Consumer survey on the consumption of pulses in Hungary

GÁBOR ZSOLT NAGY – LIVIA SIMON SARKADI – ERZSÉBET SZABÓ

Summary
Pulses are essential multifunctional crops whose biological and nutritional properties play an important role in making our diet "healthier" and improving the sustainability of agroecosystems. The aim of our research was to explore the pulse consumption habits of Hungarians and to map the development possibilities of pulse-based products. An internet-based survey was conducted among Hungarian respondents (n = 1 023). The survey included questions about the frequency of pulse consumption, the intention to increase their consumption, socio-demographic background factors and perceptions, and knowledge of various pulses. Beans, green beans, lentils, red lentils, green peas, yellow peas and chickpeas were selected for detailed evaluation. The results showed that the most purchased products were green peas and dry legumes in their frozen and canned forms. The five favourite ready-made pulse-based dishes were sandwich spreads, croquettes, crackers, bread, croissants, buns and pasta. Based on the survey, we also developed a path model in which nine factors were introduced with exploratory factor analysis. Among Hungarians, consumer habits, the image of pulses and consumer preference were the most important factors in increasing the consumption of pulses.

Keywords
chickpeas; consumer survey; legumes; path model; pulses

Legumes are essential multifunctional crops that have been consumed either directly as food or in various processed forms or used as feed in many countries worldwide since ancient times [1]. In 2012, pulse crops accounted for approximately 1 million square kilometres in agricultural land use worldwide [2].

Legumes belong to the family Fabaceae (Leguminosae) [3]. According to the Food and Agriculture Organization (FAO), pulses are a subgroup of legumes harvested for dried grains that can be used for both feed and food [4]. Pulses (e.g. beans, peas, lentils) are important sources of plant-based proteins. Their protein content (approximately 21–25 %) is almost double that found in cereals [5]. Legumes have high dietary fibre content [6]. Common beans, chickpeas, dry peas and lentils contain 2 to 3 times more fibre per 100 g edible portion than other dietary staples [7]. The fat content of legumes is generally 2–21 %, with the valuable composition of unsaturated fatty acids such as linoleic acid (C18:2). Most legumes contain phytochemicals and bioactive compounds may provide health benefits and protect against numerous disorders or diseases [8]. Grain legumes appear to help reduce the risks for worldwide health problems like diabetes [9, 10] obesity [11], coronary heart disease [12] and significantly lower serum cholesterol concentrations [13].

The nutritional value of pulses is generally little known and underestimated. For this reason, in 2014, the 68th United Nations General Assembly declared 2016 as the International Year of Pulses (IYP) and mandated FAO with its implementation. The main objective was to heighten public awareness of pulses' nutritional benefits as part of sustainable food production aimed towards food security and nutrition. Building on the success of IYP in 2016, United Nations General Assembly designated February 10 as World Pulses Day as an international day to recognize the importance of pulses [4].

Global environmental problems, the greenhouse effect and the exponential increase in popu-

Gábor Zsolt Nagy, Livia Simon Sarkadi, Department of Nutrition, Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences, Somlói St. 14–16, 1118 Budapest, Hungary.
Erzsébet Szabó, NARIC Food Science Research Institute, Herman Ottó St. 15, 1022 Budapest, Hungary.

Correspondence author:
Livia Simon Sarkadi, e-mail: simonne.sarkadi.livia@uni-mate.hu

lation are global world problems requiring urgent solutions. Considering all these reasons, people have become more health conscious and seek to adopt meat alternatives instead of animal meat [14]. Among plants, legumes can be suitable alternative sources of protein due to their nutrient content [5], and have a number of health benefits [3].

Pulses also play an important role in sustainability. Pulse crops contribute to sustainable agriculture due to their ability to "give back" nitrogen to the soil and improve soil fertility through their nitrogen-fixing properties. This unique feature is ensured by the nitrogen-fixing symbiotic system between *Rhizobium* bacteria and legume plants [15].

These crops can help reduce the environmental impact of both agriculture and the food industry by reducing animal-based food consumption and greenhouse gas emissions. In Europe, legume consumption has increased over the last decade, with some differences between countries [8]. Consumption of animal-protein-based food in Europe exceeds the recommendations of nutritional guidelines [16]. United Nations recommend balancing protein intake between animal and plant sources on a 1 : 1 ratio. Nutritionists and dietitians advise eating more plant-based proteins, and pulses are the plants with the highest protein content [17]. Higher legume consumption rates were observed in the Mediterranean region, with per capita daily consumption between 8 g and 23 g [8].

The Italian "Bring some fruit to school" project was exemplary in children's nutrition education. The project aimed to increase children's consumption of legumes, fruits and vegetables, while reducing consumption of chips and sugar-sweetened beverages. In the teachers' intervention group, the consumption of legumes increased by 32 % among primary school children [18].

In contrast, in Northern Europe is the daily consumption of pulses less than 5 g per capita [8]. A similar situation was observed in North America. Perera et al. [19] found that legume consumption frequency among US adults was low and showed a downward trend from 2011 to 2014, dropping from 18.5 % to 13.7 %. Behavioural and educational interventions are required to improve American eating habits [20]. Increased consumption of legumes would benefit children and the elderly. Mitchell et al. [21] and Mudryj et al. [22] found that both in Canada and USA, the individuals whose consumption of pulses is high, meet recommended levels of dietary fibre intake in comparison to groups who eat the same daily number of servings of cereal grains.

When assessing the nutritional value of legumes, it should also be taken into account that they contain components that have a negative effect on the digestive process and on utilization of nutrients, or which may cause adverse symptoms. For example, enzyme inhibitors can diminish protein digestibility, lectins can reduce nutrient absorption, phytic acid can diminish mineral bioavailability, galacto-oligosaccharides may cause flatulence, while some phenolic compounds can reduce protein digestibility and mineral bioavailability [8]. These ingredients can be inactivated by heating, toasting, extruding, baking, steaming or cooking [3].

