



DOCTORAL SCHOOL OF ECONOMIC AND REGIONAL SCIENCES

The producer and consumer aspects of the mushroom sector in Hungary

Thesis summary

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1. PREVIOUS STUDIES AND THE AIMS OF THE PRESENT PROJECT

1.1. Selecting a research topic

The issue I have selected for my dissertation topic is the assessment of mushroom production and consumption from an economic point of view.

The first section addresses the current situation, competitiveness and development potential of mushroom production in Hungary in the form of empirical research.

The second section elaborates on the mushroom consumption habits of the population in Hungary.

My dissertation focuses on the factors that impact the potential success of the mushroom production sector in Hungary, and the general characteristics of mushroom consumer behaviour.

1.2. The significance of the research project

The production of mushrooms is different from all other horticultural and agricultural production. It has a very low environmental footprint: one pound of mushrooms needs a mere 1.8 litres of water and 1.0 kWh energy input (Monterey Mushroom, 2019); it relies on organic waste from the horticultural, forestry and food processing sectors, and results in the production of food with high biological value.

According to Gyórfi (2010b):

- mushrooms are a useful source of proteins, suitable for mitigating the effects of malnutrition in developing countries;
- mushrooms are a useful part of special diets;
- mushrooms could be an integral part or source of nutritional supplements;
- mushrooms are an important component of vegan or vegetarian diets;
- mushrooms contribute to protecting the environment.

Marshall and Nair (2009) emphasise the nutritional value, medicinal properties, and income-generating potential of mushrooms.

1.3. Previous studies

After obtaining a BSc in agricultural engineering at Szent István University, I started my career at the Institute of Technology of the Hungarian Ministry of Agriculture, as an associate at the office of Mechanisation of Plant Cultivation. I participated in assembling a catalogue of agricultural machinery, and in evaluating the financial and professional background of young farmers who were applying for subsidies for mechanisation. I gained my first glimpses into the situation and difficulties of the mushroom sector at this time.

My BSc thesis research focused on the role and significance of investments into mechanisation in the agricultural sector (2001). The project evaluated the effects of technological assets and investment subsidies on the competitiveness of agricultural enterprises.

In the next step, my MEd in Engineering thesis in 2004 focused on educating environmental consciousness. Later on, I also participated in managing a “school mushroom” project in primary

schools and in Premontrei Szent Norbert Secondary School in the town of Gödöllő from 2016 to 2019.

My dissertation research was supported by research grants ÚNKP-2017 (The opportunities of expanding vertical relationships in food processing, with a special focus on the mushroom sector); ÚNKP-2018 (The role of the mushroom sector in achieving social goals, such as equal opportunities and healthy nutrition); and ÚNKP-2019 (An international comparison of the economic assessment of mushroom production and consumption).

1.4. Aims of the doctoral dissertation

The following issues are addressed in the current doctoral dissertation.

I. Secondary research aims

1. Introduction of the significance of mushroom production and consumption
2. An overview of the international mushroom sector, analysis of trends and changes in the international market
3. An overview of the mushroom sector in Hungary, analysis of trends and changes in the national market
4. A summary of consumer behaviour and its principles, focusing on functional food and food with medicinal properties, and models of food consumption.
5. An assessment of international and national mushroom consumption, evaluation of marketing strategies promoting mushroom consumption

