

Sources of Information about Dietary Fibre: A Cross-Country Survey

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Abstract

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Dietary fibre (DF) is recognized as a major determinant for improvement of health. Hence the means of information through which people become aware of its benefits are crucial and this work aimed at studying the sources of information about DF. Factors such as age, gender, level of education, living environment or country were evaluated as to their effect on the selection of sources and preferences. For this, a descriptive cross-sectional



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study was carried out in a sample of 6010 participants from 10 countries. For the analysis were used descriptive statistics, crosstabs and chi square test, and factor analysis with Varimax rotation. The results showed that mostly the information about DF comes from the internet, but the participants recognize that television might be a most suitable way to disseminate information about DF. The results also indicated differences between age groups, genders, levels of education, living environments and countries. The internet, the preferred source of information, got highest scores for Hungary, for urban areas, for university level of education and for female gender. The radio, the least scored source of information, was preferred in Egypt, for men and with lower education (primary school). As a conclusion, people get information through the internet due to easy access. However, it is to some extent a risk given the impossibility to control the information made public on the internet. The role of health centers and hospitals as well as schools should definitely be increased, as a responsible way to ensure correct information.

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Keywords: Dietary fibre; Information media; Internet; Television; Survey.

1. Introduction

Dietary fibre (DF) has long been recognised as healthy, so much that the European Food safety Authority (EFSA) allows health claims on dietary fibre (Mackie, Bajka, & Rigby, *sem data*). Some fibres act as prebiotics, such as dietary fibre preparations containing resistant dextrins, branched dextrins, resistant maltodextrins and soluble corn fibre. Prebiotics reach the colon without being hydrolysed and are selectively metabolized by health-positive bacteria like bifidobacteria and lactobacilli thus providing a beneficial effect on the host health (Gidley, 2013; Sabater, Prodanov, Olano, Corzo, & Montilla, 2016). The consumption of prebiotic substances may be one of the factors preventing overweight and obesity (Barczynska et al., 2015).

Over the last years a high degree of information has been discovered about the different compounds present in DF, such as prebiotics (with certain fermentability profiles of specific substances and their interaction with colonic microflora) or even bioactive compounds closely associated with DF (exerting important antioxidant properties with protective effect on the human body (Giuntini & Menezes, 2011; Saura-Calixto, 2011)). However, the benefits from an adequate ingestion of dietary fibre are far wider and include: preventing cardiovascular diseases, atherosclerosis, type 2 diabetes, constipation, gastrointestinal types of cancer and facilitating good colonic health (Sumczynski, Bubelová, & Fišera, 2015; Zhu, Du, & Xu, 2015; Zhu, Du, Zheng, & Li, 2015).

The beneficial effects and effectiveness of DF depend firstly on fibre intake but, not exclusively, because factors like fibre composition, organisational structure, physicochemical characteristics or associated bioactive compounds, which have been found directly related to its plant source and preparation methods have also demonstrated to be implicated on the way DF acts on the human body (Elleuch et al., 2011).

Education is pivotal for achieving a desired level of knowledge so as to make appropriate food choices. Differences in diet quality may contribute to different health status across socioeconomic groups, so that, in general, people from higher socioeconomic status tend to adhere to higher-quality diets. The disparities in diets and health have also been lined to neighbourhood food environments, for their influence of the dietary patterns (Acar Tek et al., 2011; Drewnowski, Aggarwal, Cook, Stewart, & Moudon, *sem data*; Rahmanian, Gasevic, Vukmirovich, & Lear, 2014).

The knowledge about DF as a food component is sometimes low, due to neglected involvement in producing effective ways of educating people about the topic. The sources of information are therefore important to identify fragilities and plan interventions aimed at increasing the level of education (Martinho et al., 2013). Still, because of the importance of DF as an agent of protection and promotion of human well-being and health, more recently there has been an increase in knowledge about DF (Macagnan, da Silva, & Hecktheuer, 2016).

