Beliefs about plant-based diet based in a sample of Hungarian females

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Abstract

Introduction. The aim of research is to examine the knowledge about plant-based diets, what beliefs and misconceptions exist about plant-based diets (PBDs), and how these differ between lifestyle groups among Hungarian females.

Materials and methods. Data were collected through an online survey on social media. These data were processed using univariate statistics (general description of the sample), exploratory factor analysis (identification of healthy lifestyles), cluster analysis (segmentation purposes), chi-square statistics (cluster profiling), F-statistics (comparing attitudes toward PBDs), and cross tabulation (knowledge and perceptions of PBDs).

Results and discussion. Four health-related lifestyle dimensions (health-conscious eating, mindfulness, carbohydrate avoidance, red meat avoidance) were identified, and four segments emerged (healthy food choosers, red meat avoiders, stress-free women, rejecters). Healthy food choosers (40.9%) prioritize healthy eating, avoid sugary snacks, and monitor carbohydrate intake. Red meat avoiders (27.9%) are neutral about healthy eating, but avoid red meat and processed foods; don't focus on carbohydrates. Stress-free women (20.8%) value mindfulness, relaxation, and outdoor physical activity for a stress-free life. Rejecters (10.4%) have a negative attitude toward healthy eating, mindfulness, carbohydrates, and red meat. Red meat avoiders live in the capital city, eat fruits and vegetables more often or at least once a day. Rejecters live in villages and eat fruits and vegetables every 4–5 days in a week or do not eat fruits and vegetables in a week. Healthy eaters eat fruits and vegetables more times a day. Stress-free people eat fruits and vegetables every 2–3 days in a week. They differed in their knowledge, attitudes and perceptions of PBDs.

72.1% of healthy food choosers, 84.8% of red meat avoiders, 75.8% of stress-free people and 71.9% of rejecters thought that plant-based diet was similar to vegan and vegetarian diet. The attitudes range from "*may have health benefits for certain diseases*" as the attitude with the highest mean level of agreement (4.26), especially among red meat avoiders, to "*encourages diary consumption*" as the attitude with the lowest mean level of agreement (1.69), especially among red meat avoiders. Red meat avoiders, healthy food choosers, and stress-free women had more positive attitudes toward PBDs than did rejecters. The majority of females were thinking about trying out PBDs. Red meat avoiders, healthy eaters, and stress-free women had more positive attitudes toward PBD than did rejecters. Healthy eaters perceived PBD as healthy. Red meat avoiders perceived the plant-based diet as healthy, safe, varied, exciting, environmentally friendly, and a complete diet. Stress-free women thought the plant-based diet was unhealthy and environmentally unfriendly. Rejecters attached more negative attributes to the PBD. They perceived the meatless diet as unhealthy, dangerous, monotonous, boring, environmentally unfriendly, difficult to digest, and malnutrition.

Conclusions The results contribute to the literature by adding empirical evidence to the emerging trends (PBD, vegan, vegetarian diets), as well as generating suggestions for nutrition and dietetics professionals and the government, as targeted marketing programs can be planned to change dietary behavior.

Introduction

Research by the United Nations (UN) World Health Organization (WHO) worldwide has shown that inadequate fruit and vegetable consumption may play a role in the deaths of 2.7 million people each year (OECD, 2016). However, with a balanced diet reduces the risk of heart disease, cancer and stroke (Jenkins et al., 2021).

While it is clear that a myriad of factors (in addition to fruit and vegetable consumption) influence an individual's health and years of healthy life, the data show that the "situation" of men in the country is alarming in terms of life expectancy at age 65. Almost 2/3 of Hungarian men do not even reach this age.

Estimates of current fruit and vegetable consumption vary widely around the world, ranging from less than 100 g/day in less developed countries to approximately 450 g/day in Western Europe (Liu et al., 2021). In terms of global fruit and vegetable consumption, the majority of countries do not meet the 2003 WHO/FAO recommendation of at least 400 grams of fruit and vegetables per day. Recognizing this problem, the UN has designated 2021 as the International Year of Fruit and Vegetables, hoping to raise awareness of this global issue (UN, 2019; WHO, 2020). 55% of the Hungarian population does not eat fruit daily, another 35% at least once a week and 9.4% less than once a week or never, while 45% eat vegetables daily, 46% weekly and 8.8% less than once a week or never. While the EU average is 32.9% of the population not consuming fruit and vegetables every day, in Hungary it is 36.3% (Kocsis, 2022).

Daily consumption of fruits and vegetables varies by age group, education, and income level (European Health Interview Survey - EHIS, 2019). Older people, women, those with higher incomes and those with higher levels of education are more likely to consume fruit and vegetables (KSH, 2018). Hungary's poor performance in this area can be partly explained by the relatively high price sensitivity of the Hungarian population, as price increases, especially for food, including fruit and vegetables, have increased significantly in 2021 and 2022 (Szabó et al., 2022). 60% of shoppers say they eat at least one portion of fresh fruit and vegetables a day, according to a GfK survey of 3,500 people in 2022. The amount bought per shopping trip has not increased in the summer of 2021 compared to previous years, with the average family taking home 2.36 kg of fruit and 1.75 kg of vegetables per trip. The drastic increase in prices in recent years and other effects (job losses, changes in family cost structures) are clearly visible: although the average household in Hungary will spend about 41,000 HUF on fruit in 2021, the amount purchased will decrease from 89 kg in 2014 to 83 kg in 2021. The same applies to vegetables, on which the average Hungarian household spent HUF 71,716 per year last year (GfK, 2022).

In Hungary, the total amount of food available to the population in 2020 (these data are not included in Figure 1) is 683.7 kg, a decrease of almost 0.6 percent compared to the average of the previous 5 years. The structure of the food supply has not changed significantly compared to previous years, with vegetables and fruits accounting for almost 30 percent of consumption.

Per capita consumption of fruits and vegetables in 2020 is 189.9 kg, slightly lower than in previous years. On the positive side, however, consumption of fruits and vegetables has increased by about 20 percent since 1970, and the trend is upward (Figure 1).

