Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 16 (XXXI), number 4, 2016: 7–17

Cristina-Bianca Pocol[1], **Călin Moldovan-Teselios**[2], **Laura Stan**[3], **Ioana-Delia Pop**[4]
[1,3,4] University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca
[2] Metro Media Transylvania, Cluj Napoca

Alfalfa Powder: Healthy Food Supplement for Sustainable Consumption

Abstract. An upward trend for plant dietary supplements has been reported lately in the Romanian market, suggesting that they could become a component of a sustainable food diet for consumers. The aim of this study was (1) to explore consumers' perceptions about alfalfa powder (a plant dietary supplement), to identify their needs and expectations regarding the use of this product and to define the consumer profile; (2) to outline the significant factors of alfalfa sustainable consumption. For this purpose, the evaluation was performed using a questionnaire on a sample of consumers from two important Transylvanian cities (Deva and Cluj-Napoca). The results of the study indicate that the product is consumed by youth, adults and elderly people with upper-class education and high incomes. Emphasis was placed on identifying the main benefits perceived by the use of alfalfa powder. Hence, these are directly related to immunity (10%), detoxification (15%) and healthy dietary supplements (32%). Furthermore, since sustainability is a key factor for increasing quality of life, evidence emerged revealing alfalfa sustainable consumption. Consequently, this study shows that a more sustainable consumption of alfalfa can be stimulated through successful strategies for consumer education through label information including traceability data.

Key words: alfalfa; behaviour; consumer perception; dietary supplements; consumer sustainability, Romania

Introduction

Food consumption is indispensable for human survival. Recent scientific evidence demonstrates that a diet comprising less animal and more plant-derived foods (rich in antioxidants, vitamins and fibers), delivers both nutritional and ecological benefits (Friel *et al.*, 2014; Tuso *et al.*, 2015; Tuso *et al.*, 2013; Joyce *et al.*, 2012). The sustainability of plant-based diets is based on using fewer natural resources and thus being less taxing on the environment (Sabate and Soret, 2014). In addition, policymakers support scientific findings by setting specific objectives to encourage more sustainable and healthy patterns of food and drink consumption, including reduced consumption of livestock products, increased consumption of fruit and vegetables and/or vegetarian food, and reduced consumption of bottled drinks (European Commission, 2012). These objectives aim to change existing food consumption habits in order to promote a healthy lifestyle, while at the same time ensuring the economic, social and environmental benefits for all stakeholders of the food chain (Johnston *et al.*, 2014).

[1] Associate professor, PhD, Department of Economic Sciences, 3-5 Manastur Street, 400372 Cluj-Napoca, Romania, e-mail: cristina.pocol@usamvcluj.ro
[2] Researcher, Metro Media Transylvania, 174 Constantin Brancusi Street, 400462 Cluj-Napoca, Romania, e-mail: calin.moldovan@gmail.com
[3] Lecturer, PhD, Department of Food Sciences, 3-5 Manastur Street, 400372 Cluj-Napoca, Romania, e-mail: laurastan@usamvcluj.ro, corresponding author
[4] Professor, PhD, Department of Exact Sciences, 3-5 Manastur Street, 400372 Cluj-Napoca, Romania, e-mail:-popioana@usamvcluj.ro

A sustainable diet has been defined as a "diet that's healthy, affordable, environmentally sustainable and culturally acceptable" (WWF, 2013). In addition, to increase food availability, Foley *et al.* (2011) suggests shifting diets from the current 16 major crops used for feed and biofuels to human food consumption only. Alfalfa (*Medicago sativa*) is an ubiquitary forage crop, important both for livestock feed and supplementing the human diet due to its rich content in proteins, minerals, vitamins and phytochemicals (Gaweł, 2012). Due to its high nutritional value, alfalfa leaf extract is a novel food or a novel food ingredient, safe for human consumption in the European Union (Commission Decision (2009/826/CE), 2009). In 2009 the European Food Safety Authority published the results of a study conducted in 2006 in all 25 EU member states, five of them confirming that alfalfa is used for human consumption as a dietary supplement or as an ingredient in soups and salads (European Food Safety Authority, 2009). Food supplements made from alfalfa are present on the market in the form of capsules, tablets, tinctures and powders (Rodrigues *et al.*, 2014; Karimi *et al.*, 2013; Pandey *et al.*, 2011). The use of alfalfa was approved in the United States, Canada and Mexico as an ingredient in beverages and candy bars, and as sprouts (Gaweł, 2012). Mielmann (2013) and Gawel (2012) consider that alfalfa is a rich source of protein and amino acids, especially exogenous amino and semi-exogenous acids, and that its consumption has beneficial effects for health. Moreover, even the sprouts of alfalfa (Gholami*et al.*, 2014) present important pharmaceutical properties. O'Dea (2003) identified the types of dietary supplements consumed by teenagers, among which there were also herbal supplements. However, it is not specified if these supplements include alfalfa-based products as well. Although there is plentiful evidence that food supplements are frequently used in addition to pharmaceuticals for health enhancement (European Food Safety Authority, 2009; Rodrigues *et al.*, 2014; Karimi *et al.*, 2013; Pandey *et al.*, 2011), there is insufficient evidence of consumers perception about the products (Klepser *et al.*, 2000). However, studies on dietary supplement notoriety, performed at the national level in the United States, do not identify top products obtained from alfalfa (Kennedy, 2005). In addition, (De Jong*et al.*, 2003) found that the main determinants of dietary supplement consumption are numerous and depend on the type of product, knowledge and attitudes of consumers. The potential use of alfalfa for human consumption is hampered by the lack of awareness of the benefits of this plant among consumers (Mielmann, 2013). Moreover, in the scientific literature there are no studies about consumer perception of the products obtained from alfalfa, nor about consumer segmentation for sustainable food choices.