In addition to surveying the amount of consumption, it is becoming increasingly common to assess consumption motivation and willingness [23–26]. In Finland, the Eating Motivation Survey measured reasons for consumption of animal- and plant-based proteins. Participants whose diets included beans and soya products endorsed a higher level of genuine concerns, health, weight control motives together with a lower level of convenience and price motives [23]. The Finnish study also showed that beans are culturally accepted among consumers aged 15–64, who rate them as "tasting good" but rarely consume them. A fifth of the respondents intended to increase their bean consumption in the future, especially those who already include beans in their diets [24].

A Polish study examined producers, processors and consumers to understand consumption preferences regarding legumes. Śmiglak-Krajewska and Wojciechowska-Solis [25] found that women more often consider pulses to be "healthy" and nutritious products. A lack of knowledge about how to prepare tasty meals from pulses is one of the most critical barriers that prevents consumers from eating them more frequently.

For the Portuguese population, the most consumed pulses were beans and peas. Of the respondents, 15 % stated that they would not substitute animal products for pulses. The lack of recognition of nutritional value, the lengthy cooking time and the effects of anti-nutritional factors had the greatest influence on the perception of legumes [26].

In the Central European region, the role of pulses in nutrition is different. Due to globalization, the situation of legumes has improved a lot in terms of both their supply and ideas for their use. An excellent example of this is the proliferation of Turkish, Arabic and Indian restaurants in Hungary, which have introduced their legume dishes (e.g. falafel, hummus or chana masala) to the country. In addition, legumes are part of traditional Hungarian gastronomy. The most popular

examples are Jókai bean soup, bean goulash, pea soup, green bean casserole and lentil stew.

Chickpea (*Cicer arietinum* L.) is an important ingredient in many dishes that are starting to become popular in Hungary. There is a growing interest in cultivation of chickpea varieties adapted to the domestic climate and soil conditions. The Hungarian National Catalog contains five popular varieties: Boglárka, Bori, Dora, Dónia and Pax [27]. Several Hungarian cooking websites containing dishes prepared from chickpeas and showing the recipes are available [28, 29]. The most popular are soups and garnishes.

Although many delicious recipes are made from legumes, the legume consumption habits of the Hungarian population have hardly been studied. Based on Hungarian Central Statistical Office data, in 2010, men in single-person households had consumed 0.2 kg of green beans, 0.3 kg of green peas and 1.1 kg of dry pulses. At the same time, women had consumed 1.4 kg of green beans, 1.2 kg of green peas and 1.6 kg of dry pulses [30]. The first Hungarian representative nutrition study was conducted between 1985 and 1988, and the latest representative National Nutrition and Nutrition Status Survey (OTÁP) was between 2009 and 2014. These surveys were based on the diet diary for general eating habits and did not contain data on perceptions and knowledge of legumes [31, 32].

This study had three objectives: to collect information about Hungarian consumption habits related to pulses since the International Year of Pulses; to learn more about what influences Hungarians in their consumption of pulses; and finally, to conduct basic research on chickpea-based product development to help to increase consumption of chickpea in the future.

MATERIALS AND METHODS

Samples

We performed a consumer survey among the Hungarian population in connection with the knowledge of consumption habits and pulses. In the present study, we evaluated data for beans, green beans, lentils, red lentils, green peas, yellow peas and chickpeas. Chickpeas played a key role in the study to obtain information on chickpea-based product development. This study joined another research investigating Hungarian chickpea varieties and possible new uses for them. In addition to pulses, green beans and green peas were also included in the study because these are legumes typically consumed in Hungary.

Questionnaire design

Taking into account the aims of our study, the questionnaire was developed by a group of experts, also using the relevant literature on food choice behaviour, such as the Pilgrim consumer behaviour model [33] and the Shepherd food choice and intake model [34]. Prior to publishing the questionnaire on the internet, we checked the questions for clarity on a sample of ten consumers. The questionnaire contained five main question groups: current consumption habits, knowledge of pulses, attitude towards new pulse-based products, issues related to health knowledge, as well as social and demographic data. The types of questions were typical of the five-level Likert-scale (1 – strongly disagree; 2 – disagree; 3 – neither agree nor disagree; 4 – agree; 5 – strongly agree), simple-choice and multiple-choice [35]. For some, respondents were given the option to provide other textual answers. It contained questions on the frequency of pulse consumption, intentions to increase consumption of pulses and chickpeas, social and demographic background factors and perceptions, and knowledge about various pulses. There were also Likert-scale statements about health awareness. The following socio-economic background factors were used in the present study: gender, age, geographical area and level of education. Participants completed the questionnaire online through Google Forms between 27 December 2016 and 31 January 2017. Contacted consumers received the questionnaire via e-mail or Facebook groups and, in the end, 1 023 completed questionnaires were processed.

Participants

Our target group included people who might, for various reasons, have been more informed and interested in nutrition than the average. These reasons could include raising children, age, illnesses or other motivations for a health-conscious life. Facebook groups made it possible to reach people belonging to target groups (e.g. mothers of young children, people with gluten sensitivity, food allergies, vegans, vegetarians or those interested in „healthy" eating). We wanted to identify the main factors that cause members of these target groups to increase their consumption of pulse products.

Statistical Analysis

Data were analysed using SPSS statistical software version 25 (Statistical Package for Social Sciences, IBM, Armonk, New York, USA) [36] and Microsoft Excel (Microsoft, Redmond, Washington, USA). For evaluation of the results, descriptive statistics tools like crosstabs and fre-

quencies were used [37]. A Chi-square test was applied (at $p \leq 0.05$) to determine statistically significant differences.

We developed a model of the factors affecting the consumption of legumes using path analysis. Path analysis is a particular form of multivariate analysis that allows for the analysis of data and presentation in the form of a path diagram. This diagram illustrates proposed causal relationships between multiple variables [38]. Statements (Tab. 1) and questions (Tab. 2) were used. A total of ten factors were defined that can be related to the consumption of pulses and then we tried to describe the possible connections.