The aim of this study is to explore the knowledge about plant-based diets, the beliefs and misconceptions about plant-based diets (PBD), and how these differ between lifestyle groups among Hungarian females. Females are more concerned about their body weight and eat less and more fruits and vegetables (Wah, 2016). Graca et al. (2015) and Beacom et al. (2021) highlighted that meat is more important for males, while females are willing to adopt a more plant-based diet to be healthier (Lea et al., 2006).
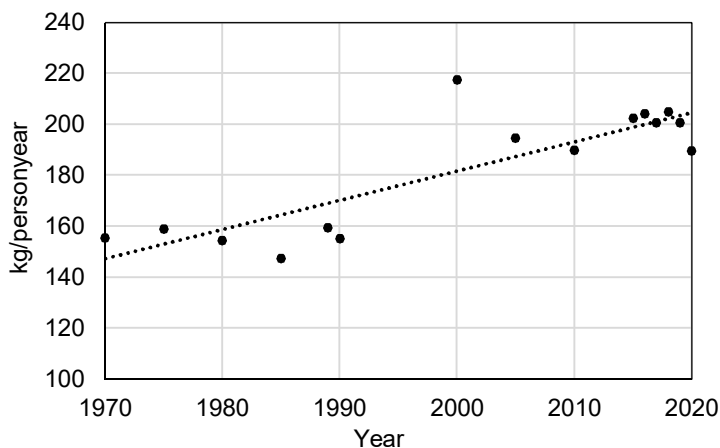
Figure 1: Per capita consumption of fruit and vegetables (kg/year)
Source: *Own construction based on KSH data*

The article is organized as follows: first, in relation to the research question theory and literature on healthy eating and plant-based diet. Then, the methodology is explained, followed by the results. Finally, the theoretical and practical implications of the findings are discussed, and the paper concludes with an exploration of research limitations and future research opportunities.

Theoretical background

Healthy eating

An increasing number of international studies have focused on segmenting people based on their healthy or unhealthy eating behavior (André et al., 2017; Heerman et al., 2017; Lv et al., 2011; Psouni et al., 2016). Some papers focused on children (Sabbe et al., 2008; Smith et al., 2011) or adolescents (Cuenca-García et al., 2013; Honaken et al., 2004; Matias et al., 2018) and clustered adolescents based on eating behavior and physical activity or sedentary behavior. These studies analyzed the demographics of each group and found gender differences. Wah (2016) and Lv et al. (2011) also highlighted the healthy eating behaviors of females and the unhealthy eating behaviors of males. Men consume more high-calorie foods, junk foods, and oily foods with carbohydrates.

Among the international researches, more results that studied a specific consumer group (André et al., 2017; Benedet et al., 2017; Tanton et al., 2015). Tanton et al. (2015) analyzed the eating habits of British university students, whose lifestyle is considered risky in terms of eating. The researchers used the consumption of snacks, convenience and fast foods, and fruits and vegetables. They identified four segments: risky, mixed, moderate, and favorable eating patterns. The majority of university students had unfavorable eating habits. André et al. (2017) categorized older Norwegian citizens (65+) based on similarities in food consumption. They distinguished between people with an unhealthy eating pattern (21.5%) and people with a healthy eating pattern (78.5%). The first group of people consumed a greater amount of foods and beverages such as chocolate/candy, pasta, sausage, sugar-free and sugary soft drinks, whole milk, juice, white bread and half-wheat bread. The second group consumed more fruits, vegetables, boiled potatoes, oily fish, whole wheat bread and

water. Benedet et al. (2017) used clustering of four unhealthy food habits (low fruit intake, low vegetable intake, high candy intake, and high fried snack intake) among Brazilian workers. They found that unhealthy food habits were more common among female workers, those with lower levels of education, and those living without a partner.

Heernan with coauthors (2017) identified eating styles from six eating behaviors (frequency of eating healthy foods, frequency of eating unhealthy foods, frequency of breakfast, frequency of snacking, overall diet quality, and problem eating behaviors) and tested their association with BMI in adults. Four eating styles were identified and defined by healthy vs. unhealthy eating patterns and engagement in problem eating behaviors. Unhealthy and unhealthy problem eating groups had significantly higher BMI than healthy eaters. Psouni et al. (2016) examined patterns of eating and physical activity attitudes and behaviors in relation to BMI. They also identified healthy and unhealthy groups of Greek people. Healthy people were associated with healthier physical activity and eating behaviors. They had normal BMI. Unhealthy people were associated with lower levels of exercise and healthy eating. They belonged to the overweight category considering their BMI.

Jenkins and coauthors (2021) highlighted the importance of behavioral segmentation in the case of healthy lifestyles. De Vries et al. (2008) identified clusters based on five important preventive health behaviors, namely non-smoking, alcohol consumption, fruit consumption, vegetable consumption and physical activity in the Netherlands. They distinguished healthy, unhealthy, and poor diet clusters. They found a strong relationship between cluster membership and education level. The higher the education, the healthier the behavior. Later, Bennasar-Veny et al (2020) did a similar behavior-based clustering. They found that men consumed more alcohol, had a less healthy diet, were more likely to be overweight, and were more physically active. Women had a higher prevalence of underweight and were less physically active. They distinguished between moderate-risk unhealthy lifestyles, high-risk unhealthy lifestyles, and low-risk healthy lifestyles. Lv with coauthors (2011) identified three distinct health-related lifestyle clusters: an unhealthy (25.7%), a moderately healthy (31.1%), and a healthy (43.1%) group among Chinese adults (ages 18 and 64). Lifestyle variables analyzed included tobacco use, physical activity, fruit and vegetable consumption, and eating out. Men were more likely than women to lead an unhealthy lifestyle. Adults aged 50 and 64 were more likely to have a healthy lifestyle. Adults aged 40 and 49 were more likely to have an unhealthy lifestyle. They also highlighted the relationship with cluster membership and education level and wealth index.

On the other hand, many researchers focused on the lifestyle of health and sustainability (LOHAS), which can be characterized by health, well-being, and environmental sustainability (Choi and Feinberg, 2021). Sung and Woo (2019) highlighted that individuals who value health and sustainability in their lifestyle by purchasing local products and thus helping the environment have been a popular consumer trend in recent years. LOHAS consumers tend to value green living, which includes organic foods, local products, and healthier products, which further influences their family and friends to adopt sustainable living and healthier lifestyles as well. Lendvai et al. (2022) found that this group of people strives for a sense of naturalness, aims to behave ethically, and seeks to hold authentic and individualistic values. They surveyed 357 Hungarian members of Generation Z. They distinguished three personas within this generation: (1) personas that fit LOHAS, (2) personas that may fit LOHAS, and (3) personas that do not fit LOHAS. Tam et al. (2021) studied the adoption of LOHAS by Chinese consumers. They found that women, older people, and people with higher incomes are most likely to be in this group. Environmentally conscious consumers tend to be more quality and price conscious in their shopping behavior. Health and fitness conscious consumers tend to look for quality and novelty products.