II. Primary research aims

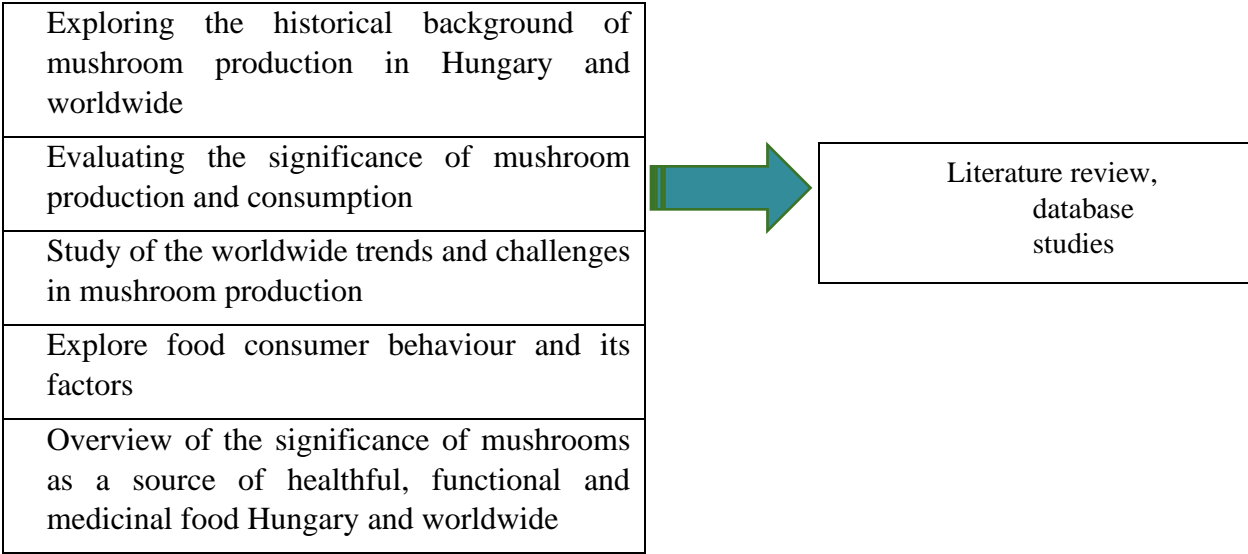
II.a. Aims related to mushroom production:

1. Explore the current situation and development potential of the mushroom production sector in Hungary with the help of structured interviews.

II.b. Aims related to mushroom consumption:

2. Explore consumer behaviour and preferences
3. Classify Hungarian mushroom consumers
4. Create a model of mushroom consumer behaviour

RESEARCH BASED ON SECONDARY SOURCES



RESEARCH BASED ON PRIMARY SOURCES

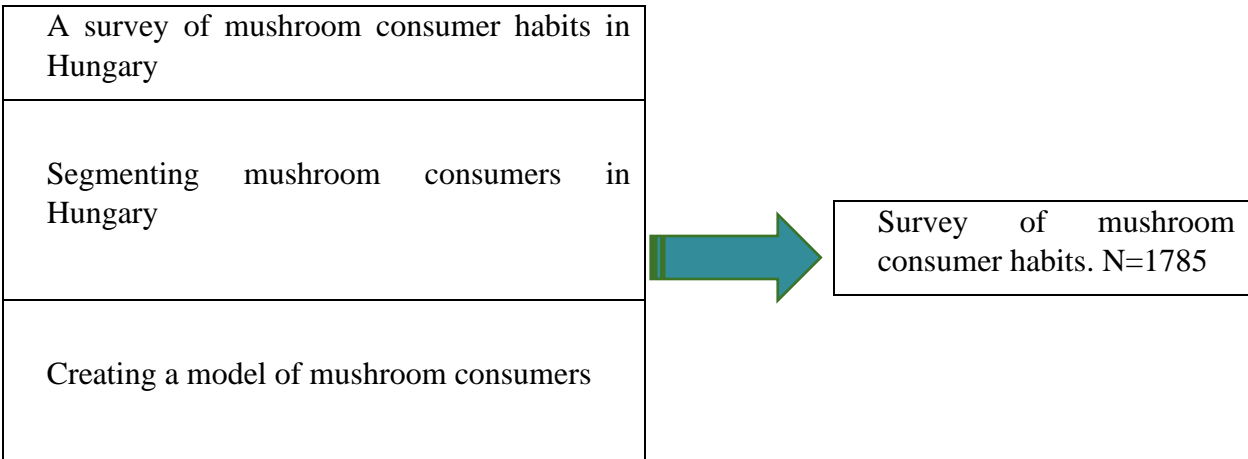
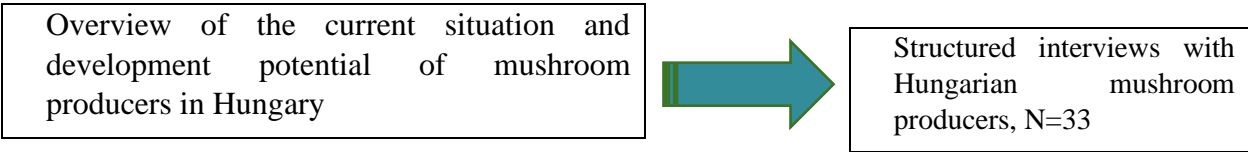


Figure 1 below is a visual representation of the progress and steps of my research project.

Source: own editing

1. MATERIAL AND METHODS

2.1. Structure of the empirical research

2.1.1. Hypotheses for the empirical study of mushroom production

H1.: There are significant differences between the development opportunities of micro, small and medium enterprises active in mushroom production.