This work aimed at evaluating the sources of information about DF on a sample population original from 10 different countries. Factors like age, gender, level of education, living environment or country were studied in relation to their effect regarding the data obtained for information about DF.

2. Materials and methods

2.1. Instrument

The questionnaire was structured into different sections, designed to gather, among other aspects, information about the sources of information regarding dietary fibre, given its importance as a healthy food component.

The socio-demographic characteristics like age, gender, level of education, country and living environment were addressed in the beginning of the questionnaire. The questionnaire also contained a section about the sources of information from where the respondents get information about dietary fibre. The respondents were asked to classify the different options on a scale from 1 (least important) to 6 (most important). There were two questions: “Where do you usually find information about dietary fibre” and “What means of communication do you consider the most appropriate to encourage the consumption of dietary fibre”, and for both the answering options were: (a) Health centres/hospitals, (b) Radio, (c) Television, (d) School, (e) Magazines/books, (f) Internet.

2.2. Data collection

The study was conducted with 6010 participants resident in several countries from different continents (Argentina, Croatia, Egypt, Hungary, Italy, Latvia, Macedonia, Portugal, Romania, Turkey). The participation included different countries because these integrated a project of the CI&DETS Research Centre (IPV, Viseu, Portugal).

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 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.

All the answers were kept anonymous and no personal data were ever collected or related to any answers, thus protecting the participants. Furthermore, all ethical issues were strictly guaranteed when designing the questionnaire and applying the survey.

2.3. Statistical analyses

For all data analysis the software SPSS, from IBM Inc. (version 22) was used. For the analysis of the data basic several descriptive statistics tools were used. Also the crosstabs and the chi square test were used to assess the relations between some of the variables under study. The level of significance considered was 5%.

A factor analysis (FA) was applied to the different sources of information, to observe if there was a grouping structure between some of them. Firstly, the data was tested to verify their applicability for FA by Principal Component Analysis (PCA), by means of the following elements: the correlation matrix between the variables included in the study; the Bartlett's test to check for intercorrelation between variables; and the Kaiser-Meyer-Olkin measure of adequacy of the sample (KMO) (Broen et al., 2015). After confirmation of the adequacy of the data, then the FA was applied with extraction by PCA method and Varimax rotation with Kaiser Normalization, i.e., with the number of components determined by eigenvalues ≥ 1 . In all cases, the communalities were calculated to show the percentage of variance explained by the factors extracted (Broen et al., 2015). Factor loadings with an absolute value exceeding 0.4 were used, because this lower limit accounts for about 16% of the variance in the variable (Rohm & Swaminathan, 2004; Stevens, 2009).

3. Results and Discussion

3.1. Sample characterization

This study was undertaken simultaneously in ten different countries originating from three different continents (Europe, America, Africa), as shown in Figure 1.

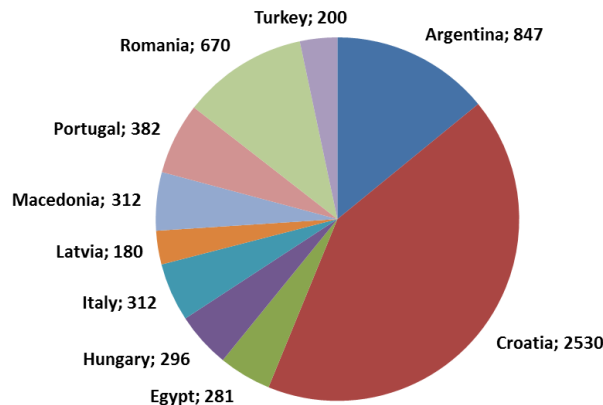


Figure 1. Number of participants by country.