Plant-based diet

According to European Health Interview Survey (EHIS, 2019) data, one fifth of the Hungarian population consciously follows some kind of diet, 14% follow one and 4.3% several at the same time. The most common special diets are diabetic (6.4%) and lactose-free (4.1%). As people age, the number of special diets increases, which, in addition to health-conscious lifestyles, has been linked to the development of food allergies, food sensitivities and other conditions requiring special diets. One in ten 15- to 17-year-olds and 21% of people aged 65 and older follow a special diet. Regardless of age, women are more likely to follow a special diet than men do. The proportion of people following a special diet increases with education and income. Only 1.1% of the population follows a vegetarian diet. According to a survey conducted by the TÉT (Diet, Lifestyle and Physical Activity) Platform a few years ago, only 2-2% of people consider a vegan or vegetarian diet to be healthy. Hungarians are typically meat lovers and find it difficult to give up animal products, but the vegan lifestyle has a growing number of followers (NAK, 2019). Schmidt (2019) noted that in recent years, vegetarian and vegan diets have become an increasingly popular dietary trend, which is actually a separate lifestyle as well.

An important consumption trend is "vegetable stars", which is about the positioning of vegetables, i.e. the spread of the plant-based food trend. Vegetables have taken over the role of meat, in part because of growing questions about meat consumption, especially in terms of environmental impact and sustainability. As a result, "vegetables are moving from side dish status to main course." Strict veganism, which rejects all animal products, is gaining more and more adherents (Törőcsik, 2019).

The reasons for low fruit and vegetable consumption may be personal, economic, or cultural, and changing them is not an easy task. Szabó and Lehota (2020) conducted a focus group study on the main reasons for consumption and identified love of fruits and vegetables, healthy lifestyle and healthy diet as the main reasons.

Plant-based diets are one of the trendy diets of our time (Törőcsik, 2016), and their impact on health is attracting the attention of an increasing number of researchers. In fact, plant-based diets have been used for centuries. Vegetarianism first appeared in India and the ancient Greek world, and was part of the religious aspirations of both cultures. A plant-based diet consists of "*all minimally processed fruits, vegetables, whole grains, legumes, nuts and seeds, herbs, and spices and excludes all animal products, including red meat, poultry, fish, eggs, and dairy products*" (Ostfeld, 2017; Szabó et al., 2016). Plant-based diets range from strict plant-based (vegan) to semi-vegetarian. Today, vegetarianism is "*no longer simply a health-conscious dietary trend, but a holistic worldview whose proponents have a closed philosophical, ethical-moral, environmental, and agro-technological view; others appeal to socio-economic reasons*" (Balogh, 2017). The previous thought is reinforced by Törőcsik and Szűcs (2021) cited in Forbes, who found that members of Generation Z are going to climate protests instead of school and adopting vegan lifestyles. The authors also highlight the more positive environmental impact of a plant-based diet based on the traditional food chain.

People who follow a vegan lifestyle completely exclude the consumption of animal derivatives, so they do not consume eggs and dairy products apart from meat. In Hungary, an advocacy group (Hungarian Vegan Association) was founded in 2017. Veganism is a "non-violent way of life" that opposes the exploitation of animals of both sexes. This is reflected in the way they eat (avoiding meat, dairy products, eggs, gelatin, honey, etc.), dress and have fun. Vegans do not wear leather shoes or use cosmetics that have been tested on animals. Balogh classifies veganism as a form of vegetarianism.

In addition, there are several other trends (Balogh, 2017):
- *Semi-vegetarian*: The diet includes poultry and fish.
- *Ovo-vegetarianism*: Eggs are eaten along with plant foods.
- *Ovo-lacto vegetarianism*: Eggs and dairy products are consumed along with plant foods.
- *Lactovegetarianism*: Dairy products of animal origin are consumed along with plant foods.
- *Pesco-vegetarianism*: Where fish is eaten along with plant foods.
- *Raw vegetarianism*: Followers eat 75-100% of vegetarian foods raw.

Looking at the motivations of people who follow a plant-based diet, it can be seen that the most common reasons for choosing this lifestyle are ethical, ecological, environmental, economic, political, animal welfare, spiritual or health-related. Several religious traditions - Brahmanism, Judaism, and Hinduism - also favor a meatless or meat-free diet (Szabó et al., 2016).

Increased competition in the market has also prompted retailers to review their business policies, and as Törőcsik and Szűcs (2021) have pointed out, the battle for customers' money is no longer just between identical types of stores, but also between different types of stores. The authors pointed out that the success of discount stores, for example, is due to their expansion and the targeting of specialized segments (organic, vegan, vegetarian, free, etc.).

Several recent national studies (Fehér et al., 2020; Szabó et al., 2016; Véha et al., 2019) have been conducted on plant-based diets. They mainly present the literature background and the characteristics of the diet. Krause and Williams (2017) conducted an empirical study to investigate the knowledge of university students on plant-based diets. In their systematic literature review, Fehér et al. (2020) developed a conceptual model based on the planned behavior model, taking into account objective supporting and inhibiting factors for switching to a plant-based diet, which they intend to test empirically in the future. Several researchers have also investigated the factors that hinder (Lea et al., 2006; Véha et al., 2019a) and support (Reipurth et al., 2019; Véha et al., 2019b) plant-based diets. According to Véha et al. (2019b), the main benefits of plant-based diets can be explained by factors that positively influence health and positive effects on well-being, satisfaction, and quality of life. In addition, ethical environmental benefits have been identified, including aspects such as more efficient use of economic resources, reduced global pollution, and animal welfare. From an economic perspective, the benefits of a plant-based diet are linked to sustainability, as it has a much smaller ecological footprint than meat consumption, i.e. an omnivorous diet. Today, one of the main reasons people are switching to a plant-based diet is to mitigate climate change (Reipurth et al., 2019). A plant-based diet produces 2.5 times less carbon emissions than a meat-based diet. Second, there are ethical arguments in favor of meat-free diets (Véha et al., 2019b). One is the rights-based or deontological approach, which argues that animals have intrinsic value because of their ability to "experience life" and should therefore be seen as ends in themselves rather than means to an end. The other approach is utilitarian or consequentialist, which argues that every sentient being should have at least one right - the right not to be treated as property. One of the characteristics of ethical vegans is their total rejection of the commodification of animals. They also do not use animal products for clothing, fragrances, or any other purpose, and try to avoid animal-tested ingredients (Balogh, 2017). The way in which animals are kept is the main subject of ethical objections. Animals are forced to live in overcrowded stalls and confined spaces that do not allow them to express their natural behaviors. Animals are deprived of exercise, which burns energy and wastes material resources. They also unnaturally force animals to gain maximum weight, causing