H2.: There are significant differences regarding the assessment of the impact of human labour as a contributing factor to the quality and quantity of mushrooms produced.

H3.: There are significant differences between the online marketing activities of micro, small and medium enterprises active in mushroom production

2.1.2. Hypotheses for the empirical study of mushroom consumption

The effect of social and demographic factors on mushroom consumption habits:

H4.: Social and demographic factors have an impact on the role of mushrooms in nutrition.

H5.: Social and demographic factors and nutrition habits had different effects on mushroom consumption over the past five years.

The theoretical model of mushroom consumers in Hungary is based on background research on national and international trends and on various models of food consumption.

The following seven latent variables were introduced in the theoretical model of mushroom consumption (Figure 2):

- nutrition habits,
- sensitivity to prices,
- preconceptions and prejudices,
- origin of the mushrooms,
- sensory assessment,
- national cuisine,
- medicinal and functional properties.

In addition, the following three target variables were introduced:

- healthy food,
- exotic food,
- frequency of consumption.

A six-point Likert scale was used to assess the latent variables.

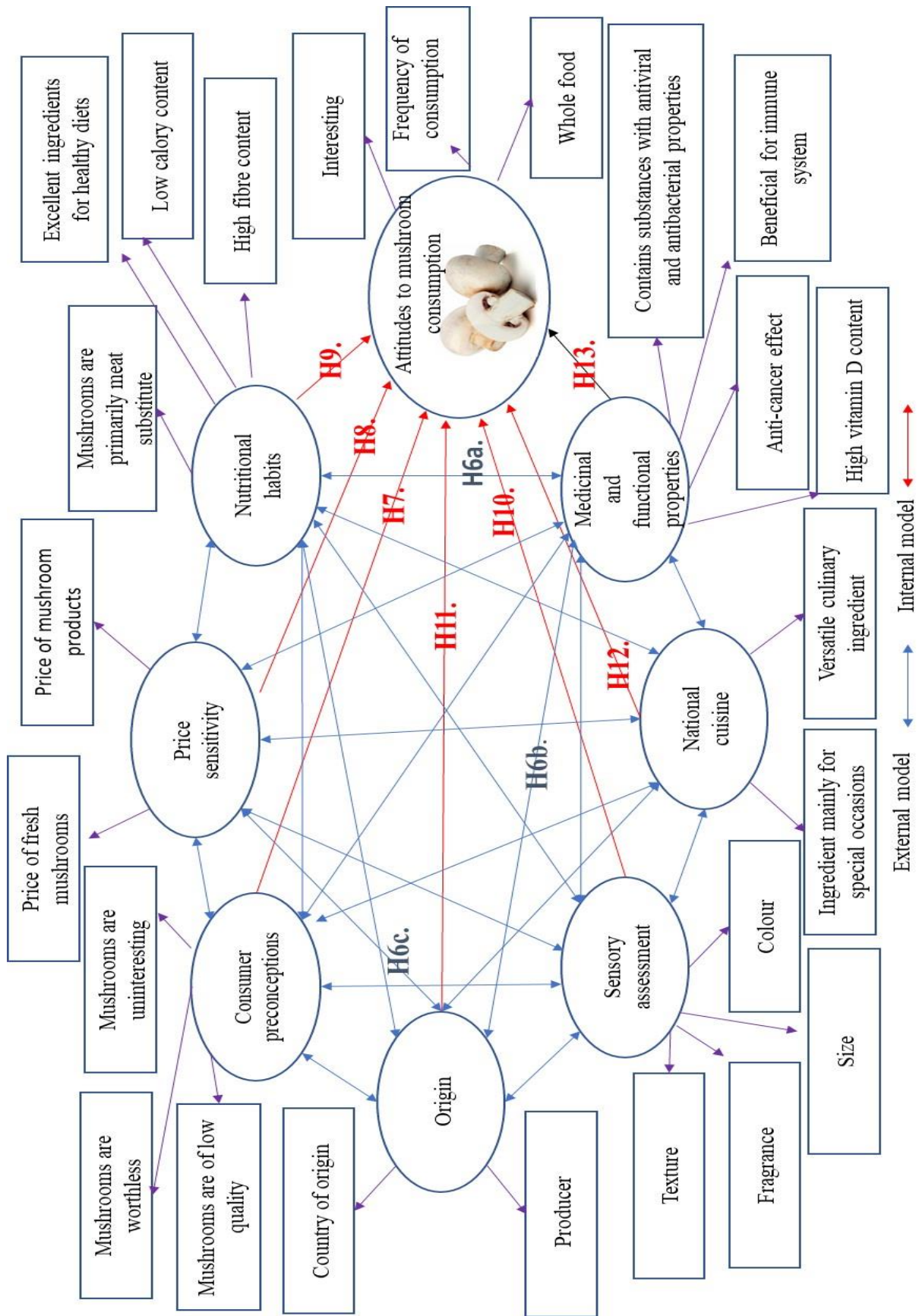


Figure 2: A hypothetical model of the factors influencing mushroom consumer behaviour in Hungary

Source: own research

Hypotheses related to the model of mushroom consumer behaviour

- H6.** Factors having an impact on mushroom consumption are interrelated and interdependent.
- H6a.:** Medicinal and functional properties correlate with general nutritional habits.
- H6b.:** Medicinal and functional properties strongly correlate with the origin of the mushrooms.
- H6c.:** The price of mushrooms and the origin of the mushrooms are strongly correlated.
- H7.** Negative attitudes have a negative impact on mushroom consumption.
- H8.** Prices have a significant impact on attitudes to mushroom consumption.
- H9.** Nutritional habits have a significant impact on attitudes to mushroom consumption.
- H10.** Sensory assessment has a significant impact on attitudes to mushroom consumption.
- H11.** Origin of the mushrooms have a significant impact on attitudes to mushroom consumption.
- H12.** National cuisine has a significant impact on attitudes to mushroom consumption.
- H13.** Medicinal and functional properties have a significant impact on shaping attitudes to mushroom consumption.

2.2. Research based on secondary sources

Secondary research is also referred to as desk research (Gyulavári et al. 2015), as it is a summary and systematic review of relevant studies and research projects in the field.

The literature review, therefore, sets out with an overview of mushroom production worldwide, historical background, and current trends.

For the assessment of global mushroom production and consumption market trends, I relied primarily on FAO databases. As detailed data are not available for the mushroom sector specifically, national databases were added as well: CEFA data for China, USDA for the USA, and STATCAN for Canada. In the case of the European Union, FAO databases as well as GEPC were consulted.