The total number of participants was 6010, from which 65.7% were female and 34.3% were male. The average age of the participants was 34.5 ± 13.7 years, ranging from 18 to 84 years. The average age of the female participants was slightly lower (33.5 ± 13.3 years) when compared to the average age of the male participants (36.5 ± 14.4 years). The variable age was classified into categories according to: • young adults, from 18 to 30 years (accounting for 50.0%); • average adults, from 31 to 50 years

(representing 34.5%); • senior adults, from 51 to 65 years (corresponding to 13.5%); and finally elderly, over 65 (representing 2.0%).

The majority of the participants had a high level of education (55% with a university degree), while 42% had completed secondary school and just 3% had the lowest level of education (primary school) (Figure 2). Most of the participants lived in an urban environment (80.2%), while 19.8% lived in rural areas.

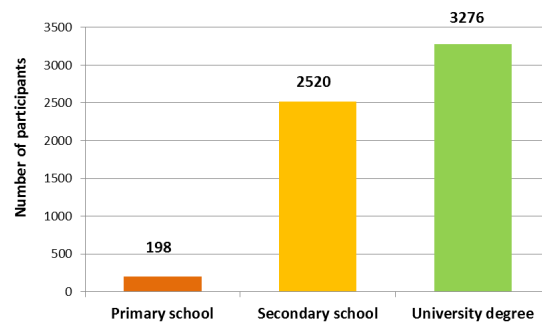


Figure 2. Distribution of the participants according to level of education.

3.2. Sources of information about DF

The level of information about nutritional and health related facts is largely dependent on the sources of information. There are different ways to disseminate information and allow keeping the public aware of the issues related to food fibres. Hence, this was one of the aspects evaluated in the present study by two questions: one related to the public's perceptions about the way information is presently being disclosed and also what would be the most appropriate means, in their opinion, to disseminate information about fibres.

The results in Table 1 shows the average score obtained for the multiple answering options for the two questions. It is possible to verify that internet is referred as the source from where the participants get more information about DF (average score of 4.3 ± 1.8). Health information presently represents one of the most popular search destinations online (Whitten, Kreps, & Eastin, 2011). Because of internet's attributes of convenience, ease of use, ability to reach large audiences and interactivity, it stands as an attractive option for disseminating information related to health care. However a better understanding is still needed to facilitate efficient and productive web-based health applications (Lin et al., 2015). Lin et al. (2015) in a survey about the uses of internet for health information, refer that ethnicity is not a significant determinant for the online searches about health information. Furthermore, they observed that social locators are less influencing than cognitive factors in explaining search behaviour.

The least pointed source of information about DF was radio (2.7 ± 1.6), and was also indicated as not so convenient for the transmission of information (2.9 ± 1.6) (Table 1). Nowadays, radio is not recognized as a privileged source of information, being rather seen as an entertainment source. According to Martinho et al. (2013) radio was given very little importance as a source for health communication. On the other hand, television was indicated as a potential adequate means of

communication to encourage the consumption of DF, getting the highest score (4.1±1.7). A similar result was reported by Martinho et al. (2013) for a study about DF. The TV commercials have a marked influence on the food choices. Ramos and Navas (2015) studied the influence of TV commercials on child obesity in Spain and concluded that, in face of complex advertising regulation, the commercials seen by children negatively influence their food options, and hence result in a high consumption of products high in simple sugars and saturated fat with a medium fat and salt content. However, since television reaches great audiences, it can also be used to disseminate healthy food information. Dovey et al. (2011) investigated whether healthy food television advertisements have a different effect on subsequent food intake by children. They concluded that although children with low levels of food neophobia responded positively to healthy food messages, children with higher levels of food neophobia did not alter unhealthy eating habits.

Table 1. Scores relative to the classification of the sources of information about dietary fibre (mean value ± standard deviation; scale from 1=least important to 6=most important).