The statements in the questionnaire were subjected to exploratory factor analysis and, thus, nine factors were developed. One of these was the target variable (increasing the consumption of pulses), while the other eight were the independent variables in the path model. As the fit of some statements was unsatisfactory, these were omitted. Numerous studies demonstrated that health awareness [39, 40], knowledge [41, 42] and social engagement [43, 44] have a motivating effect on the consumption of foods with nutritional benefits. In our model, we assumed the same. Other factors in our model (e.g. consumer habits in relation to pulse consumption, image of pulses and

Tab. 1. Factors and statements of path model.

Factor of path model	Statements used for analysis
Increasing the consumption of pulses	I would love to consume more pulse-based foods as a source of protein
	I plan to increase my consumption of chickpea products in the future
	I plan to try chickpea products and chickpea recipes
Health assessment on pulses	Regular consumption of pulses can lower blood cholesterol levels
	Regular consumption of pulses can help reduce the risk of cardiovascular disease
	Chickpeas have a significant fibre content
	Chickpeas are gluten-free, making them a valuable ingredient for people suffering from celiac disease
	Chickpeas have a low glycemic index, so they can be consumed by diabetics
Future perspectives of nutrition	Plant proteins are key factors in human nutrition
	Developed countries should encourage the consumption of more products of plant origin and less of animal origin
	The taste and nourishing effect of meat cannot be replaced by vegetable proteins
Inhibitory factors	Moderate amount of legume foods should be consumed
	Pulses are difficult to digest
	I would be afraid to consume more pulse-based products because of the bloating effect and digestive impact
Health awareness	I avoid consuming foods that contain additives
	“Healthy eating” is important to me
	I try to keep up with the latest information on the relationship between nutrition and health
Image of pulses	Pulses contain valuable nutrients
	A variety of dishes can be made from pulses
	Chickpeas are a valuable food that should be more widely distributed

Tab. 2. Factors and questions of path model.

Factors of path model	Questions used for analysis
Popularity of pulses	How much do you like to consume dry beans?
	How much do you like to consume beans?
	How much do you like to consume lentils?
	How much do you like to consume yellow peas?
Consumer preference for chickpeas	Have you ever eaten falafel or hummus?
	Did you like hummus or falafel?
Openness to try new products	How many new pulse-based products would you like to try?
Consumer habits in relation to pulses’ consumption	How often have you consumed pulses (e.g. beans, peas, lentils) in the last 3 months? What kind of food from pulses do you usually make / consume?

Tab. 3. Statistical indicators of the factor groups formed in the path model.

Factor	KMO test	Explained proportion [%]	Cronbach's alpha test
Health assessment of pulses	0.801	62.3	0.722
Health awareness	0.679	68.6	0.771
Popularity of pulses	0.673	55.0	0.637
Increasing the consumption of pulses (target variable)	0.667	66.5	0.747
Future perspectives of nutrition	0.610	60.5	0.623
Image of pulses	0.570	65.4	0.718
Inhibitory factors	0.553	55.4	0.577
Consumer preference for chickpeas	0.500	89.0	0.782
Consumer habits in relation to pulse consumption	0.500	65.1	0.552

consumer preferences) could be deduced from the Shepherd food choice and intake model [34].

In the path analysis, the validity of scales was tested using the Kaiser-Meyer-Olkin (KMO) test [45] and Cronbach's alpha [46] to determine the sampling adequacy of data used for Factor Analysis (Tab. 3). To interpret the results related to trying of new pulse-containing food products, we hypothesized that there was a correlation between trying new pulse-containing food products and increasing pulse consumption. Therefore, we created a new variable (openness to trying new products) by re-scaling responses to the willingness to try the new products listed. This became the tenth variable in the path model.

RESULTS

Participants

A sample of 1 023 Hungarians from all over the country participated in the study, most of whom (74.6 %) were female. The two main age groups were the 25–34 (n = 300) and 45–59 (n = 223). According to geographical location, the majority (50 %) were from the capital and all 19 counties of the country were represented. In terms of education, 17.9 % had a secondary school diploma and 78.2 % had a university degree. Regarding eating habits, 76.8 % followed an omnivorous diet (Tab. 4).

Frequency of pulse consumption

Questions regarding the frequency of pulse consumption were based on a three-month time interval. Most respondents consumed pulses every two weeks (33.3 %) or 1–3 times per week (33.2 %; Tab. 5). The two largest dietary groups were "omnivorous diet" (n = 786) and "vegetarian, vegan" (n = 130) categories. More than a third of the respondents having an omnivorous diet (37.5 %) consumed pulses every two weeks, while 47.7 % of vegetarians or vegans did so 1–3 times a week. Only 1.4 % did not consume any pulses at all, while 0.9 % consumed them daily. Of the legumes consumed, lentils were the most popular (46.1 %), followed by dry beans (38.4 %), red lentils (27.2 %) and yellow peas (27.6 %), while chickpeas (23.8 %) were less popular.

The survey also provided an overview of barriers to consumption. The proportion of respondents with "strongly agree" responses to the obstacle findings was as follows: preparation is time-consuming (12 %), difficult to digest (13 %), bloating and flatulence (16 %), health risk (5.9 %).

Tab. 4. Characteristics of respondents.

Social and demographic characteristics	Result [%]
Gender	
Female	74.6
Male	25.4
Place of residence	
Capital	50.0
County town	19.5
Town	19.6
Village	10.9
Type of diet	
Omnivorous diet	76.8
Vegetarian, vegan	12.7
Has food allergy, hypersensitivity	6.2
Other type	4.3
Highest level of education	
Primary school	1.1
Vocational training	2.0
Graduated from high school	17.7
Higher education degree	78.2

Tab. 5. Consumption frequency of pulses in last three-month period in connection with diet (n = 1 023).