internal organ disease, physical deformities, and suffering. Vegetarian principles do not consider any form of animal slaughter to be humane. A plant-based diet can have many beneficial, positive effects on health and therefore quality of life (Lea et al., 2006), but people need to be prepared. Plant-based diets are generally lower in energy, fat, and therefore saturated fat, reducing the risk of overweight, obesity, and cardiovascular disease (Szabó et al., 2016). Beacom, Bouge and Repar (2021) highlighted that Irish and British females were almost twice as likely as males to consume plant-based products (PBPs). The main motivations for consumption were 'sustainability,' 'animal welfare' and 'health.'

A predominantly or exclusively plant-based diet has its own dangers, as it can lead to deficiency diseases due to the lack of protein intake (Reipurth et al., 2019). To compensate for deficiencies, dietary supplements or functional foods should be consumed (Szakály, 2008). It is always advisable to consult a dietician before switching to a plant-based diet. Lea et al (2006) found that the main perceived barrier to adopting a plant-based diet was lack of information. In a literature review of barriers to plant-based diets, Véha et al. (2019a) found that in addition to negative physiological effects, enjoyment of eating meat and difficulty in giving it up, convenience and time constraints, information acquisition, social barriers and associated negative discrimination, and financial constraints all hindered the adoption of a plant-based diet. Barriers to consumption for non-PBP consumers were 'not seeing the need to change their diet' and 'taste' (Beacom et al., 2021). Havermans et al. (2021) found a similar result among Dutch adolescents. Pohjolainen et al. (2015) found that enjoyment of meat, eating routines, health beliefs, and difficulties in preparing vegetarian foods hindered PBD adaptation.

Based on the literature review the authors defined the following research questions:
1. What kind of factors can be distinguished on the basis of healthy eating?
2. Is it possible to segment consumers based on healthy eating?
3. Is it possible to profile each segment based on demographics (age, location, occupation, family life cycle and diet, online lifestyle group)?
4. What knowledge does each group have about vegetarian, vegan and plant-based diets? Are they planning to try a plant-based diet?
5. What are the respondents' attitudes toward plant-based diets?
6. What associations does each group have with plant-based diets?

Materials and methods

Data collection

Data was collected through an online survey in Hungary. The questionnaire was pre-tested in order to ensure consistency, and understanding. Data was collected through non-probability snowball sampling by distributing to Hungarian consumers through social media during one week in April 2023. The survey was created in the Google Sheet platform, and SPSS 26.0 was used for statistical analysis.

The questionnaire was divided into three sections: (1) health behaviors; (2) knowledge and beliefs about plant-based diets, (3) sociodemographic characteristics. Participants reported their attitudes toward *health behaviors* by expressing their level of agreement on a 5-point Likert scale with the endpoints 1: strongly disagree, 5: strongly agree. The 15 statements were as follows: (1) 'I take care of my health', (2) 'I eat fresh fruit every day', (3) 'I eat fresh vegetables every day, (4) 'I watch my fluid intake', (5) 'I avoid sugary foods', (6) 'I watch my carbohydrate intake', (7) 'I do not snack', (8) 'I eat high-fiber foods', (9) 'I avoid

red meat', (10) 'I avoid processed foods', (11) 'I make sure I get fresh air every day', (12) 'I try to avoid stressful situations', (13) 'I exercise regularly, (14) 'I consciously seek out things that relax me and make me feel good', (15) 'I make a conscious effort to relax''. These statements are based on a previous study by Keller (2019).

Knowledge about plant-based diet was measured on nominal scale that was used by Krause and Williams (2017).

Attitudes toward a plant-based diet were measured by 15 attitude statements using a 5 point Likert scale (1) does not provide the body with enough protein, (2) avoids processed foods, (3) encourages consumption of diary products, (4) eliminates or minimizes the consumption of animal products, (5) promotes oil consumption, (6) limits or excludes eggs, (7) discourages complex carbohydrates, (8) does not get enough omega-3 fatty acids, (9) helps prevent chronic diseases, (10) facilitates digestion, (11) good for extra energy, (12) perfect for muscle building, (13) is beneficial for some illnesses, (14) more environmentally friendly, (15) reduces saturated fat consumption. These statements are based on a previous study by Krause and Williams (2017).

Pairwise comparisons were used to measure the *associations toward a plant-based diet*. 10 contrasting attributes were questioned: (1) healthy – unhealthy, (2) cheap – expensive, (3) dangerous – safe, (4) monotonous – varied, (5) boring – exciting, (6) old-fashioned, fashionable, (7) simple – complicated, (8) environmentally unfriendly – environmentally friendly, (9) difficult to digest – easy to digest, and (10) malnutrition – full diet.

Sociodemographic characteristics included age (in years), place of residence (village, town, city, capital), occupation (student, white-collar worker, blue-collar worker, unemployed, retired), marital status (single, cohabiting, married without children, family with children).

Categories of fruit and vegetable consumption were measured on a weekly basis: more than once a day, once a day, every 2-3 days, every 4-5 days, not eating fresh fruit and vegetables on a weekly basis.