Thus, the aim of this novel study was focused on two important goals: firstly, to evaluate the reputation of alfalfa powder among Romanian consumers alongside consumer profiles and identification of their needs and expectations and secondly, to articulate the importance of sustainability issues related to alfalfa consumption.

Materials and Methods

The research design covered exploratory, descriptive and motivational dimensions. The data were collected using a survey questionnaire, structured as follows:

- perceptions and knowledge about alfalfa powder: Q1 – Did you hear about alfalfa powder (yes/no); Q2 – If yes, from what you know, what are the main uses of this product? (open question);

- purchase behaviour (frequency, source, quantity, price): Q3 –Have you ever bought alfalfa powder?(yes/no); Q4 – If yes, how frequently do you buy: weekly or more often/once at two-three weeks/monthly or rarely? Q5 – From where did you buy alfalfa powder last time: specialized shops/ supermarkets/producer/ elsewhere; Q6 – What quantity did you buy last time? (open question); Q7 – How much did you pay for that quantity? (open question);
- consumption behaviour (expectations, fears, quantity), sources/channels of information: Q8 – How often do you consume alfalfa powder: every day or almost every day/once per two-three weeks/monthly or rarely?Q9 – For what purposes do you consume alfalfa powder? (open question); Q10 – Approximately what quantity of alfalfa powder do you consume for a meal?(open question); Q11 – What are your main sources of information concerning the benefits of alfalfa powder consumption: Internet/specialized shops/nutritionist, doctors/friends, relatives/TV shows, radio, press/other members of the family;
- concerns about sustainability issues: Q12 – Please indicate your agreement in purchasing decision of alfalfa powder regarding the following aspects: it was produced in unpolluted areas from local genetic material; it was cultivated without using chemicals; it was produced by using the local labour force; dehydration and grounding of alfalfa were performed with an artisanal system and with low energy consumption; recyclable packaging was used for the product; label information with data about the product's traceability was available; the price is affordable;
- socio-demographic characteristics: gender, age, education, profession, income, residence.

The study was conducted from 1st to 23rd October 2013, on a sample of 104 consumers of food supplements from two Transylvanian cities (Deva and Cluj-Napoca). The questionnaires were applied at four food supplements stores, 1 from Deva and 3 from Cluj-Napoca. Sample stratification was made in relation to market potential of the two cities (number of stores, number of potential customers), therefore, from the total of 104 respondents: 27 were from Deva and 77 from Cluj-Napoca. The structure of the sample is presented in Table 1. The high percentage of women (91,3%) is due to their traditional role in Romanian culture for selection and purchase of foodstuffs. This argument is typical in Eastern Europe and has been previously identified (Kutnohorska and Tomšík, 2013).