For the overview of the situation in Hungary, FAO and GEPC were used. In addition, publications by the Agricultural Research Institute of Hungary (AKI), MUSHROOMFORUM, FRUITWEB and UMDIS were utilised for detailed national and worldwide information.

Surveys by the Central Statistical Office (KSH) in Hungary proved to be invaluable for analysing mushroom consumption. The situation in other countries was assessed with the help of their relevant national background research and statistical databases.

Further literature review was facilitated by academic databases, most importantly: EBSCO, SCOPUS, Web of Science, Science Direct, and Researchgate.

Special attention was paid to consumer models, and food consumer behaviour and its impacting factors. As mushrooms are clearly not only healthful and wholesome, but also functional, special emphasis was added to overviewing the background of the consumption of functional foods as well.

The secondary research phase was concluded with studies into national and worldwide consumer trends and habits. In addition, changes in prices from 2012 to 2016 were evaluated with the help of analytical trend calculations and by applying a linear trend function to chronological data, and seasonal differences were analysed using an additive model.

Table 1 summarises the secondary research phase.

Table 1: Summary of secondary research aims, databases and materials and methods

Research aims and hypotheses	Materials and methods
Aim 1. Introduction of significance of mushroom production and consumption	Overview of national and international publications.
Aim 2. Introduction of main stakeholders in international mushroom sector. Analysis of trends and changes in international mushroom sector	Survey of international trends (FAO, STATCAN, USDA, CEFA, GEPC, AKI, UMDIS).
Aim 3. Overview and analysis of the mushroom sector and recent changes in Hungary	Overview of publications and databases, analytical trend calculation (AKI- Institute of Agricultural Research, GEPC),
Aim 4. Introducing concepts of consumer behaviour, with an emphasis on functional and medicinal foods and food consumer models	Overview of national and international publications
Aim 5. Introduction to national and international mushroom consumption and its marketing activities	Overview of national and international publications: USDA, KSH- Central Statistical Office, STATCAN, FAO, MUSHROOMFORUM)

Source: own editing

2.3. Research based on primary resources

2.3.1. Structured interviews with mushroom producers

Structured interviews with selected mushroom producers in Hungary were conducted with the aim of exploring the current situation and development potential of the sector. The survey was preceded by a series of site visits and informal interviews focused on professional issues and business operation and management aspects from June 2014 to December 2019. This had been the first project of its scope and depth in this field of study.