Source of information	Question A ¹	Question B ²
Health centres/hospitals	3.1 ± 1.8	3.6 ± 1.8
Radio	2.7 ± 1.6	2.9 ± 1.6
Television	3.7 ± 1.5	4.1 ± 1.7
School	3.3 ± 1.6	3.9 ± 1.7
Magazines/books	3.9 ± 1.5	3.6 ± 1.6
Internet	4.3 ± 1.8	4.0 ± 1.7

¹Where do you usually find information about dietary fibre

²What means of communication do you consider the most appropriate to encourage the consumption of dietary fibre

3.3. Influence of social factors on the perception of the sources of information

Table 2 reveals the influence of social factors on the perception of the different sources of information about DF. Regarding the influence of the variable age, it was seen that internet was given less importance as the age increased (from 4.4±1.8 for your adults to 3.5±1.9 for elderly people). This is expected, since the internet is a relatively new means of communication and therefore it is more difficult for older people to use it frequently. Interestingly, the TV got the lowest score for young adults (3.5±1.5) as compared to the other age groups, revealing that the younger people prefer other sources of information and do not use TV so much for educational purpose, maybe because they like TV for entertaining purposes more. Also the results for radio indicate that it is preferred by older people (over 51 years) when compared to those aged under 50 years. The other sources of information showed variable results, with health centre/hospitals being preferred by elderly (3.4±1.9), schools by young adults (3.3±1.6) and magazines/books by people aged between 31 and 65 years. Statistically significant differences were found for all sources of information evaluated.

Internet was the most relevant means of information as seen before by the results in Table 1. Statistically significant differences were encountered for the rating of internet among genders (p=0.000) with a higher score for women (4.4±1.8) than for men (4.3±1.8) (Table 2). This is not surprising given that usually women are more devoted to care with diet and weight, and they look for answers to their problems in the internet, for easiness and convenience.

Table 2. Statistics regarding the different sources of information about dietary fibre (scale from 1=least important to 6=most important).

Variable	Var. level <i>p-value</i>	Internet ¹	TV ¹	Radio ¹	Health centres/ Hospitals ¹	School ¹	Magazines/ Books ¹
Age ²	YA (18-30)	4.4±1.8	3.5±1.5	2.6±1.6	3.2±1.8	3.3±1.6	3.8±1.5
	AA (31-50)	4.3±1.8	3.8±1.6	2.8±1.6	2.9±1.8	3.2±1.6	4.0±1.5
	SA (51-65)	4.0±1.8	3.9±1.6	3.1±1.5	3.0±1.8	3.0±1.6	4.0±1.6
	EL (>65)	3.5±1.9	3.8±1.6	3.2±1.6	3.4±1.9	2.8±1.7	3.9±1.5
	<i>p-value</i>	0.000	0.000	0.000	0.000	0.000	0.000
Gender	Female	4.4±1.8	3.6±1.5	2.6±1.6	3.1±1.8	3.3±1.6	4.0±1.5
	Male	4.3±1.8	3.9±1.6	2.9±1.6	3.0±1.8	3.1±1.6	3.7±1.5
	<i>p-value</i>	0.000	0.000	0.000	0.046	0.000	0.000
Level of Education	Primary	3.1±2.0	4.0±1.6	3.5±1.6	3.6±1.8	3.1±1.7	3.8±1.6
	Secondary	4.4±1.8	3.8±1.6	2.7±1.6	3.1±1.8	3.2±1.6	3.8±1.5
	University	4.4±1.8	3.6±1.5	2.7±1.6	3.1±1.8	3.3±1.6	4.0±1.5
	<i>p-value</i>	0.000	0.000	0.000	0.000	0.180	0.000
Living Environment	Rural	4.1±1.9	3.7±1.6	2.8±1.6	3.3±1.9	3.4±1.6	3.8±1.6
	Urban	4.4±1.8	3.7±1.5	2.7±1.6	3.0±1.8	3.2±1.6	3.9±1.5
	<i>p-value</i>	0.000	0.614	0.061	0.001	0.001	0.184
Country	Argentina	4.3±1.7	3.5±1.5	2.6±1.6	3.6±1.7	2.9±1.5	4.0±1.5
	Croatia	4.5±1.8	3.7±1.5	2.7±1.6	2.8±1.8	3.3±1.6	3.9±1.5
	Egypt	3.5±2.0	3.7±1.7	3.5±1.7	3.6±1.8	3.2±1.4	3.6±1.5
	Hungary	4.9±1.4	3.6±1.5	2.4±1.3	3.1±1.7	3.0±1.5	4.2±1.5
	Italy	3.8±1.7	3.4±1.6	2.6±1.7	3.4±1.8	3.4±1.7	4.0±1.5
	Latvia	4.4±1.9	3.3±1.3	2.7±1.4	2.9±1.8	3.6±1.5	4.2±1.5
	Macedonia	4.7±1.8	4.0±1.4	2.3±1.5	3.0±1.8	3.2±1.5	3.9±1.4
	Portugal	3.8±1.9	3.9±1.6	2.4±1.6	3.4±1.8	3.8±1.7	3.9±1.6
	Romania	4.4±1.7	3.9±1.7	3.2±1.6	2.7±1.6	2.9±1.7	3.9±1.5
	Turkey	4.5±1.8	3.6±1.5	2.6±1.6	3.4±1.6	3.8±1.6	3.2±1.7
	<i>p-value</i>	0.000	0.000	0.000	0.000	0.000	0.000

