
	Senior adults (51-65)	3.15±1.16	

Guiné, R., Ferreira, M., Correia, P. & Duarte, J. (2016). Attitudes of the Portuguese Population Regarding Dietary Fibre. *Millenium, 2*(1), 49-62.

Gender	Female	3.02±1.17	0.001[b]
	Male	2.61±1.12	
Level of Education	Secondary school	2.42±1.16	0.001[b]
	University degree	2.97±1.15	
Living Environment	Rural	2.85±1.11	0.950[b]
	Urban	2.87±1.18	
	Total	**2.86±1.17**	

[a] U-Mann Whitney test; [b] Kruskal-Wallis test

2.3. Knowledge about dietary fibres and variety of foods

DF is original from plant foods (Macagnan et al., 2015)2015 and therefore the statement analysed in Table 12 is true. The results showed that the participants had a low level of knowledge about the origin of DF, with an average score of 3.04±1.35. While the differences between genders and living environments were not statistically significant, those between age groups or levels of education were significant (p = 0.026 and p = 0.012, respectively). The highest knowledge about this fact was shown by average adults (3.19±1.36) and by more educated people (3.13±1.37).

Table 12. Statistics for vegetable nature of dietary fibre.

Statement evaluated: *"Dietary fibres are original from plant foods"* (scale from 1= totally disagree to 5= totally agree)			
Variable		**Mean ± St. Dev.**	**p-value**
Age	Young adults (19-30)	2.73±1.35	0.026[a]
	Average adults (31-50)	3.19±1.36	
	Senior adults (51-65)	3.02±1.25	
Gender	Female	3.01±1.39	0.827[b]
	Male	3.08±1.28	
Level of Education	Secondary school	2.65±1.17	0.012[b]
	University degree	3.13±1.37	
Living Environment	Rural	2.99±1.34	0.701[b]
	Urban	3.05±1.36	
	Total	3.04±1.35	

[a] U-Mann Whitney test; [b] Kruskal-Wallis test

The question evaluated next, whose results are shown in Table 13, was false, as it was previously stated that DF comes from vegetable sources, exclusively. Despite the fact that people were not so sure about the plant nature of DF, it was interesting to observe that when the question was opposite a relatively strong disagreement occurred, as demonstrated by the low score (1.69±0.74). The differences were significant among genders (p = 0.035) and among levels of education (p = 0.000), being the senior adults and women more informed about this (lower scores of 1.60±0.60 and 1.62±0.67, correspondingly).

Table 13. Statistics for animal nature of dietary fibre.

Statement evaluated: *"Dietary fibres are original from animal foods"* (scale from 1= totally disagree to 5= totally agree)			
Variable		**Mean ± St. Dev.**	**p-value**
Age	Young adults (19-30)	1.69±0.81	0.652[a]
	Average adults (31-50)	1.73±0.76	
	Senior adults (51-65)	1.60±0.60	
Gender	Female	1.62±0.67	0.035[b]
	Male	1.82±0.83	
Level of Education	Secondary school	1.95±0.67	0.000[b]
	University degree	1.64±0.76	
Living Environment	Rural	1.77±0.77	0.284[b]
	Urban	1.68±0.75	
	Total	1.69±0.74	

[a] U-Mann Whitney test; [b] Kruskal-Wallis test

Fibres provide calories when ingested: 2 kcal/g (8 kJ/g) (Reg. EU Nº 1169/2011), so the statement analysed was true. Still, the agreement of the participants with this statement was not noticeable (2.95±1.27) (Table 14), because many people have the wrong and outdated idea that fibre does not have calories. In this case, only the differences between levels of education were statistically significant (p = 0.015) and interestingly, it was among the people with secondary school that the knowledge about this fact was higher (3.31±1.05).

Table 14. Statistics for calories in dietary fibre.

Statement evaluated: *"Dietary fibres have calories"* (scale from 1= totally disagree to 5= totally agree)			
Variable		**Mean ± St. Dev.**	**p-value**
Age	Young adults (19-30)	2.86±1.30	0.515[a]
	Average adults (31-50)	2.99±1.26	
	Senior adults (51-65)	3.09±1.26	
Gender	Female	2.98±1.32	0.670[b]
	Male	2.95±1.20	
Level of Education	Secondary school	3.31±1.05	0.015[b]
	University degree	2.89±1.31	
Living Environment	Rural	3.15±1.13	0.161[b]
	Urban	2.92±1.30	
	Total	2.95±1.27	

[a] U-Mann Whitney test; [b] Kruskal-Wallis test

A diet rich in fruit and vegetables has been pointed as vital for a healthy lifestyle, being these particularly important also for their content in DF (O'Shea et al., 2012). Table 15 demonstrated that most of the participants actually know what types of food are rich in DF (4.13±0.87). The differences were statistically significant only for gender (p = 0.001), with women getting a higher mean score (4.27±0.76).

Guiné, R., Ferreira, M., Correia, P. & Duarte, J. (2016). Attitudes of the Portuguese Population Regarding Dietary Fibre. *Millenium, 2*(1), 49-62.

Table 15. Statistics for fibre rich foods.