Diet	Frequency of consumption of pulses							
	Not even once	1× or 2× in the last 3 months	Monthly	Every 2 weeks	1–3× per week	4–6× per week	Daily	Total
Omnivorous diet	4	100	134	295	245	7	1	786
Vegetarian, vegan	0	1	5	19	62	37	6	130
Has food allergy, hypersensitivity	1	10	12	15	24	1	0	63
Other type of diet	9	7	3	12	9	2	2	44
Total	14	118	154	341	340	47	9	1023

Availability and preparation of legumes for consumption

Pulses are available in several forms in shops and markets. Respondents most often bought dry seeds (81 %), followed by canned (66 %) and quick-frozen products (49 %). The order can be influenced by storability and degree of kitchen-readiness. Pre-cooking and freezing are the most typical preservation processes in Hungary. According to the answers, green peas were the most commonly purchased legumes in canned and frozen forms. Hungarian cookbooks [47] and cooking websites [28, 29] mention pulses in many dishes. The questionnaire also covered what kind of dishes respondents prepared from pulses. Based on the answers, the two main types were pottage and soups (Fig. 1).

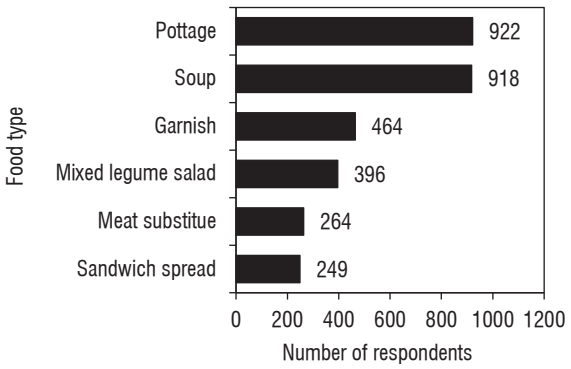

Fig. 1. Distribution of food types most often prepared by respondents (n = 1 023).

Tab. 6. Proportion of respondents familiar with chickpeas by age groups (n = 1023).

Age group	Familiar with chickpeas
< 18	100.0 %
18–24	80.9 %
25–34	89.7 %
35–44	87.9 %
45–59	78.5 %
60–47	64.1 %
> 75	46.7 %

Most respondents have already prepared two (30 %), three (28 %), or four (21 %) types of foods from pulses, while 94 % of respondents had prepared two to six types of dishes. Focusing only on the two most prominent diet groups, we found differences. Those respondents reporting an omnivorous diet typically prepared two (34 %), three (28 %) or four (22 %) types of foods. In the case of vegetarians, three (25 %), five (23 %) or six (25 %) types of dishes were typically prepared.

Chickpea consumption in Hungary

Consumption of chickpeas is becoming more and more widespread in Hungary.

Examining the recognition of chickpeas by age group, we obtained a positive picture (Tab. 6). In all other age groups except the 75-age bracket, the proportion of those who knew about chickpeas was over 60 %, and almost every member of the younger generation was familiar with it: 100 % of the <18 age group and 80.9 % of the 18–24 age group knew about chickpeas.

In India, hummus and falafel are traditional dishes made from chickpeas, which are well known also in Hungary. Of those familiar with chickpeas (835 people), 52.8 % had already tried both dishes ($p < 0.05$), 11.6 % only falafel, 16.9 % only hummus. A quarter of respondents (27 %) had never eaten hummus or falafel before, 141 people liked hummus and 162 enjoyed falafel. Both dishes were appreciated by 365 people, while there were only 75 people in total who did not like either of them.

Product development opportunities

In addition to traditional products, several new products appear on the market every year, building on the positive health effects of pulses

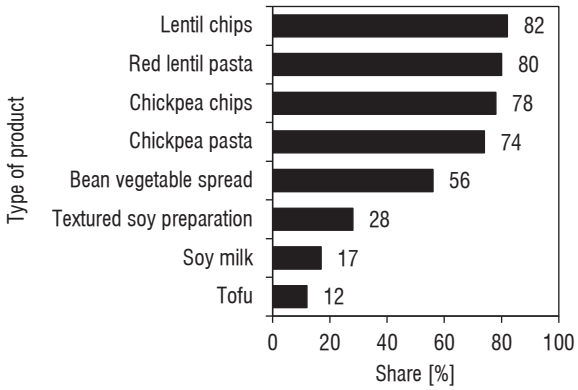

Fig. 2. Distribution of unknown pulse-based products among respondents (n = 1 023).

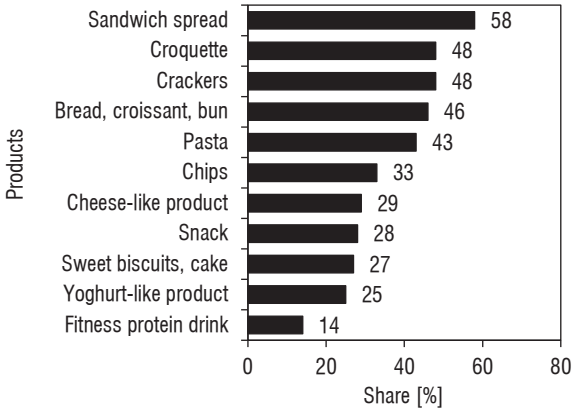

Fig. 3. Willingness to try new pulse-based products (n = 928).

[48], using them for protein enrichment in bread, pasta, or gluten-free foods. Dry and wet fractionation methods (e.g. bioprocessing methods like germination or fermentation) help develop new functional pulse ingredients [49]. We chose some products available in Hungarian shops to test if the respondents had knowledge of them. For four products (chickpea pasta, chickpea chips, red lentil pasta, lentil chips), over 70 % respondents had never heard of them. The product with which most of the respondents were familiar was tofu (Fig. 2).