The interview comprised 33 questions in the following main topics:

- demographic and general information,
- questionnaire items focusing on management and sales,
- R+D outcomes, innovation, participation in producer or marketing cooperatives

Sampling: nationwide

Duration: December 2019 – January 2020.

Target group: mushroom producers in Hungary

Act XXXIV of 2004 on Small and Medium-Sized Enterprises and the Support Provided to Such Enterprises (“SMEA”) clearly defines the specifications of micro, small and medium enterprises (net sales revenues, balance sheet total, number of employees). In my research project, subjects were divided into micro enterprises and small or medium enterprises based on the number of employees.

The largest percentage of responders can be described as individual entrepreneurs and primary producers.

Table 2: Distribution of mushroom producers in the study by type of business

Type of business	Percentage of respondents (N=33)
Limited partnerships	6.1
Individual entrepreneurs	39.4
Association	3.0
Limited companies	21.2
Primary producers	30.3
Total	100.0

Source: own research

Participants are geographically located in 11 different counties as well as in the capital city; 33% of the businesses are situated in Pest county (Table 3).

Table 3: Geographical distribution of participants in the survey of mushroom producing businesses

County	Percentage of respondents
Bács- Kiskun county	6.1
Békés county	3.0
Borsod-Abaúj-Zemplén county	6.1
Budapest	3.0
Fejér county	3.0
Hajdú-Bihar county	12.1
Heves county	6.1
Pest county	33.3
Somogy county	12.1
Szabolcs-Szatmár-Bereg county	9.1
Vas county	3.0
Veszprém county	3.0
Total	100.0

Source: own research

Sectors are usually assessed using a diagnostic SWOT model created by researchers of Harvard Business School. Among other notable mentions, it was used extensively in Pallás (2016) for analysing the grapes and wine sector, and in Medina (2005) and Bene (2011) for the vegetables sector. In order to conduct the SWOT analysis of the mushroom production sector in Hungary, the following resources were used:

- national and international publications,
- databases,
- interviews,

- questionnaire survey of mushroom producers,
- questionnaire survey of consumers.

According to Michael E. Porter’s *The Competitive Advantage of Nations* (1990), a country will have competitive advantage if the factors considered key are interrelated. Several studies using Porter’s model have surveyed the competitiveness of the agricultural and food sector in Hungary in recent years, including De Keijn (1995), Illés et al (2017), and Lakner (2017).

The following materials were consulted regarding the competitiveness of the Hungarian mushroom sector specifically:

- publications,
- databases,
- questionnaire survey of mushroom producers.

Table 4 below summarises the primary research aims, materials and methods related to mushroom production.

Table 4: Primary research aims, materials and methods in the field of mushroom production

Research aims and hypotheses	Materials	Methods
<p>Aim 6.: Survey the current situation and development potential of mushroom production in Hungary with the help of structured interviews.</p> <p>H1.: There are significant differences between the development opportunities of micro, small and medium enterprises active in mushroom production.</p> <p>H2.: There are significant differences regarding the assessment of the impact of human labour as a contributing factor to the quality and quantity of mushrooms produced.</p> <p>H3.: There are significant differences between the online marketing activities of micro, small and medium enterprises active in mushroom production</p>	<p>Structured interviews with managers of mushroom producing businesses in Hungary (N=33)</p>	<p>SWOT analysis</p> <p>PORTER diamond model</p> <p>Kruskal–Wallis test</p> <p>Dunn–Bonferoni post hoc test</p> <p>Friedman test</p>

Source: own research

2.3.2. A survey of mushroom consumer habits in Hungary

In order to survey consumer habits in the target population, an online questionnaire was administered using LimeSurvey. The questionnaire was compiled after consulting the relevant chapters of Malhotra & Simon (2009) and Babbie (2001), and tested using 40 subjects first. Subsequently, 2017 respondents filled in the questionnaire, out of which 1785 were complete and used for analysis. Participation was voluntary, subjects were chosen randomly and anonymously. The questionnaire included open-ended items, Likert scales, nominal questions, and ordinal questions as well. For instance, knowledge of mushrooms and agreement with statements were assessed using 6-point Likert scales (1= strongly disagree, 6= strongly agree).

The questionnaire contained 36 items, including the following sections.