Statement evaluated: *"Legumes, cereals and fruits are foods rich in dietary fibre"* (scale from 1= totally disagree to 5= totally agree)			
Variable		**Mean ± St. Dev.**	**p-value**
Age	Young adults (19-30)	4.11±0.77	0.645[a]
	Average adults (31-50)	4.16±0.88	
	Senior adults (51-65)	4.06±1.01	
Gender	Female	4.27±0.76	0.001[b]
	Male	3.92±0.99	
Level of Education	Secondary school	3.96±0.94	0.071[b]
	University degree	4.17±0.85	
Living Environment	Rural	4.17±0.76	0.812[b]
	Urban	4.12±0.90	
	Total	4.13±0.87	

[a] U-Mann Whitney test; [b] Kruskal-Wallis test

To measure the global degree of knowledge about DF, a new variable was created as the average value considering the four statements, but after inverting the scores for the statement that was false (animal origin of DF). The newly created variable varied from 1, corresponding to the lowest degree of knowledge, to 5, corresponding to the highest degree of knowledge. The results in Table 16 showed that the average global knowledge was relatively low, 3.38±0.65. The global knowledge varied significantly only according to age group (p = 0.008), being the average adults those who showed a higher score (3.46±0.66).

Table 16. Measurement of the general level of knowledge.

General Level of Knowledge (scale from 1= totally disagree to 5= totally agree)			
Variable		**Mean ± St. Dev.**	p-value
Age	Young adults (19-30)	3.23±0.61	0.008[a]
	Average adults (31-50)	3.46±0.66	
	Senior adults (51-65)	3.39±0.63	
Gender	Female	3.43±0.63	0.054[b]
	Male	3.32±0.66	
Level of Education	Secondary school	3.31±0.63	0.197[b]
	University degree	3.40±0.65	
Living Environment	Rural	3.44±0.61	0.550[b]
	Urban	3.37±0.66	
	Total	3.38±0.65	

[a] U-Mann Whitney test; [b] Kruskal-Wallis test

CONCLUSIONS

This work allowed important conclusions relating to the ingestion of fruits, vegetables and whole grains among a sample of the Portuguese population, which was much below the recommendations. In this way, further actions are necessary so as to better inform the general population about the benefits of a diet rich in DF. The level of knowledge about dietary fibre was in general not satisfactory, and therefore also this is a field for improvements so as to better being able to communicate the nutritional importance of DF. Although the meals are made essentially at home, few foods rich in DF are cooked and/or consumed, which may

be related precisely with the low knowledge of the nutritional value of DF.

This study further revealed that the attitudes of Portuguese people towards food labelling are inadequate and show a lack of interest for the nutritional information as helping to make adequate food choices. Also in this area further educational efforts should be implemented.

ACKNOWLEDGMENTS

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.

REFERENCES

Ajila, C.M., Rao, U.J.S.P., 2013. Mango peel dietary fibre: Composition and associated bound phenolics. J*ournal of Functional Foods* 5, 444–450. doi:10.1016/j.jff.2012.11.017

Aune, D., Chan, D.S.M., Lau, R., Vieira, R., Greenwood, D.C., Kampman, E., Norat, T., 2011. Dietary fibre, whole grains, and risk of colorectal cancer: systematic review and dose-response meta-analysis of prospective studies. *British Medical Journal* 343, d6617–d6617. doi:10.1136/bmj.d6617

Brownlee, I.A., 2011. The physiological roles of dietary fibre. Food Hydrocolloids, Dietary Fibre and Bioactive Polysaccharides 25, 238–250. doi:10.1016/j.foodhyd.2009.11.013

Debusca, A., Tahergorabi, R., Beamer, S.K., Partington, S., Jaczynski, J., 2013. Interactions of dietary fibre and omega-3-rich oil with protein in surimi gels developed with salt substitute. *Food Chemistry* 141, 201–208. doi:10.1016/j.foodchem.2013.02.111

Giacco, R., Costabile, G., Della Pepa, G., Anniballi, G., Griffo, E., Mangione, A., Cipriano, P., Viscovo, D., Clemente, G., Landberg, R., Pacini, G., Rivellese, A.A., Riccardi, G., 2014. A whole-grain cereal-based diet lowers postprandial plasma insulin and triglyceride levels in individuals with metabolic syndrome. *Nutrition, Metabolism and Cardiovascular Diseases* 24, 837–844. doi:10.1016/j.numecd.2014.01.007

Godinho, C.A., Alvarez, M.-J., Lima, M.L., 2016. Emphasizing the losses or the gains: Comparing situational and individual moderators of framed messages to promote fruit and vegetable intake. *Appetite* 96, 416–425. doi:10.1016/j.appet.2015.10.001

Guiné, R., Martinho, C., Barroca, M.J., Viseu, C., 2014. Knowledge and attitudes regarding dietary fibres: a consumer survey in Portuguese population. *Journal of Basic and Applied Research International* 1, 1–12.