Classification techniques were used to provide a typology of consumers who have heard of alfalfa powder. The method used was the Hierarchical Cluster Analysis performed with SPSS Program. Cluster analysis helps to organize multivariate data into subgroups, in order to emphasize the characteristics of a structure (Everitt *et al.*, 2011). The method is used in medicine, psychology and market research. Cluster identification was based on the use of ascendant algorithms for aggregation, and descendant algorithms for division. The two types of algorithms have been brought together in the hierarchical classification (Hierarchical Cluster Analysis). The steps of the hierarchical ascending classification algorithm were: identification of n elements to be classified; determination of the pair of elements which are nearest to each other, obtaining a new element by aggregation; classification of the n-1 remaining elements until there is only one element to classify. For the descending classification algorithm, the same method has been applied in reverse: identification of the total set of elements; in every following step the division of the most heterogeneous group in two subgroups, continuing the algorithm until all the groups constituted had one element (Clocotici, 2014). Identification of consumer clusters was

made in relation to three variables: age, education and income. The variable gender was not relevant for this analysis since 92% of the female participants have heard of this product.

Results and Discussion

Perceptions of and knowledge about alfalfa powder

Data analysis shows that over three quarters (78%) of the respondents have heard of alfalfa powder. An analysis of its notoriety in the main socio-demographic categories indicates that male persons, under 40 years, with secondary education and with a family income of up to 1500 lei per month/member have heard of the product in high proportions, more than 80% (Table 2). The influence of gender and age on the reputation of dietary supplements was previously demonstrated (Kelly *et al.,* 2005), the determinants varying according to the type of supplement (Fennell, 2004).

Table 1. Profile of respondents

		Number of respondents	% of total
Gender	Male	9	8,7
	Female	95	91,3
Age	Maximum 30 years	25	24,0
	Between 31-50 years	57	54,8
	Over 50 years	22	21,2
Education	High school	15	14,4
	Post – high school	6	5,8
	Higher education	47	45,2
	Postgraduate education	33	31,7
	I do not know/I do not answer	3	2,9
Occupation	A student, university student	9	8,7
	Housewife/husbehusband	2	1,9
	Retired, unable to work	10	9,6
	Employee	65	62,5
	Patron, self-employed	8	7,7
	Other	4	3,8
	I do not know/I do not answer	6	5,8
Family income (lei*)	Maximum 1000 lei	7	6,7
	Between 1001-2000 lei	16	15,4
	Between 2001-3000 lei	18	17,3
	Between 3001-4000 lei	25	24,0
	Over 4000 lei	16	15,4
	I do not know/I do not answer	22	21,2

*1 euro = 4.4560 lei (1st of October 2013, Romanian National Bank)

Source: own research.

After having applied the procedure Hierarchical Cluster Analysis, 3 different clusters were obtained (Table 3), as follows:

- *Cluster* 1: young people with secondary education and income under 3000 lei monthly, unemployed, who match the profile of the student;
- *Cluster* 2: people over 40 years, with high education, income under 3000 lei monthly (but not in the same proportion as the persons from Cluster 1), unemployed, who match the profile of retirees with high education;

- *Cluster* 3: employed people, from the upper class in education and income, with incomes slightly over 3000 lei, who match the profile of persons employed with higher education.

Table 2. Alfalfa powder notoriety for the main socio-demographic categories

		Notoriety
Gender	masculine	89%
	feminine	77%
Age	under 40 years	89%
	over 40 years	66%
Education	secondary education	90%
	higher education	76%
Occupational status	unemployed (student, housewives, retirees)	86%
	employed (employee, employer)	75%
Household income	maximum 1500 lei /month/family member	90%
	over 1500 lei /month/family member	61%
Locality	Cluj-Napoca	81%
	Deva	70%

Source: own research.

Table 3. Clusters obtained after applying Hierarchical Cluster Analysis

	Cluster 1	Cluster 2	Cluster 3
Age	Under 40 years	Over 40 years	Balanced
Education	High school studies	Balanced	Superior
Income	Under 3000 lei monthly	Under 3000 lei monthly	Over 3000 lei monthly
	Rather unemployed	Unemployed	Employed

Source: own research.

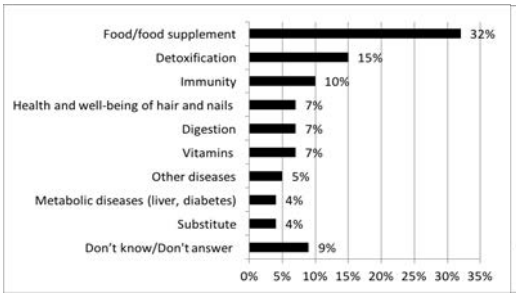


Fig. 1. Perceived benefits of alfalfa powder (N=81)

Source: own calculations.