Data analysis

The sample was not representative - the authors would like to emphasize that this is an exploratory study and that the main conclusions apply only to this sample. Data analysis was conducted using SPSS 26.0 software. Multivariate statistical analysis was used to answer the research questions. To answer the first research question, the authors used factor analysis. The method of factor extraction was principal components analysis. The number of factors was determined by a priori determination (3) and approaches based on eigenvalues (5), scree plot (5), and percentage of variance accounted for (5). The number of factors was determined by the eigenvalues. The benchmark of factor loading above 0.4 was used as a criterion for inclusion of items in each factor. Factor rotation was assessed using the Varimax method. To answer the second research question, the method of cluster analysis, specifically the method of Ward's hierarchical cluster analysis, namely agglomerative clustering, was used (Malhotra, 2018). Since the aim was to highlight the main differences, the square Euclidean distance was used to measure the distances. After investigating the prerequisites, the researchers considered different clustering solutions, but finally they decided to apply the four clustering solution. In the next step, they considered these clusters as nominal variables. To answer the third research question to analyze the relationship between cluster membership and basic demographics, chi-square analysis was performed. In this case, the authors considered the expected value and the state of the variables measured on nominal scales. Cross-tabulations were used to analyze knowledge, attitudes, and associations toward a plant-based diet across cluster membership.

Results and discussion

In relation to healthy eating 15 statements were examined. In this case the value of Cronbach α was 0.921, which means that this scale is consistent. The values of the indicators that prove the adequacy of the factor analysis were adequate (KMO: 0.893, Bartlett's Test: 3820.136, Sig. 0.000). The number of factors was determined by Scree test that is four factors could be distinguished explaining 65.101% of the total variance (Table 1).

Table 1

Results of factor analysis

	Statements	Loading	Factor
1	I eat fresh vegetables every day (2)	0.830	*health-conscious eating* (20.14%; 0.85)
2	I eat fresh fruit every day (3)	0.824	
3	I eat high-fiber foods (8)	0.644	
4	I take care of my health (1)	0.626	
5	I watch my fluid intake (4)	0.560	
6	I make a conscious effort to relax (15)	0.810	*mindfulness* (17.35%; 0.76)
7	I consciously seek out things that relax me and make me feel good (14)	0.768	
8	I try to avoid stressful situations (12)	0.724	
9	I make sure I get fresh air every day (11)	0.531	
10	I exercise regularly (13)	0.449	
11	I watch my carbohydrate intake (6)	0.791	*avoidance of carbohydrate* (16.42%; 0.77)
12	I avoid sugary foods (5)	0.767	
13	I do not snack (7)	0.763	
14	I avoid red meat (9)	0.834	*avoidance of red meat* (11.17%; 0.75)
15	I avoid processed foods (10)	0.740	

Source: Own research, n = 614 respondents. Method: Main component analysis, Rotation: Varimax
Note: First number behind the factors is the explained variance; second number is the value of Cronbach alpha.

The *first factor* included five variables, which represented a *health-conscious eating* (HCE) behavior and the choice of vegetables, fruits, nutritious foods, and fluid intake that are good for the body. The *second factor* contained five variables representing *mindfulness* (MF), the importance of relaxation, and physical activity in fresh air, and the avoidance of stressful situations. The third factor included items related to the *avoidance of carbohydrate* (ACH) intake and the refusal of sugar and snacks. The last factor included two items that are the *refusal of red meat and processed food* (ARM). It can be stated that four factors can be distinguished based on health behavior, namely health-conscious eating, mindfulness, avoidance of carbohydrates, and refusal of red meat.

In the next step using the results of factor analysis were used for clustering. Based on the results of Elbow criterion and Agglomeration schedule the four-cluster solution was selected. Count and frequency in case of each cluster was the following: first cluster 251 people (40.9%), 2nd cluster 171 people (27.9%), the 3rd cluster 128 people (20.8%) and the 4th cluster 64 people (10.4%). In order to make a typology of the different clusters, it was necessary to analyze the means. The method of one-way ANOVA was used to check the

category means of the health behavior factors (HCE, MF, ACH, ARM) in case of each cluster and significant differences (FCHF: 509.468, p: 0.000, η^2:0.472; FRUF: 748.369, p: 0.000, η^2: 0.568). There were significant differences between groups for all variables. To test the homogeneity of variables post-hoc tests (Dunnett T3 and LSD) were performed. according to the results there were statistically significant differences between variables.

1. *Healthy food choosers* (40.9%): they try to eat in a healthy way and they typically refuse unhealthy foods like sugary odd and snacks and the pay attention to their carbohydrate intake.
2. *Red meat avoiders* (27.9%): they are mainly neutral when it comes about healthy eating, they do not pay attention to their carbohydrate intake, but they avoid red meat and processed foods.
3. *Stress-free women* (20.8%): could be characterized by the importance of mindfulness. They pay attention to relaxation and physical activity in the fresh air, so a stress-free life is important to them.
4. *Rejecters* (10.4%): they could not be characterized by health-conscious eating, mindfulness, avoidance of carbohydrates and red meat. They have a negative attitude towards all the four aspects of health behavior (Table 2).

Table 2

Results of cluster analysis

Ward Method		HCE	MF	ACH	ARM
1, heathy food choosers (40.9%)	Mean	0.346	-0.054	0.8368129	0.001
	N	251	251	251	251
	Std. Deviation	0.783	0.942	0.683	0.842
	Variance	0.614	0.888	0.467	0.711
2, red meat avoiders (27.9%)	Mean	0.195	0.232	-0.629	0.840
	N	171	171	171	171
	Std. Deviation	0.773	0.955	0.743	0.565
	Variance	0.598	0.913	0.553	0.319
3, stress-free women (20.8%)	Mean	-0.064	0.228	-0.562	-1.076
	N	128	128	128	128
	Std. Deviation	0.882	0.891	0.707	0.753
	Variance	,779	,795	0.500	0.568
4, rejecters (10.4%)	Mean	-1.751	-0.865	-0.474	-0.098
	N	64	64	64	64
	Std. Deviation	0.634	1.055	0.800	0.788
	Variance	0.403	1.114	0.641	0.621
Total	Mean	0.000	0.000	0.000	0.000
	N	614	614	614	614
	Std. Deviation	1.000	1.000	1.000	1.000
	Variance	1.000	1.000	1.000	1.000

Source: Own research, n=614 respondents

It can be seen that consumers can be divided into homogeneous groups based on health behavior factors (HCE, MF, ACH, and ARM). Four groups of consumers were identified: healthy food choosers (40.9%), red meat avoiders (27.9%), stress-free women (20.8%), neutrals (26.2%) and rejecters (10.4%).