Regarding diet, we examined the two most populous groups (vegetarians and omnivores). An important question in the relationship between the product and consumers is whether they have tasted the product. Members of the omnivorous diet group had a higher rate of having tasted the three soy products (tofu: 37 %, soy milk: 31 %, textured soy preparation: 28 %).

The majority of respondents (90.7 %) stated that they would like to try new pulse-based products. Based on the answers of 928 people who were open to new products, the following five products were the most interesting: sandwich spread (57.7 %), croquettes (47.8 %), crackers/bread/croissants/buns (46.1 %) and pasta (42.5 %; Fig. 3). We compared the five most popular products, focusing on the two largest diet groups. For omnivores, sandwich spreads, bread, croissants, and buns were preferred. Croquettes, crackers, and pasta were more popular with vegetarians.

Path model for evaluating pulse consumption

The results presented so far showed consumption habits, preferences and interest in new products. When assessing the situation of pulses in Hungary, an important question is what factors influence their consumption. Based on the questions and statements mentioned in Tab. 1 and Tab. 2, ten factors were identified that may affect consumption. Using these factors, we designed a path model. The model described relationships between the factors and the target variable (Increasing pulse consumption, Fig. 4). The statistical indicators of the factors are shown in Tab. 3.

Our target variable focused on pulse consumption in whole-seed form, with a particular focus on chickpea consumption to support further product development. The explained variance of the model was found to be 35 %. Two variables had the greatest direct effect on the target variable: image of pulses (0.21) and consumer habits in relation to the consumption of pulses (0.213). Accordingly, this means that consumers who already like pulse-containing foods (who have prepared them in many ways and consume them often), and who associate positive impressions with pulses, are committed to increasing their consumption of pulses. The variable “consumer preference for chickpeas” was smaller (0.138), but still had a significant direct effect on the target variable. This means that knowledge and popularity of falafel and humus are less influential factors than pulse consumption habits and product image. It is also worth mentioning that the popularity of pulses interacted with the image of pulses (0.317).

The model also pointed out that there was no linear relationship between the willingness to try new pulse products and an increase in its consumption. This means that our hypothesis was not confirmed. This finding is consistent with Rogers’ theory on diffusion of innovation [50]. According to him, it is a long cognitive affective and conative process from product tasting to becoming a customer. It is also important that this factor is not related to other factors either, so the introduction of these new products to the market would require

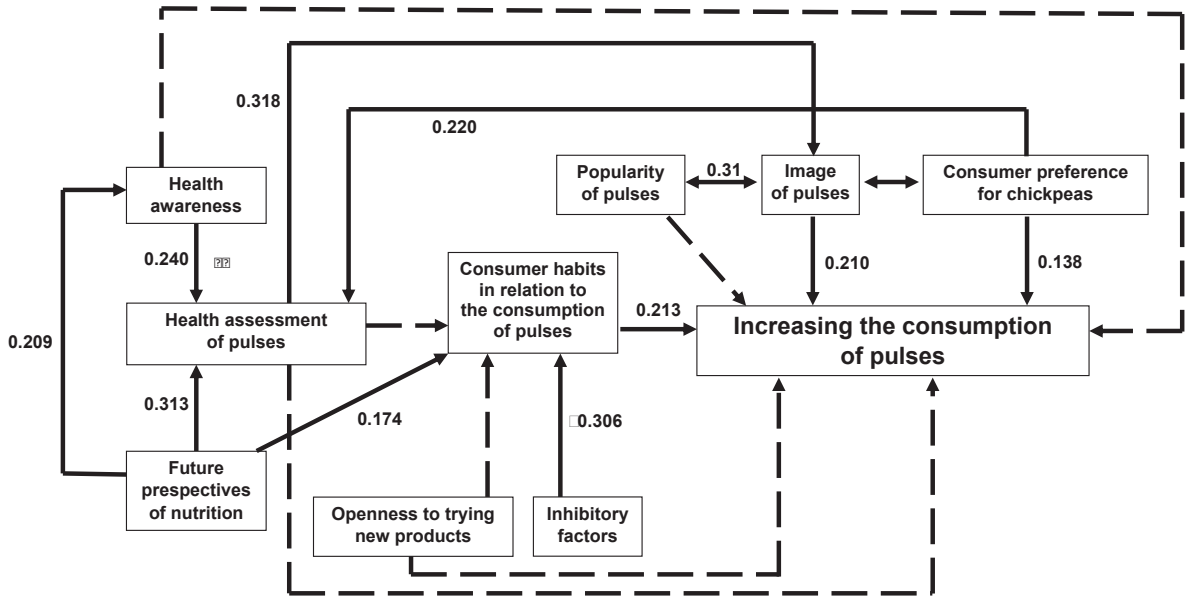

Fig. 4. Path model of factors influencing the "Increase in consumption of pulses" (n = 1023).

The figure shows full and broken lines (path). The full lines indicate significant connections at the $p \leq 0.05$ level. The broken lines represent assumed but not substantiated relationships. The values next to the lines indicate the value of the effect.

a significant marketing communication resource. Based on calculation, the "inhibitory factors" had a significant negative effect on the target variable indirectly through "consumer habits in relation to pulses' consumption" (–0.306). The flatulence factor [51] and bloating effect [52] of pulses as well as their difficult digestibility [5] are well known in the literature to be aspects that limit their consumption among sensitive consumers.

The results of our model on health-related topics can be summarized as follows. Knowledge of the beneficial physiological characteristics of pulses (e.g. lowering blood cholesterol, high fibre content, low glycemic index) influenced the image of pulses (0.318) as well as preference of chickpeas (0.220) and thus indirectly contributed to the increase in pulse consumption. We detected a correlation between future perspectives of nutrition, health awareness, and health assessment of pulses factors. The future perspectives of nutrition factor influences pulse consumption partly by mediating consumer habits in relation to the consumption of pulses (0.174) and partly through health assessment of pulses (0.313) factors. There was no direct relationship between the health awareness factor based on personal experience and the increase in pulse consumption. However, more health-conscious consumers were aware of the health benefits of pulses, which had an impact (0.204) on consumption of pulses.