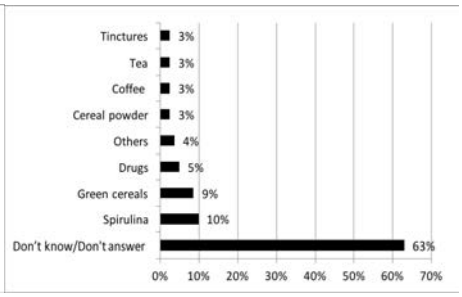


Fig. 2. Perceived substitutes for alfalfa powder (N=81)

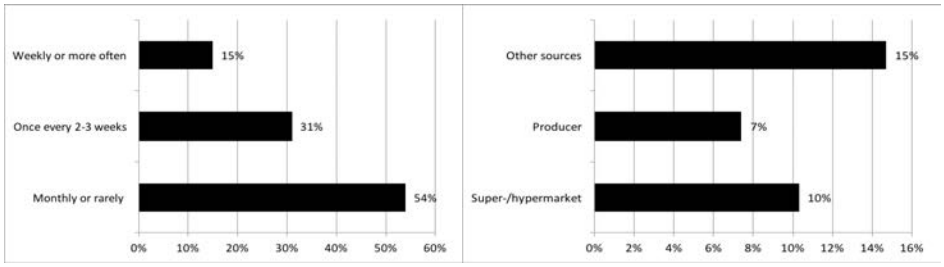
Source: own calculations.

Almost a third (32%) of those who have heard of this product acknowledge alfalfa powder as food, 15% indicate its detoxification properties, and 10% think that the product increases immunity (Figure 1). Exhaustive pharmacological studies reveal alfalfa's potential in the treatment of cardiovascular diseases and central nervous system affections (Bora and Sharma, 2011), in diabetes due to important hypoglycaemic effects (Pathak and Das, 2013; Dwivedi and Kumar, 2011; Permender *et al.,* 2010; Singab *et al.,* 2014). Isolated tannins from the alfalfa have remarkable antimicrobial properties against foodborne pathogens (Doss *et al.*, 2011) and antifungal potential. The content of Vitamin C

in alfalfa increases the amount of haemoglobin in the blood, being recommended as a dietary supplement in increasing body resistance (Gaweł, 2012). Lucerne can also be used as an adjunct to improve the health of patients recovering after chemotherapy and radiotherapy or for patients diagnosed with HIV (Gaweł, 2012). According to the respondents, alfalfa powders are viewed as substitutes for spirulina (10%), of green grains (9%) and, to a smaller extent, of some medicines, tea, coffee or tinctures. However, almost two thirds of respondents could not mention a product that can substitute powdered alfalfa (Figure 2).

Purchasing behaviour of alfalfa powder

Approximately 84% of those who have heard of alfalfa powder bought such products. In terms of the frequency of purchase, 31% of consumers buy the products at least once every 2-3 weeks, and 15% of them purchase them weekly (Figure 3a, 3b).



(a) (b)

Fig. 3. (a) Frequency of alfalfa powder purchase (N=68) and (b) Purchase source for alfalfa powder (N=68)
Source: own calculations.

Table 4. Shares of alfalfa powder buyers for the main socio-demographic categories

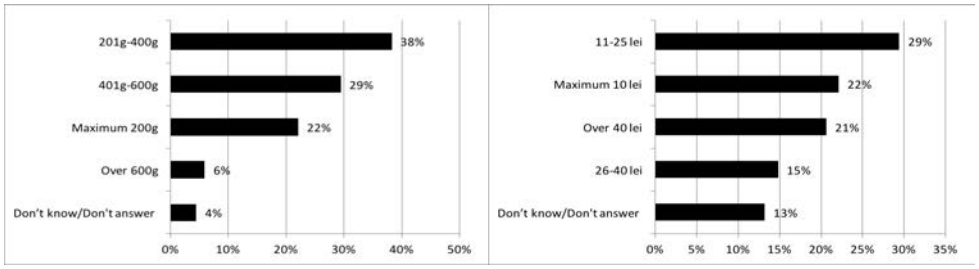
Category	Subcategory	Purchase (% of total subcategory)
Gender	Masculine	88
	Feminine	84
Age	under 40 years	90
	over 40 years	76
Education	secondary education	74
	higher education	87
Occupational status	unemployed (student, housewives, retirees)	89
	employed (employee, employer)	81
Household income	maximum 1500 lei /month/family member	85
	over 1500 lei/ month/family member	89
Locality	Cluj-Napoca	90
	Deva	63

Source: own calculations.

About two-thirds of buyers have most recently purchased alfalfa powder from a specialty store. Another 10% bought it from the supermarket, and 7% bought it directly from the manufacturer. The main buyers of powders are under age 40, with higher education and from Cluj-Napoca (Table 4).