Profiling consumer groups

Table 3 shows the sociodemographic characteristics of the sample. To analyze the relationship between cluster membership and basic demographics, cross tabulation (chi-square analysis) was performed. The relationship between cluster membership and occupation, family life cycle, income level, and weekly fruit and vegetable consumption were analyzed. Significant associations were found for residence (χ^2=20.377; p=0.01), fruit (χ^2=150.496; p=0.00) and vegetable consumption (χ^2=190.084; p=0.00). However, these associations were weak (Cramer's $V_{residence}$=0.105; Cramer's V_{fruit}=0.286; Cramer's $V_{vegetable}$=0.321) (Table 4).

Based on the results of the adjusted standardized residuals, we can say that red meat avoiders live in the capital city, eat fruits and vegetables more often or at least once a day. Rejecters live in villages and eat fruits and vegetables every 4-5 days in a week or do not eat fruits and vegetables in a week. Healthy eaters eat fruits and vegetables more times a day. Stress-free people eat fruits and vegetables every 2-3 days in a week (Table 4).

Table 3

Sociodemographic characteristics of the four segments and the total sample

	Healthy food choosers	Red meat avoiders	Stress-free women	Rejecters	Total
Age (median)	28.0	30.0	28.0	30.5	29.0
Place of residence					
Capital city	23.9%	30.4%	16.4%	12.5%	23.0%
City	21.5%	17.5%	21.9%	23.4%	20.7%
Town	31.5%	31.0%	33.6%	23.4%	30.9%
Village	23.1%	21.1%	28.1%	40.6%	25.4%
Occupation					
Student	29.9%	24.6%	38.3%	25.0%	29.6%
White-collar workers	49.8%	55.6%	43.0%	37.5%	48.7%
Blue-collar workers	16.7%	16.4%	15.6%	31.3%	17.9%
Unemployed	2.8%	2.9%	1.6%	3.1%	2.6%
Retired	0.8%	0.6%	1.6%	3.1%	1.1%
Marital status					
Single	33.5%	26.9%	30.5%	29.7%	30.6%
Cohabiting	31.5%	34.5%	33.6%	26.6%	32.2%
Married without children	16.7%	14.6%	18.0%	28.1%	17.6%
Family with children	18.3%	24.0%	18.0%	15.6%	19.5%

Clusters and basic demographics

Demographics		Adjusted standardized residuum			Rejecters	Sign. relations with clusters
		Healthy food choosers	Red meat avoiders	Stress-free women		
Residence	capital city	0.5	**2.7**	-2.0	-2.1	read meat avoiders
	village	-1.1	-1.5	0.8	**3.0**	rejecters
Fruit consumption in a week	more than once a day	**3.6**	**2.1**	-3.5	-4.2	healthy food choosers red meat avoiders
	once a day	0.8	**2.9**	-1.5	-3.6	red meat avoiders
	every 2-3 days	-2.9	-2.6	**5.4**	1.2	stress-free people
	every 4-5 days	-2.4	-1.5	0.8	**5.0**	rejecters
	not eating fresh fruit on a weekly basis	-0.8	-3.8	-0.6	**7.6**	rejecters
Vegetable consumption in a week	more than once a day	**4.7**	**3.2**	-4.3	-6.6	healthy food choosers red meat avoiders
	every 2-3 days	-3.5	-3.7	**4.3**	**5.3**	stress-free people rejecters
	every 4-5 days	-0.8	-2.1	-0.4	**4.9**	rejecters
	not eating fresh fruit on a weekly basis	-2.6	-2.4	-0.6	**8.4**	rejecters

Source: Own research

It is possible to profile each segment based on demographics, especially based on place of residence and fruit and vegetable consumption.

Vegetarian, Vegan and Plant-Based Diet

In the next session, knowledge of the different types of plant-based diets was analyzed. The majority of respondents (80.1% of red meat avoiders, 77.7% of healthy food choosers, 67.2% of rejecters, and 66.4% of stress-free people) believed that a vegetarian diet meant rejecting white and red meat and fish, while eating other foods of animal origin such as eggs

and dairy products. 20.3% of the rejectionists, 18.0% of the stress-free women, 13.1% of the healthy food choosers, and 11.7% of the red meat avoiders believed that vegetarians should not have eaten meat, but could eat fish. The rejection of all animal foods was believed to be true by 8.6% of the women. The refusers were not aware of the principles of the vegetarian diet, 7.8% of them thought that animal products could be consumed (Table 5).

Table 5

Attributes of Vegetarian Diet, %

	Healthy food choosers	Red meat avoiders	Stress-free women	Rejecters	Total
Do not eat (red, white) meat, fish, dairy products and eggs.	9.2	7.0	11.7	4.7	8.6
Do not eat meat (including red meat, white meat, and fish), but do eat other animal products, including dairy and eggs.	77.7	80.1	66.4	67.2	74.9
Eat all animal products.	0.0	1.2	3.9	**7.8**	2.0
Do not eat red or white meat, but do eat fish.	13.1	11.7	18.0	20.3	14.5

Source: Own research
Note: χ^2 = 28.76; p = 0.00, Cramer's V = 0.12; p=0.00

Regarding the vegan diet, the majority knew that not all foods of animal origin could be consumed, especially those who avoided red meat. 9.4% of the rejecters thought that the refusal of meat but the consumption of fish was typical of a vegan diet (Table 6).

Table 6

Attributes of Vegan Diet, %

	Healthy food choosers	Red meat avoiders	Stress-free women	Rejecters	Total
Do not eat (red, white) meat, fish, dairy products and eggs.	84.1	**90.1**	76.6	78.1	83.6
Do not eat meat (including red meat, white meat, and fish), but do eat other animal products, including dairy and eggs.	7.2	3.5	8.6	6.3	6.4
Eat all animal products.	6.0	5.3	7.8	6.3	6.2
Do not eat red or white meat, but do eat fish.	2.8	1.2	7.0	**9.4**	3.9

Source: Own research
Note: χ^2 = 18.27; p = 0.03, Cramer's V = 0.10; p=0.03

72.1% of healthy food choosers thought that plant-based diet was similar to vegan and vegetarian diet, and 27.9% of them admitted that it was a diet free of products derived from animals. 84.8% of red meat avoiders thought that plant-based diet was similar to vegan and vegetarian diet, and 14.6% of them admitted that it was a diet free from foods derived from animals; only 0.6% thought that PBD allowed diary consumption. 75.8% of stress-free people admitted that PBD was similar to vegan and vegetarian diets, 22.7% of them thought it was a meat-free diet. 71.9% of rejecters thought it was similar to vegan and vegetarian diets, 25% thought it was a meat-free diet, and 3.1% mentioned that diary consumption was allowed in this diet.