¹ Value = mean ± standard deviation

² YA = Young adults, AA = Average adults, SA = senior adults, EL = Elderly

Also the level of education was found to significantly influence the results ($p = 0.000$), so that the participants with a lower level of education, primary school, gave considerably lower scores for internet (3.4±2.0) when compared to secondary school or university level (4.4±1.8, in both cases) (Table 2). Also in this case the results are in accordance to what would be expected, since people with higher levels of instruction tend to use more the internet also for educational purposes.

Regarding the living environment, again significant differences were found with a higher average score for urban when compared to rural areas (4.4±1.8 against 4.1±1.9, respectively) (Table 2). This result is not surprising attending to the fact that in rural areas the access to internet is still more difficult than in urban areas.

With respect to the countries at study, statistically significant differences were found ($p = 0.000$), being given more importance for internet as a source of information about DF in Hungary (4.9±1.4) whereas in Egypt internet was not so much recognized as a good source of information (3.5±2.0)

(Table 2). These results might undoubtedly be related to cultural differences and also to the easiness of access to internet, which vary from country to country.

The results in Table 2 also show that factors such as age, gender, level of education or country were significantly associated ($p < 0.05$) with the TV as source of information about DF, contrarily to living environment, which did not correlate with this source of information. TV was preferred by men (3.9 ± 1.6), by participants with lower level of education (primary school) (4.0 ± 1.6) and by people from Macedonia (4.0 ± 1.4).

The radio was the media considered least used to get information about DF, as seen previously. The socio-demographic variables were associated with radio, except for living environment, for which the differences between living in urban or rural areas did not induce significant differences in the rating given by the participants in the survey. Although radio had a lowest expression, still it was scored as having some importance, particularly by men (2.9 ± 1.6), by participants with primary school (3.5 ± 1.6) and by people from Egypt (3.5 ± 1.7).

Table 2 reveals that health centres and hospitals were differently rated among participants of different ages, genders, levels of education, living environments or countries, with significant differences in all cases ($p < 0.05$). Health centres were rated with higher scores by elderly people (3.4 ± 1.9), women (3.1 ± 1.8), by participants with primary school (3.6 ± 1.8), by people living in rural areas (3.3 ± 1.9) and by people from Argentina and Egypt (3.6 ± 1.7 and 3.6 ± 1.8 , respectively).

The results in Table 2 show that, while age, gender, living environment and country were associated ($p < 0.05$) with the recognition of school as a source of information about DF, the level of education was not. School got higher scores, significantly different, for women (3.3 ± 1.6), for participants living in rural areas (3.4 ± 1.6) and for people from Portugal and Turkey (3.8 ± 1.7 and 3.8 ± 1.6 , respectively).