As data emerged three clusters were identified with different consumption behaviours:
- *Cluster 1*: young people, with secondary education and income under 3000 lei monthly, unemployed: 79% consumed alfalfa powder;

- *Cluster 2*: persons over 40 years, with higher education, income under 3000 lei monthly: 100% consumed alfalfa powder;
- *Cluster 3*: employed persons, from the upper class as education and income, with incomes slightly over 3000 lei 86% consumed alfalfa powder.



(a) (b)

Fig. 4. (a) Purchased quantity of alfalfa powder (N=68) and (b) Price paid for alfalfa powder (N=68)

Source: own calculations.

Modelling a quantitative purchasing behaviour of alfalfa powder, it can be noticed that consumers purchase, on average, about 415g in one shopping session, the most commonly purchased quantity being in the 201g-400g category. The price paid for this amount was on average 27 lei (Figure 4 (a) and 4 (b)).

Consumer behaviour of alfalfa powder

Consumption of alfalfa powder is a daily habit for more than half of buyers. Over 80% of them consume the product at least once a week. There are socio-demographic determinants for frequency of consumption. Thus, daily consumption is more common among women, persons with higher education and employees. A lower frequency of consumption was identified in people over 40 years of age, or those from Deva. The consumption of dietary supplements is influenced by a complex mix of demographic and health-related factors (Egan *et al.*, 2011). Similar associations between socio-demographic characteristics and the consumption of dietary supplements have been identified by (Greger, 2001) as well, with women and more educated people consuming these products more often. Women's stronger propensity to consume dietary supplements is underlined also by other authors (Fennell, 2004; McNaughton*et al.*, 2005).

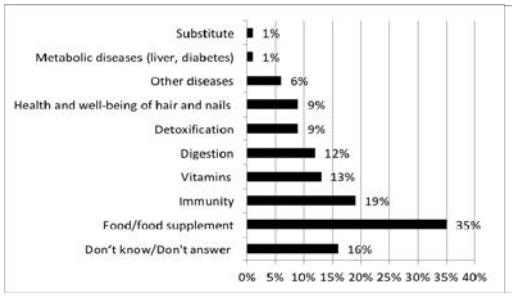


Fig. 5. Motivations for consumption of alfalfa powder (N=68)

Source: own calculations.

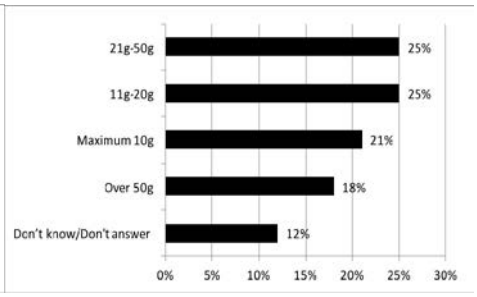


Fig. 6. Quantity of alfalfa powder consumed at a meal (N=68)

Source: own calculations.

Motivation for the consumption of alfalfa powder broadly reproduces the perceived usefulness of the product. Most likely, the transfer was made from motivation to perception of the usefulness (when making the effect for which it is used, the product is very useful to that end). A third of those who consume this product do so by including it in their diet, while 19% do it to get extra immunity. Another 12%-13% consume the product for the additional intake of vitamins or to improve digestion (Figure 5).

On average, for one consumption occasion (meal), 40g of alfalfa powder is consumed. However, there are important segments of consumers who consume less than 20g (46%), indicating non-uniform consumption behaviour (Figure 6).

Sources of information regarding alfalfa powder

One of the main issues raised by researchers regarding dietary supplements brings into discussion the sources of information related to the consumption of these products. Previous studies (Greger, 2001) show that magazines, books, specialty stores and fitness activities are the most used sources of information, to the detriment of information provided by doctors or nutritionists. Moreover, consumers of food supplements do not, in most cases, inform their physicians about the consumption of such products (Greger, 2001).

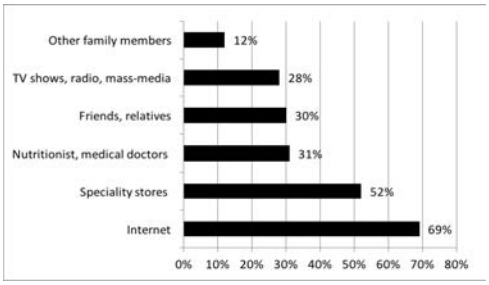


Fig. 7. Sources of information regarding alfalfa powder (N=81)

Source: own calculations.