Attitude towards plant-based diet

37.6% of respondents rejected the plant-based diet and the rest thought about trying it. 50.6% of the healthy food choosers thought about following a PBD, 4.4% thought about it only for a short period, and 31.9% rejected this diet. The proportion of undecided women was 13.1%. 73.7% of the red meat avoiders planned to follow a PBD, 3.5% only for a short time. 16.4% refused the diet and 6.4% did not know. Taking into account the stress-free women, they abstained from a plant-based diet, as 61.7% of them refused this type of diet. The refusers were attached to meat, as 68.8% of them did not think of trying a meat-free diet.

Table 7 shows the sample's mean level of agreement with 15 attitudinal statements about plant-based diets. The attitudes range from "*may have health benefits for certain diseases*" as the attitude with the highest mean level of agreement (4.26), especially among red meat avoiders, to "*encourages diary consumption*" as the attitude with the lowest mean level of agreement (1.69), especially among red meat avoiders. No significant results based on cluster membership were found in two cases, "*excludes the consumption of processed foods*" and "*encourages the consumption of complex carbohydrates*". Red meat avoiders, healthy food choosers, and stress-free women had more positive attitudes toward PBD than did rejecters.

Perception about Plant-Based Diet

Women viewed a plant-based diet as healthy, safe, varied, exciting, fashionable, simple, environmentally friendly, easy to digest, and satisfying. The majority associated it with positive attributes. However, 47.4% perceived it as cheap and 52.6% perceived it as expensive. Healthy eaters perceived PBD as healthy. Red meat avoiders perceived the plant-based diet as healthy, safe, varied, exciting, environmentally friendly, and a complete diet. Stress-free women thought the plant-based diet was unhealthy and environmentally unfriendly. Rejecters attached more negative attributes to the PBD. They perceived the meatless diet as unhealthy, dangerous, monotonous, boring, environmentally unfriendly, difficult to digest, and malnutrition (Table 8).

Attitude towards Plant-Based Diet

Statement – A plant based diet…	Healthy food choosers	Red meat avoiders	Stress-free women	Rejecters	Total
is beneficial in case of some illnesses* (13) $F=4.26$, $p=0.00$	4.27 (1.02)	4.45 (0.95)	4.17 (1.07)	3.93 (1.19)	4.26 (1.04)
eliminates or minimizes the consumption of products of animal origin* (4) $F=2.89$, $p=0.03$	4.27 (1.19)	4.36 (1.24)	4.02 (1.37)	3.93 (1.47)	4.21 (1.28)
facilitates digestion* (10) $F=5.51$, $p=0.00$	4.17 (1.10)	4.36 (0.99)	4.03 (1.18)	3.75 (1.15)	4.15 (1.10)
is more environmentally friendly* (14) $F=5.97$, $p=0.00$	4.19 (1.09)	4.34 (1.09)	4.01 (1.15)	3.70 (1.29)	4.14 (1.14)
reduces saturated fat consumption* (15) $F=4.08$, $p=0.00$	4.11 (1.07)	4.15 (1.09)	3.82 (1.13)	3.73 (1.27)	4.02 (1.12)
helps prevent chronic diseases* (9) $F=5.52$, $p=0.00$	3.88 (1.27)	4.02 (1.26)	3.82 (1.21)	3.28 (1.20)	3.84 (1.26)
good for extra energy* (11) $F=6.03$, $p=0.00$	3.76 (1.30)	4.00 (1.24)	3.60 (1.31)	3.25 (1.20)	3.74 (1.29)
limits or excludes eggs* (6) $F=6.46$, $p=0.00$	3.59 (1.44)	3.92 (1.40)	3.47 (1.38)	3.15 (1.40)	3.63 (1.43)
is perfect for muscle building* (12) $F=12.38$, $p=0.00$	3.48 (1.37)	3.76 (1.36)	3.07 (1.37)	2.70 (1.28)	3.39 (1.39)
avoids processed foods (2) $F=1.35$, $p=0.25$	3.38 (1.43)	3.12 (1.58)	3.28 (1.33)	3.45 (1.42)	3.29 (1.45)
discourages complex carbohydrates (7) $F=0.27$, $p=0.84$	3.17 (1.35)	3.19 (1.38)	3.08 (1.21)	3.25 (1.32)	3.17 (1.32)
does not get enough omega-3 fatty acids* (8) $F=6.90$ $p=0.00$	2.19 (1.24)	1.90 (1.21)	2.20 (1.21)	2.71 (1.26)	2.16 (1.24)
promotes oil consumption* (5) $F=5.26$, $p=0.00$	2.04 (1.09)	1.99 (1.14)	2.39 (1.22)	2.45 (1.19)	2.14 (1.15)
does not provide the body with enough protein* (1) $F=8.25$, $p=0.00$	1.98 (1.23)	1.83 (1.20)	2.25 (1.21)	2.65 (1.28)	2.06 (1.24)
encourages dairy consumption* (3) $F=5.48$, $p=0.00$	1.67 (1.03)	1.47 (1.01)	1.87 (1.17)	2.01 (1.21)	1.69 (1.09)

Source: Own research
Note: Values are means measured on a 5-point Likert scale from strongly disagree (1) to strongly agree (5), and values in parentheses are standard deviations.

Table 8

Perception of PBD

Plant based diet is	Healthy food choosers, %	Red meat avoiders, %	Stress-free women, %	Rejecters, %	Total, %	χ2 p
healthy	**78.5**	**89.5**	54.7	45.3	73.1	74.26
unhealthy	21.5	10.5	**45.3**	**54.7**	26.9	0.00
cheap	47.4	48.5	43.8	51.6	47.4	
expensive	52.6	51.5	56.3	48.4	52.6	
dangerous	35.9	25.7	39.1	**46.9**	34.9	11.45
safe	64.1	**74.3**	60.9	53.1	65.1	0.01
monotonous	35.1	21.1	35.9	**48.4**	32.7	18.97
varied	64.9	**78.9**	64.1	51.6	67.3	0.00
boring	38.2	22.8	43.0	**56.3**	36.8	27.12
exciting	61.8	**77.2**	57.0	43.8	63.2	0.00
old-fashioned	20.3	16.4	18.0	25.0	19.2	
fashionable	79.7	83.6	82.0	75.0	80.8	
simple	68.9	66.1	61.7	54.7	65.1	
complicated	31.1	33.9	38.3	45.3	34.9	
environmentally unfriendly	13.9	8.8	**27.3**	**34.4**	17.4	32.54
environmentally friendly	86.1	**91.2**	72.7	65.6	82.6	0.00
difficult to digest	14.3	10.5	15.6	**28.1**	15.0	11.46
easy to digest	85.7	89.5	84.4	71.9	85.0	0.00
malnutrition	33.5	23.4	40.6	**56.3**	34.5	24.96
full diet	66.5	**76.6**	59.4	43.8	65.5	0.00

Note: Based on the results of the adjusted standardized residuals, the attributes of the PBD are related to the groups of consumers shown in bold.