The results in Table 2 also show that factors such as age, gender, level of education or country are significantly associated ($p < 0.05$) with the magazines and books as sources of information about DF. Contrarily, living environment did not correlate with written sources of information (magazines/books), meaning that no significant differences were encountered relating to the area of living: rural or urban. This source of information was preferred by women (4.0 ± 1.5), by participants with university level of education (4.0 ± 1.5) and by people from Hungary (4.2 ± 1.5).

3.4. Factor analysis

The correlation matrix showed that there were some correlations between the variables, with some values around or higher than 0.4, although just moderately high (the highest value was 0.434, which was the correlation between the variables radio and internet). In this way, the values are indicative that it is possible to apply FA, being this also corroborated by the results of the Bartlett's test, because the p-value was highly significant ($p < 0.0005$), thus leading to the rejection of the null hypothesis that the correlation matrix was equal to the identity matrix. However, the value of KMO was weak (0.398) according to the classification of Kaiser and Rice (Kaiser & Rice, 1974).

The solution obtained by FA with PCA and varimax rotation retained two components, based on the Keiser criterion to consider eigenvalues greater than one (1.773 and 1.531, in the present case). The

percentages of total variance explained by the factors were 29.6% for factor 1 (F1) and 25.5% for factor 2 (F2), with a total variance explained of 55.1%.

The variable Internet had the largest fraction of its variance explained by the FA rotated solution, corresponding to 66.8%, followed by variable Television, with 65.9% of the variance explained. The variable School had a lower communality (0.376), corresponding to a lower percentage of its variance explained (only about 40%), and all other variables had communalities higher than 0.400.

The rotation converged in three iterations and resulted in two factors, as shown in Table 3. One factor (F1) was obviously associated with social communication media (Radio, Magazines, Internet) contrarily to the other factor (F2) more associated with health and educational services (Hospitals and Schools), although surprisingly also including Television. This grouping structure could be related to reliability, i.e., the participant may find some of the sources more reliable than others, and in that case they associate TV also as a reliable source of information. In relation to factor F1, all loadings were relatively high, with the lowest being 0.658 for variable Magazines, and regarding factor F2 the correlation of the variable most strongly associated to this factor was school, followed by hospitals and then by television. Because all variables were included in the solution with loadings higher than 0.4, this solution is acceptable with all the twelve variables included (Stevens, 2009), giving place to a grouping solution that can be somewhat interpreted as: factor F1 – less reliable sources of information and factor F2 – more reliable sources of information.

Table 3. Results of the FA solution with extraction by PCA and Varimax rotation.

Factor	Variables	 Loadings
F1	Radio	0.774
	Magazines	0.658
	Internet	0.713
F2	Hospitals	0.641
	School	0.774
	Television	0.613

4. Conclusion

The results in the present study allowed concluding that the majority of the information about DF comes from searches made through internet, but the participants recognize that television might be the best media to disseminate information about health related subjects such as diet and particularly DF. The results further showed differences between age groups, genders, levels of education, living environments and countries. The internet got highest scores for Hungary, for urban environment, for younger people, university level of education and for female gender. For the books the highest scores were for middle aged people, females, with university education and for Hungary and Latvia. TV was preferred by people from Macedonia, with university education, average adults or elderly and of the male gender. School was identified as a source of information in Portugal and Turkey, in rural environments, by young adults and female participants. Health centres got highest scores for Egypt and Argentina, rural areas, lower education (primary school), elderly people and female gender. The radio,

the least scored source of information, was preferred in Egypt, for men, for participants with primary school and elderly.

The factor analysis showed that the six sources of information could be grouped into two factors, one associated with sources potentially considered more reliable (hospitals, schools and television) and the other associated with less reliable sources (radio, internet or magazines). This is important, because it allows focusing on the best ways to disseminate information about a healthy eating, including DF regularly in the diet, so as to contradict the present trend to look for information on the internet.

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