In this study, the aforementioned conclusions are once again confirmed. The main source of information about alfalfa powder is the Internet, 69% of respondents declaring to have used the Internet to search for information. The second most important source of information is the specialized personnel working in dedicated stores or the stores themselves. Fewer respondents get their information from nutritionists, doctors, mass-media or from friends or relatives. On average, those who search for information use two sources (Figure 7). However, of those who use a single source of information, only 39% choose the Internet. About 9% of respondents do not get information from any of the sources mentioned above. Residence distinguishes different behaviours in terms of gathering information, respondents in Deva using on average 1.6 sources, while those in Cluj-Napoca using 2.4 sources. Of course, there can be seen in some way an expected behaviour regarding sources of information (younger individuals, those with higher education, and those with higher family incomes use more information sources than those over 40, with secondary education, and low family incomes), but the differences are not statistically significant.

Sustainable concerns about alfalfa powder

Previous studies demonstrate that consumer concerns about sustainability differ according to the product category, e.g. packaging-related issue for ice cream, soft milk and social issues for coffee, chocolate and sweets (Grunert *et al.,* 2014). In the present study, the respondents were more concerned about components of environmental sustainability (maintain renewable resource harvest, unpolluted areas and recyclable packaging) (see Figure 8.) This finding is consistent with previous studies (Vanhonacker *et al.,* 2013; Reisch *et al.,* 2013), which have identified the same pattern of environmentally-friendly behaviour like recycling and sorting waste and energy saving. In addition, in the current study the respondents were less concerned about methods of production and label information containing data about product traceability.

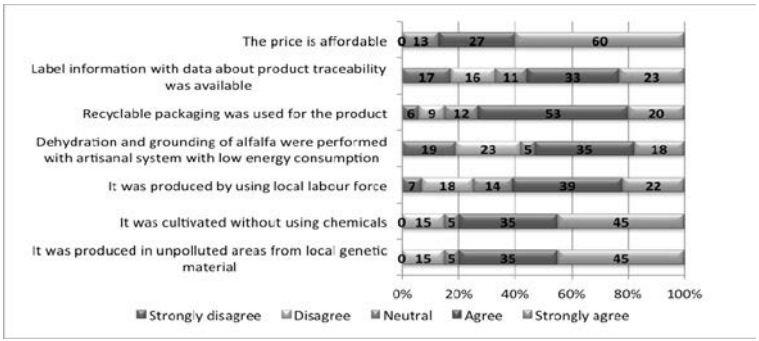


Fig. 8. Respondents' concerns about sustainability issues

Source: own calculations.

Economic access remains a key factor for assuring sustainability and food security (Kneafsey *et al.,* 2013). However, economic sustainability in terms of affordability is still important for Romanian consumers (Figure 8) due to low income. Other research (FAO) also discussed the question of income and suggested two possible directions: either to eat according to income and social status, or to eat responding to multiple goals of quality, environment, health, social, economic and governance (FAO, 2010; Arcese, 2015).

Conclusions

Currently, in Romania, a healthy lifestyle is an ascending trend. To this end, the use of dietary supplements has become a very common practice. Regarding the reputation of alfalfa powder, this product is known mainly by consumers of dietary supplements, the product being perceived as a food that complements a normal diet and as a therapeutic product that prevents, treats or cures certain diseases. Most consumers purchase this product from specialty stores and hypermarkets. Alfalfa powders are consumed by young, adult and older consumers, especially educated persons with reasonable incomes. Before consuming this product, Romanian consumers should be properly informed about the health benefits, the appropriate intake quantity, the moment and the period of administration. Moreover, they should be informed about the importance of consuming food sustainably, thus leading to conscious consumption of "healthy and sustainable" diets. In the present, doctors are the recommended source of information. The Internet, relatives, friends do not

represent reliable channels, expert advice being needed, especially for children, the elderly, pregnant women and people with chronic diseases. The authors believe that consumer education is a key factor in encouraging a more sustainable diet which could have a "win-win" effect on the whole sustainable food chain. This could also create opportunities for policy makers in major fields such as public health, climate change, food security and environmental protection.

Acknowledgments

This work was a part of a research project in the framework of NESsT Competition, dedicated to Social Enterprises, Edition 2013. The authors wish to thank Bogdan Diaconu for collaboration and Molly McDonough for linguistic revision.

References

Arcese, G., Flammini, S., Lucchetti, M.C., Martucci, O. (2015). Evidence and Experience of Open Sustainability Innovation Practices in the Food Sector. *Sustainability*, *7(7)*, 8067-8090.