Discussion

Healthy lifestyle is an important multidisciplinary topic, as it is not only addressed by health studies, but also by social sciences in general. Most previous studies have classified consumers or specific consumer groups, such as children (Smith et al., 2011), adolescents (Matias et al., 2018), Generation Z (Tanton et al., 2015), or seniors, based on their eating habits (André et al., 2017) or their healthy lifestyle. As more and more researchers (Beacomet al., 2021; Lea et al., 2006) have highlighted the openness of women to healthy lifestyles, the present study focused only on women. The authors first distinguished various health factors, such as health-conscious eating, mindfulness, carbohydrate avoidance, and red meat avoidance. As previous studies such as Jenkins et al. (2021) have highlighted the importance of behavioral segmentation in the case of healthy lifestyles, we also adopted this approach. The present quantitative study identified four consumer segments among women based on their health behaviors. Healthy food choosers (40.9%), red meat avoiders (27.9%), stress free women (20.8%), and rejecters (10.4%). The majority of the sample considers a healthy lifestyle, either eating behavior or mindfulness, to be somewhat important. This could be explained by the fact that the half of the sample follows some kind of online social media group. Red meat avoiders live in the capital city, eat fruits and vegetables more often or at least once a day. Rejecters live in villages and eat fruits and vegetables every 4–5 days in a

week or do not eat fruits and vegetables in a week. Healthy eaters eat fruits and vegetables several times a day. Stress-free people eat fruits and vegetables every 2–3 days in a week.

Many researchers (Schmidt, 2019; Törőcsik, 2016) have noted that plant-based diets have become an increasingly popular dietary trend in recent years due to health and sustainability concerns. Plant-based diets aim to marginalize animal and highly processed foods and include mostly raw, unprocessed, or minimally processed plant foods in the diet (Ostfeld, 2017; Szabó et al., 2016). Plant-based diets range from strictly plant-based (vegan) to semi-vegetarian. The majority of healthy food choosers, red meat avoiders, stress-free women, and rejecters thought that plant-based diets were similar to vegan and vegetarian diets. The majority of respondents believed that a vegetarian diet meant avoiding white and red meat and fish, while eating other foods of animal origin such as eggs and dairy products. Regarding vegan diets, the majority knew that not all foods of animal origin could be consumed, especially those who avoided red meat. The majority of women thought about trying PBDs. Red meat avoiders, healthy food choosers, and stress-free women had more positive attitudes toward PBDs than did avoiders. Women acknowledged the positive health effects of this diet, such as good for digestion and prevention of chronic disease, as previous studies have confirmed (Beacom et al., 2021; Véha et al. 2019b). Sustainability is a major advantage of the plant-based diet, which is why many researchers currently started to deal with this topic (Fehér et al., 2020, Havemnans et al., 2021; Véha et al., 2019b). In this empirical research, women admitted that PBD is environmentally friendly. More authors emphasized the negative effect of plant-based diet (Pohjolainen et al., 2015; Reipurth et al., 2019; Véha et al., 2019a). The respondents were not aware of the fact what kind of nutrition can be missed with this diet.

Women viewed a plant-based diet as healthy, safe, varied, exciting, fashionable, easy, environmentally friendly, digestible, and satisfying. Rejecters attached more negative attributes to the PBD than did healthy eaters, red meat avoiders, and stress-free women. As Havermans et al. (2021) and Pohjolainen et al. (2015) emphasized that the taste of plant-based foods could be a barrier in the adaptation process, we also found that rejecters perceived the meatless diet as unhealthy, dangerous, monotonous, boring, environmentally unfriendly, difficult to digest, and malnutrition.

Conclusions

The aim of this research was to explore the perceptions of healthy eating in Hungary There are some educational initiatives and programs targeted at the young generation by the national government, and public education related to eating behavior (smart plate, school lunch reform and school fruit program) and physical activity (mandatory daily physical education). At the same time, the attitudes and behaviors of the Hungarian population are slowly changing, and there is a large gap between recommendations and actual eating habits. The present study is useful for the health sector (physicians, dieticians and nutritionists) and the government, as targeted marketing programs can be planned to change dietary behavior.

1. In the case of the government, social marketing programs would be necessary. It is also important to raise health awareness among the rejecters.
2. To improve people's quality of life and well-being, it is necessary to improve their health. Health is not just a state of being free from disease or injury, but a more complex category.
3. A healthy mind in a healthy body should be emphasized in social marketing campaigns. Reducing overweight and obesity is the goal of society as a whole (especially in

developed countries, where this phenomenon is considered an epidemic), so it is necessary to educate people and use social marketing campaigns.

4. People should be informed about the progress of more PBDs and the principles of a healthy lifestyle (food pyramid, smart plate, WHO principles). These applications could be developed in collaboration with doctors, dieticians and nutritionists.

5. It is in the interest of society to educate people and change their unhealthy habits. Not only the individual level, but also the national economic interest such as sustainability issues should be emphasized. The social marketing campaign aims to change people's attitudes and behaviors.

This paper has limitations. First, the sample was not representative. There is little age bias in the sample. Mainly young women, students and white-collar workers could be reached by the online survey. However, previous studies have highlighted the importance of age and educational level in relation to PBDs. We focused mainly on a regional sample, people living in the western part of Hungary, which is considered to be more developed economically and in terms of quality of life. On the other hand, the survey was shared in different online social media groups, so the respondents were engaged in health issues at a higher level.

In the future, we would like to analyze men as well. Comparing the knowledge, beliefs, attitudes and perceptions of men and women would also be an interesting research question. An intercultural study comparing the beliefs, knowledge, attitudes and perceptions of people from different cultures would be interesting.

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