Based on the described correlations, if we want to increase the consumption of legumes in the Hungarian population, the following factors must be influenced: consumer habits, image of pulses, consumer preferences, future perspectives of nutrition and health awareness. Extensive education, promotional campaigns and proper marketing can be appropriate means of doing so.

DISCUSSION

Comparing the results of our path model with similar surveys, it can be concluded that our research fits with and confirms the findings of previous research. For example, a Finnish study [23] revealed that those who changed their diet (increased bean consumption and decreased meat consumption) were clearly motivated by environmental sustainability. In our model, the future perspectives of nutrition factor was related to the factor of "increasing of consumption of pulses".

Eating motives play an important role in shifting towards more sustainable food consumption patterns in which meat is replaced with plant proteins. This transformation process promisses to be a long one, consisting of small steps but nutrition policy must start on this path. According to another Finnish survey [24], consumers who previously consumed beans were more likely to increase their

consumption of these foods than those who had never consumed them before. Our model showed that product image, product popularity and pre-existing pulse consumption patterns were the main drivers of an increase in consumption.

A Polish study [25] found that the lack of knowledge and skills to prepare appealing dishes from pulses is one of the main obstacles preventing consumers from consuming legumes more often for both women and men. In our model, the "pulse popularity" factor included the diversity of preparation methods and this was a significant factor in increasing consumption. Studies among Portuguese consumers highlighted other barriers [26]. It was noticed that the lack of recognition of the nutritional value of pulses, the long cooking time and the effects of anti-nutritional factors were generally highlighted as obstacles. Lack of knowledge and unpleasant physiological changes negatively affected the consumption in our study.

Based on the literature, it seems that there is a significant problem in developed countries on how to transform our diet from animal products to plant-based protein foods – a change which is crucial, both in terms of environmental sustainability and human health. Our study draws attention to two main factors in this regard. One is the type of pulses. Good taste and a variety of recipes can increase the consumption of pulses. Another important factor is awareness, including knowledge transfer and attitude formation. The consumer needs to be made aware of health and environmental benefits, and these two factors have to be developed in concordance with one another.

CONCLUSIONS

The results of our research fill the gap in the knowledge of the habits of legume consumption and of Hungarian attitudes towards pulses, besides providing some avenues for product development. We found that chickpeas are increasingly well-known in Hungary and consumers are open to tasting new legume-based food products and incorporating them into their diet. It should be emphasized that, in order to increase the consumption of pulses, it is necessary to continue educating society through various channels and to develop new products and recipes.

REFERENCES

1. Phillips, R. D.: Starchy legumes in human nutrition, health and culture. Plant Foods for Human Nutrition, *44*, 1993, pp. 195–211. DOI: 10.1007/BF01088314.
2. Jahn, J. L. – Stampfer, M. J. – Willett, W. C.: Food, health and the environment: A global grand challenge and some solutions. Daedalus, *144*, 2015, pp. 31–44. DOI: 10.1162/DAED_a_00352.
3. Pfeuffer, M. – Erbersdobler, H. – Jahreis G.: Hülsenfrüchte in der Humanernährung. (Legumes in human nutrition. Health aspects – part 1.) Ernährungs Umschau, *67*, 2021, pp. 160–165. DOI: 10.4455/eu.2020.045.
4. Calles, T. – Xipsiti, M. – del Castello, R.: Legacy of the International Year of Pulses. Environmental Earth Sciences, *78*, 2019, article 124. DOI: 10.1007/s12665-019-8106-6.
5. Singh, N.: Pulses: an overview. Journal of Food Science and Technology, *54*, 2017, pp. 853–857. DOI: 10.1007/s13197-017-2537-4.
6. Erbersdobler, H. F. – Barth, C. A. – Jahreis, G.: Körnerleguminosen in der Humanernährung, (Legumes in human nutrition – Nutrient content and protein quality of pulses.) Ernährungs Umschau, *64*, 2017, pp. 134–144. DOI: 10.4455/eu.2017.034.
7. Chen, Y. – McGee, R. – Vandemark, G. – Brick, M. – Thompson, H. J.: Dietary fiber analysis of four pulses using AOAC 2011.25: Implications for human health. Nutrients, *8*, 2016, article 829. DOI: 10.3390/nu8120829.
8. Bouchenak, M. – Lamri-Senhadji, M.: Nutritional quality of legumes, and their role in cardiometabolic risk prevention: a review. Journal of Medicinal Food, *16*, 2013, pp. 185–198. DOI: 10.1089/jmf.2011.0238.
9. Leterme, P.: Recommendations by health organizations for pulse consumption. British Journal of Nutrition, *88*, 2002, Supplement 3, pp. 239–242. DOI: 10.1079/BJN2002712.
10. Schwingshackl, L. – Hoffmann, G. – Lampousi, A. M. – Knüppel, S. – Iqbal, K. – Schwedhelm, C. – Bechthold, A. – Schlesinger, S. – Boeing, H.: Food groups and risk of type 2 diabetes mellitus: a systematic review and meta-analysis of prospective studies. European Journal of Epidemiology, *32*, 2017, pp. 363–375. DOI: 10.1007/s10654-017-0246-y.
11. Kim, S. J. – De Souza, R. J. – Choo, V. L. – Ha, V. – Cozma, A. I. – Chiavaroli, L. – Mirrahimi, A. – Blanco Mejia, S. – Di Buono, M. – Bernstein, A. M. – Leiter, L. A. – Kris-Etherton, P. M. – Vuksan, V. – Beyene, J. – Kendall, C. W. C. – Jenkins, D. J. A. – Sievenpiper, J. L.: Effects of dietary pulse consumption on body weight: a systematic review and meta-analysis of randomized controlled trials. American Journal of Clinical Nutrition, *103*, 2016, pp. 1213–1223. DOI: 10.3945/ajcn.115.124677.
12. Marventano, S. – Izquierdo, P. M. – Sanchez-Gonzalez, C. – Godos, J. – Speciani, A. – Galvano, F. – Grosso, G.: Legume consumption and CVD risk: a systematic review and meta-analysis. Public Health Nutrition, *20*, 2017, pp. 245–54. DOI: 10.1017/S1368980016002299.
13. Bazzano, L. A. – Thompson, A. M. – Tees, M. T. – Nguyen, C. H. – Winham, D. M.: Non-soy legume consumption lowers cholesterol levels: a meta-