Bora, K.S., Sharma, A. (2011). Phytochemical and pharmacological potential of *Medicago sativa*: A review. *Pharmaceutical Biology*, *49(2)*, 211-220.

Clocotici, V. Statistică multivariată. Available online: http://thor.info.uaic.ro/~val/statistica/StatWork_12.pdf (accessed on December 2014).

Commission Decision (2009/826/CE) of 13 October 2009 authorising the placing on the market of a leaf extract from Lucerne (*Medicago Sativa*) as novel food or novel food ingredient under Regulation No 258/97 of the European Parliament and of the Council. Available online: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009D0826 (accessed on December 2014).

De Jong, N., Ocke, M.C., Branderhorst, H.A., Friele, R. (2003). Demographic and lifestyle characteristics of functional food consumers and dietary supplement users. *British Journal of Nutrition*, *89(02)*, 273-281.

Doss, A., Parivuguna, V., Vijayasanthi, M., Surendran, S. (2011). Antibacterial evaluation and phytochemical analysis of *Medicago sativa* L. against some microbial pathogens. *Indian Journal of Science and Technology*, *4(5)*, 550-552.

Dwivedi, P., Kumar, P. (2011). Anti-diabetic medicinal plants and their conservation: Waging green war on diabetes. *Medicinal Plants-International Journal of Phytomedicines and Related Industries*, *3(3)*, 181-189.

Egan, B., Hodgkins, C., Shepherd, R., Timotijevic, L., Raats, M. (2011). An overview of consumer attitudes and beliefs about plant food supplements. *Food and function*, *2(12)*, 747-752.

European Commission (2012). Policies to encourage sustainable consumption – Full report. Available online: http://ec.europa.eu/environment/archives/eussd/pdf/report_22082012.pdf (accessed on December 2014).

European Food Safety Authority (2009). Scientific Opinion of the Panel on Dietetic Products Nutrition and Allergies on a request from the European Commission on the safety of 'Alfalfa protein concentrate' as food. *The EFSA Journal*, *997*, 1-19.

Everitt, B.S., Landau, S., Leese, M., Stahl, D. (2011). *Cluster analysis*. Fifth ed., Wiley: London, UK, 7-9, 71-110.

Fennell, D. (2004). Determinants of supplement usage. *Preventive medicine*, *39(5)*, 932-939.

Foley, J.A., Ramankutty, N., Brauman, K.A., Cassidy, E.S., Gerber, J.S., Johnston, M., Mueller, N.D., O'Connell, C., Ray, D.K., West, P.C., Balzer, C., Bennett, E.M., Carpenter, S.R., Hill, J., Monfreda, C., Polasky, S., Rockström, J., Sheehan, J., Siebert, S., Tilman, D., Zaks, D.P.M. (2011). Solutions for a cultivated planet. *Nature*, *478(7369)*, 337-342.

FAO (2010). Sustainable diets and biodiversity. Directions and solutions for policy, research and action. Proceedings of the International Scientific Symposium "Biodiversity and sustainable diets united against hunger". 3–5 November 2010, FAO Headquarters, Rome. Available online: http://www.fao.org/docrep/016/i3004e/i3004e.pdf (accessed on December 2014).

Friel, S., Barosh, L.J., Lawrence, M. (2014). Towards healthy and sustainable food consumption: An Australian case study. *Public health nutrition*, *17(05)*, 1156-1166.

Gaweł, E. (2012). Chemical compositions of lucerne leaf extract (EFL) and its applications as a phytobiotic in human nutrition. *ACTA Scientiarum Polonorum Technologia Alimentaria*, *11*, 303-309.

Gholami, A., De Geyter, N., Pollier, J., Goormachtig, S., Goossens, A. (2014). Natural product biosynthesis in *Medicago* species. *Natural product reports*, *31(3)*, 356-380.

Greger, J.L. (2001). Dietary supplement use: consumer characteristics and interests. *The Journal of Nutrition*, *131(4)*, 1339S-1343S.

Grunert, K.G., Hieke, S., Wills, J. (2014). Sustainability labels on food products: Consumer motivation, understanding and use. *Food Policy*, *44*, 177-189.

Johnston, J.L., Fanzo, C.J., Cogill, B. (2014). Understanding Sustainable Diets: A Descriptive Analysis of the Determinants and Processes That Influence Diets and Their Impact on Health, Food Security, and Environmental Sustainability. *Advances in Nutrition*, *5(4)*, 418–429.