Kendall, C.W.C., Esfahani, A., Jenkins, D.J.A., 2010. The link between dietary fibre and human health. *Food Hydrocolloids* 24, 42–48. doi:10.1016/j.foodhyd.2009.08.002

Kim, H.-S., Oh, C., No, J.-K., 2016. Can nutrition label recognition or usage affect nutrition intake according to age? *Nutrition* 32, 56–60. doi:10.1016/j.nut.2015.07.004

Macagnan, F.T., Santos, L.R. dos, Roberto, B.S., de Moura, F.A., Bizzani, M., da Silva, L.P., 2015. Biological properties of apple pomace, orange bagasse and passion fruit peel as alternative sources of dietary fibre. *Bioactive Carbohydrates and Dietary Fibre* 6, 1–6. doi:10.1016/j.bcdf.2015.04.001

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, 180–188. doi:10.2174/1573401311309030002

McSpadden, K.E., Patrick, H., Oh, A.Y., Yaroch, A.L., Dwyer, L.A., Nebeling, L.C., 2016. The association between motivation and fruit and vegetable intake: The moderating role of social support. *Appetite* 96, 87–94. doi:10.1016/j.appet.2015.08.031

Molist, F., van Oostrum, M., Pérez, J.F., Mateos, G.G., Nyachoti, C.M., van der Aar, P.J., 2014. Relevance of functional properties of dietary fibre in diets for weanling pigs. *Animal Feed Science and Technology* 189, 1–10. doi:10.1016/j.anifeedsci.2013.12.013

O'Shea, N., Arendt, E.K., Gallagher, E., 2012. Dietary fibre and phytochemical characteristics of fruit and vegetable by-products and their recent applications as novel ingredients in food products. *Innovative Food Science & Emerging Technologies*

16, 1–10. doi:10.1016/j.ifset.2012.06.002

Phillips, G.O., 2013. Dietary fibre: A chemical category or a health ingredient? *Bioactive Carbohydrates and Dietary Fibre* 1, 3–9. doi:10.1016/j.bcdf.2012.12.001

Rimpeekool, W., Seubsman, S., Banwell, C., Kirk, M., Yiengprugsawan, V., Sleigh, A., 2015. Food and nutrition labelling in Thailand: a long march from subsistence producers to international traders. Food Policy 56, 59–66. doi:10.1016/j.foodpol.2015.07.011

Ruffell, M.J., 2016. Nutrition and Health Claims for Food: Regulatory Controls, Consumer Perception, and Nutrition Labeling, in: Caballero, B., Finglas, P.M., Toldrá, F. (Eds.), *Encyclopedia of Food and Health*. Academic Press, Oxford, pp. 93–97.

Russo, M., Bonaccorsi, I., Torre, G., Sarò, M., Dugo, P., Mondello, L., 2014. Underestimated sources of flavonoids, limonoids and dietary fibre: Availability in lemon's by-products. *Journal of Functional Foods* 9, 18–26. doi:10.1016/j.jff.2014.04.004

Sáyago-Ayerdi, S.G., Mateos, R., Ortiz-Basurto, R.I., Largo, C., Serrano, J., Granado-Serrano, A.B., Sarriá, B., Bravo, L., Tabernero, M., 2014. Effects of consuming diets containing Agave tequilana dietary fibre and jamaica calyces on body weight gain and redox status in hypercholesterolemic rats. *Food Chemistry* 148, 54–59. doi:10.1016/j.foodchem.2013.10.004

USDHHS, 2010. Dietary guidelines for Americans. U.S. Department of Health and Human Services, USA.

USDHHS/USDA: U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Retrieved from http://health.gov/dietaryguidelines/2015/guidelines/

Van der Kamp, J.W., Lupton, J., 2013. 1 - Definitions, regulations and health claims associated with dietary fibre and wholegrain foods, in: Poutanen, J.A.D. (Ed.), Fibre-Rich and Wholegrain Foods, Woodhead Publishing Series in Food Science, Technology and Nutrition. Woodhead Publishing, pp. 3–24.

Viebke, C., Al-Assaf, S., Phillips, G.O., 2014. Food hydrocolloids and health claims. *Bioactive Carbohydrates and Dietary Fibre* 4, 101–114. doi:10.1016/j.bcdf.2014.06.006

Wu, D., Guan, Y., Lv, S., Wang, H., Li, J., 2015. No Evidence of Increased Risk of Stroke with Consumption of Refined Grains: A Meta-analysis of Prospective Cohort Studies. *Journal of Stroke and Cerebrovascular Diseases* 24, 2738–2746. doi:10.1016/j.jstrokecerebrovasdis.2015.08.004

Ye, E.Q., Chacko, S.A., Chou, E.L., Kugizaki, M., Liu, S., 2012. Greater whole-grain intake is associated with lower risk of type 2 diabetes, cardiovascular disease, and weight gain. J*ournal of Nutrition* 142, 1304–1313. doi:10.3945/jn.111.155325

Zhu, F., Du, B., Zheng, L., Li, J., 2015. Advance on the bioactivity and potential applications of dietary fibre from grape pomace. Food Chemistry, ISPMF 2015: International Symposium on Phytochemicals in Medicine and Food (Shanghai, China, June 26th –29th, 2015) 186, 207–212. doi:10.1016/j.foodchem.2014.07.057