analysis of randomized controlled trials. Nutrition, Metabolism and Cardiovascular Diseases, *21*, 2011, pp. 94–103. DOI: 10.1016/j.numecd.2009.08.012.
14. Riya, A. V.: Meat alternative gaining importance over traditional meat products: A review. Food and Agriculture Spectrum Journal, *1*, 2020, pp. 32–37. E-ISSN: 2582-7545. <https://fasj.org/index.php/fasj/article/view/8/7>
15. Hossain, Z. – Wang, X. – Hamel, C. – Knight, J. D. – Morrison, M. J. – Gan, Y.: Biological nitrogen fixation by pulse crops on semiarid Canadian prairies. Canadian Journal of Plant Science, *97*, 2017, pp. 119–131. DOI: 10.1139/cjps-2016-0185.
16. Magrini, M.-B. – Anton, M. – Chardigny, J.-M. – Duc, G. – Duru, M. – Jeuffroy, M.-H. – Meynard, J.-M. – Micard, V. – Walrand, S.: Pulses for sustainability: Breaking agriculture and food sectors out of lock-in. Frontiers in Sustainable Food Systems, *2*, 2018, article 64. DOI: 10.3389/fsufs.2018.00064.
17. Chardigny, J.-M. – Walrand, S.: Plant protein for food: opportunities and bottlenecks. Oilseeds and Fats Crops and Lipids, *23*, 2016, article 4. DOI: 10.1051/ocl/2016019.
18. Panunzio, M. F. – Antoniciello, A. – Pisano, A. – Dalton, S.: Nutrition education intervention by teachers may promote fruit and vegetable consumption in Italian students. Nutrition Research, *27*, 2007, pp. 524–528. DOI: 10.1016/j.nutres.2007.06.012.
19. Perera, T. – Russo, C. – Takata, Y. – Bobe G.: Legume consumption patterns in US adults: National Health and Nutrition Examination Survey (NHANES) 2011–2014 and Beans, Lentils, Peas (BLP) 2017 Survey. Nutrients, *12*, 2020, article 1237. DOI: 10.3390/nu12051237.
20. Rosi, A. – Paolella, G. – Biasini, B. – Scazzina, F.: Dietary habits of adolescents living in North America, Europe or Oceania: A review on fruit, vegetable and legume consumption, sodium intake, and adherence to the Mediterranean Diet. Nutrition, Metabolism and Cardiovascular Diseases, *29*, 2019, pp. 544–560. DOI: 10.1016/j.numecd.2019.03.003.
21. Mitchell, D. C. – Lawrence, F. R. – Hartman, T. J. – Curran, J. M.: Consumption of dry beans, peas, and lentils could improve diet quality in the US population. Journal of the American Dietetic Association, *109*, 2009, pp. 909–913. DOI: 10.1016/j.jada.2009.02.029.
22. Mudryj, A. N. – Yu, N. – Hartman, T. J. – Mitchell, D. C. – Lawrence, F. R. – Aukema, H. M.: Pulse consumption in Canadian adults influences nutrient intakes. British Journal of Nutrition, *108*, 2012, Supplement 1, pp. S27–S36. DOI: 10.1017/S0007114512000724.
23. Vainio, A. – Niva, M. – Jallinoja, P. – Latvala, T.: From beef to beans: Eating motives and the replacement of animal proteins with plant proteins among Finnish consumers. Appetite, *106*, 2016, pp. 92–100. DOI: 10.1016/j.appet.2016.03.002.
24. Jallinoja, P. – Niva, M. – Latvala, T.: Future of sustainable eating? Examining the potential for expanding bean eating in a meat-eating culture. Futures, *83*, 2016, pp. 4–14. DOI: 10.1016/j.futures.2016.03.006.
25. Śmiglak-Krajewska, M. – Wojciechowska-Solis, J.: Consumption preferences of pulses in the diet of Polish people: Motives and barriers to replace animal protein with vegetable protein. Nutrients, *13*, 2021, article 454. DOI: 10.3390/nu13020454.
26. Duarte, M. – Vasconcelos, M. – Pinto, E.: Pulse consumption among Portuguese adults: Potential drivers and barriers towards a sustainable diet. Nutrients, *12*, 2020, article 3336. DOI: 10.3390/nu12113336.
27. Nemzeti fajtajegyzék – Szántóföldi növények. (National list of varieties – Agricultural species.) In: Nemzeti Élelmiszerlánc-biztonsági Hivatal [online]. Budapest : Nemzeti Élelmiszerlánc-biztonsági Hivatal (Hungarian National Food Chain Safety Office), 2015 [cited 11.04.2021]. <https://portal.nebih.gov.hu/documents/10182/364149/Fajtajegyzekszantofold2015szept.pdf/5c741776-aec5-4b86-b8be-ddbdca59711d> In Hungarian.
28. Mindmegette (Ate it all) [online]. Budapest : Kiadja a Mediaworks Hungary [cited 25 April 2021]. <www.mindmegette.hu> In Hungarian.
29. Nosalty (Nosalty) [online]. Budapest : Central Media Group [cited 25 April 2021]. <www.nosalty.hu> In Hungarian.
30. Az egy főre jutó éves élelmiszer-fogyasztás mennyisége a gyermekes, a gyermek nélküli és az egyszemélyes háztartásokban (Annual food consumption per capita in households with children, without children and in single-person households.) In: Központi Statisztikai Hivatal [online]. Budapest : Központi Statisztikai Hivatal (Central Statistics Office of Hungary), 2010 [cited 06.03.2021]. <https://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_zhc035c.html> In Hungarian.
31. Országos Táplálkozás és Tápláltsági Állapot Vizsgálat 2014 (National Nutrition and Nutrition Status Study 2014) In: Országos Gyógyszerészeti és Élelmezés-egészségügyi Intézet [online]. Budapest : Országos Gyógyszerészeti és Élelmezés-egészségügyi Intézet (Hungarian National Institute of Pharmacy and Food Health), 2014 [cited 09.08.2020]. <https://www.ogyei.gov.hu/otap_2014/> In Hungarian.
32 Országos Táplálkozás és Tápláltsági Állapot Vizsgálat 2019 (National Nutrition and Nutrition Status Study 2019) In: Országos Gyógyszerészeti és Élelmezés-egészségügyi Intézet [online]. Budapest : Országos Gyógyszerészeti és Élelmezés-egészségügyi Intézet (Hungarian National Institute of Pharmacy and Food Health), 2019 [cited 09.08.2020]. <https://www.ogyei.gov.hu/otap2019/> In Hungarian.
33. Pilgrim, F. J.: The component of food acceptance and their measurement. American Journal of Clinical Nutrition, *5*, 1957, pp. 171–175. DOI: 10.1093/ajcn/5.2.171.
34. Shepherd, R.: Social determinants of food choice. Proceedings of the Nutrition Society, *58*, 1999, pp. 807–812. DOI: 10.1017/S0029665199001093.
35. Babbie, E.: The practice of social research. 9th edition. Belmont : Wadsworth/Thomson Learning, 2001. ISBN: 0534574912.
36. Smith, M. J.: Statistical analysis handbook, A comprehensive handbook of statistical concepts, tech-