Joyce, A., Dixon, S., Comfort, J., Hallett J. (2012). Reducing the Environmental Impact of Dietary Choice: Perspectives from a Behavioural and Social Change Approach, *Journal of Environmental and Public Health*, Article ID 978672, 7 pages, doi:10.1155/2012/978672.

Karimi, E., Oskoueian, E., Oskoueian, A., Omidvar, V., Hendra, R., Nazeran, H. (2013). Insight into the functional and medicinal properties of *Medicago sativa* (Alfalfa) leaves extract. *Journal of Medicinal Plants Research*, *7(7)*, 290-297.

Kelly, J. P., Kaufman, D.W., Kelley, K., Rosenberg, L., Anderson, T.E., Mitchell, A.A. (2005). Recent trends in use of herbal and other natural products. *Archives of Internal Medicine, 165(3)*, 281-286.

Kennedy, J. (2005). Herb and supplement use in the US adult population. *Clinical Therapeutics*, *27(11)*, 1847-1858.

Klepser, T.B., Doucette, W.R., Horton, M.R., Buys, L.M., Ernst, M.E., Ford, J.K., Klepser, M.E. (2000). Assessment of patients' perceptions and beliefs regarding herbal therapies. Pharmacotherapy. *The Journal of Human Pharmacology and Drug Therapy*, *20(1)*, 83-87.

Kneafsey, M., Dowler, E., Lambie-Mumford, H., Inman, A., Collier, R. (2013). Consumers and food security: uncertain or empowered? *Journal of Rural Studies*, *29*, 101-112.

Kutnohorska, O., Tomšík, P. (2013). Consumers' perception of the health aspects of organic food. *Agricultural Economics–Czech*, *59*, 293-299.

McNaughton, S.A., Mishra, G.D., Paul, A.A., Prynne, C.J., Wadsworth, M.E. (2005). Supplement use is associated with health status and health-related behaviors in the 1946 British birth cohort. *The Journal of Nutrition*, *135(7)*, 1782-1789.

Mielmann, A. (2013). The utilisation of lucerne (*Medicago sativa*): a review. *British Food Journal*, *115(4)*, 590-600.

O'Dea, J.A. (2003). Consumption of nutritional supplements among adolescents: usage and perceived benefits. *Health education research*, *18(1)*, 98-107.

Pandey, N., Meena, R.M., Rai, S.K., Rai, S.P. (2011). Medicinal plants derived nutraceuticals: a re-emerging health aid. *International Journal of Pharmacological Biosciences*, *2*, 419–441.

Pathak, K., Das, R.J. (2013). Herbal Medicine-A Rational Approach in Health Care System. *International Journal of Herbal Medicine*, *1(3)*, 86-89.

Permender, R., Hema, C., Sushila, R., Dharmender, R., Vikash, K. (2010). Antidiabetic potential of *Fabaceae* family: An overview. *Current Nutrition and Food Science*, *6(3)*, 161-175.

Reisch, L., Eberle, U., Lorek, S. (2013). Sustainable food consumption: an overview of contemporary issues and policies. *Sustainability: Science, Practice and Policy*, *9(2)*, 7-25.

Rodrigues, F., Almeida, I., Sarmento, B., Amaral, M.H., Oliveira, M.B.P. (2014). Study of the isoflavone content of different extracts of *Medicago spp*. as potential active ingredient. *Industrial Crops and Products*, *57*, 110-115.

Sabate, J., Soret, S. (2014). Sustainability of plant-based diets: back to the future, *American Journal of Clinical Nutrition*, *100(suppl)*, 476S–82S.

Singab, A.N., Youssef, F.S., Ashour, M.L. (2014). Medicinal Plants with Potential Antidiabetic Activity and their Assessment. *Medicinal and Aromatic Plants*, *3(1)*, 151.

Tuso, P., Stoll, R.S., Li, W.W. (2015). A Plant-Based Diet Atherogenesis, and Coronary Artery Disease Prevention, *The Permanente Journal*, *19(1)*, 62-67.

Tuso, P.J., Ismail, H.M., Ha B.P., Bartolotto, C. (2013). Nutritional Update for Physicians: Plant-Based Diets, *The Permanente Journal*, *17(2)*, 61-66.

Vanhonacker, F., Van Loo, E.J., Gellynck, X., Verbeke, W. (2013). Flemish consumer attitudes towards more sustainable food choices. *Appetite*, *62*, 7-16.

WWF (2013). Adopting healthy, sustainable diets: key opportunities and barriers. Report. Available online: http://livewellforlife.eu/wp-content/uploads/2013/05/Adopting-healthy-sustainable-diets-report.pdf (accessed on December 2014).