niques and software tools. Edinburgh : Winchelsea Press, 2018. ISBN: 978-1-912556-06-9.
37. Landau, S. – Everitt, B. S.: A handbook of statistical analyses using SPSS. London : Chapman and Hall/CRC Press LLC, 2004. ISBN: 9781584883692.
38. Lockie, S. – Lyons, K. – Lawrence, G. – Grice, J.: Choosing organics: a path analysis of factors underlying the selection of organic food among Australian consumers. Appetite, *43*, 2004, pp. 135–46. DOI: 10.1016/j.appet.2004.02.004.
39. Kearney, J.: Food consumption trends and drivers. Philosophical Transactions of the Royal Society B, *365*, 2010, pp. 2793-2807. DOI: 10.1098/rstb.2010.0149.
40. Chen, M.: Attitude toward organic foods among Taiwanese as related to health consciousness, environmental attitudes, and the mediating effects of a healthy lifestyle. British Food Journal, *111*, 2009, pp. 165–178. DOI: 10.1108/00070700910931986.
41. Wardle, J. – Parmenter, K. – Waller, J.: Nutrition knowledge and food intake. Appetite, *34*, 2000, pp. 269–275. DOI: 10.1006/appe.1999.0311.
42. Spronk I. – Kullen, C. – O'Connor, H. T.: Relationship between nutrition knowledge and dietary intake. British Journal of Nutrition, *111*, 2014, pp. 1713–1726. DOI: 10.1017/S0007114514000087.
43. Webb, D. J. – Mohr, L. A. – Harris, K. E.: A re-examination of socially responsible consumption and its measurement. Journal of Business Research, *61*, 2008, pp. 91–98. DOI: 10.1016/J.JBUSRES.2007.05.007.
44. Boccia, F. – Sarno, V.: Socially responsible food behavior: Perspectives from empirical evaluations. Food Research International, *121*, 2019, pp. 91–96. DOI: 10.1016/j.foodres.2019.03.027.
45. Hadi, N. U. – Abdullah, N. – Sentosa, I.: An easy approach to exploratory factor analysis: Marketing perspective. Journal of Educational and Social Research, *6*, 2016, pp. 215–223. DOI: 10.5901/jesr.2016.v6n1p215.
46. Taber, K. S.: The use of Cronbach's alpha when developing and reporting research instruments in science education. Research in Science Education, *48*, 2018, pp. 1273–1296. DOI: 10.1007/s11165-016-9602-2.
47. Bezselics, I.: Magok a konyhában. (Seeds in the kitchen.) Dabas : BOOOK kiadó, 2016. ISBN: 978-615-5417-16-0. In Hungarian
48. Campos-Vega, R. – Loarca-Piña, G. – Oomah, B. D.: Minor components of pulses and their potential impact on human health. Food Research International, *43*, 2010, pp. 461–482. DOI: 10.1016/j.foodres.2009.09.004.
49. Sozer, N. – Holopainen-Mantila, U. – Poutanen, K.: Traditional and new food uses of pulses. Cereal Chemistry, *94*, 2017, pp. 66–73. DOI: 10.1094/CCHEM-04-16-0082-FI.
50. Rogers, E. M.: Diffusion of innovations. 3rd edition. New York : Free Press, 1983. ISBN: 0-02-926650-5.
51. Winham, D. M. – Hutchins, A. M.: Perceptions of flatulence from bean consumption among adults in 3 feeding studies. Nutrition Journal, *10*, 2011, article 128. DOI: 10.1186/1475-2891-10-128.
52. Hutchins, A. M. – Winham, D. M.: Pinto beans and green beans result in comparable glycemic control in adults with type 2 diabetes: A randomized pilot trial. Food Science and Nutrition Technology, *5*, 2020, article 211. DOI: 10.23880/fsnt-16000211.

Received 9 May 2021; 1st revised 10 July 2021; accepted 29 July 2021; published online 8 September 2021.