- General questions about mushroom consumption
- Health effects of mushroom consumption
- Purchasing mushrooms

- Demographic data

Regarding the demographic distribution of participants, 58% of the respondents were female and 42% male. Table 5 summarises distribution by age groups, which are thought to be relevant, as attitudes and consumer habits, motivations and aversions have changed multiple times and to a considerable extent over the past 100 years, as mushrooms moved from meat substitutes after the post-war years to exotic ingredients in the later decades.

As demonstrated by Table 5 below, most respondents were in partnerships.

Table 5: Distribution of questionnaire respondents by age group

Category	Responses	Responses in %
Under 20	193	10.8
20-30 years of age	661	37.0
31-40 years of age	247	13.8
41-50 years of age	368	20.6
51-60 years of age	177	9.9
61-70 years of age	100	5.6
Over 70	39	2.2
Total	1785	100.0

Source: own research

Table 6: Distribution of questionnaire respondents by family status

Category	Respondents	Respondents in %
Single	706	39.6
Married / in partnership	946	53.0
Divorced / Widowed	133	7.5
Total	1785	100.0

Source: own research

Regarding the geographical location of participants, city dwellers (79.6%) were a strong majority.

General nutrition habits were considered to be relevant, as it was hypothesised that mushrooms play a significantly different role in their meals, which was also supported by evidence from previous secondary research (Table 7).

Table 7: Distribution of questionnaire respondents by nutrition habits

Nutrition habits	Respondents	Respondents in %
Mostly traditional cuisine	561	31.4
Vegetarian	51	2.9
Vegan	22	1.2
Healthy diet	75	4.2
Prefers international cuisine	104	5.8
Likes all food	706	39.6
Moderate, balanced diet	246	13.8
Junk food	20	1.1
Total	1785	100.0

Source: own research

2.4. Statistical methods applied in the analysis of data

According to Babbie (2001), the aim of descriptive statistics is to convert quantitative data into meaningful information. In this study, means, frequencies and deviation are used extensively.

In order to compare and contrast different socio-demographic groups, non-parametric tests were used, as attitudes to mushroom consumption were surveyed using 6-point Likert scales that did not yield data with normal distribution. Mann-Whitney test was used to compare genders.

Age groups, educational background, and occupational background were contrasted using Kruskal-Wallis tests. When the Kruskal-Wallis test yielded significant differences, Dunn-Bonferroni post hoc tests were used. Kendall's coefficient of concordance was applied in order to assess agreement among respondents.

Kendall rank correlation coefficient was used to explore the factors contributing to the purchase and consumption of mushrooms.

Segmenting of Hungarian mushroom consumers was conducted using K-means clustering, since this is the recommended procedure for larger samples (instead of hierarchical clustering). (Sajtos et al, 2007, Jánosa, 2011).

Principal component analysis was conducted to identify the main characteristics of consumer behaviour.

Confirmatory factor analysis was applied to examine the construct validity of the survey items for evaluating the knowledge about mushrooms. The statistical requirements of the application of factor analysis have been confirmed by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's test. Cronbach's alpha reliability coefficient was used to examine the internal consistency of the scales.

Table 8: Primary research aims, materials and methods used for survey of mushroom consumption

Research aims any hypotheses	Materials	Methods
<p>Aim 7. Exploring mushroom consumer habits and preferences in Hungary</p> <p>H4.: Social and demographic factors have an impact on the role of mushrooms in nutrition.</p> <p>H5.: Social and demographic factors and nutrition habits had different effects on mushroom consumption over the past five years.</p>	Questionnaire survey of mushroom consumers in Hungary , N=1785	<p>Mann–Whitney test</p> <p>Kruskal–Wallis test</p> <p>Dunn–Bonferroni post hoc test</p>
<p>Aim. Segmenting mushroom consumers in Hungary</p>		<p>K-means cluster analysis</p> <p>Kendall coefficient of concordance</p> <p>Principal component analysis</p>

Source: own research

Principal component analysis was utilised again in order to survey latent variables when drawing up a mushroom consumption model. The validity of the resulting hypothetical mushroom consumer model and the reliability of the latent variables were assessed using confirmatory factor analysis and structural equations modelling (Byrne 2010).

The reliability of the latent structures was confirmed using the following indicators:

- Cronbach alpha coefficient: values over 0.6 indicate a reliable latent variable (Taber 2016).
- Spearman-Brown coefficient: values over 0.6 are acceptable (Eisinga, Grotenhuis and Pezer, 2013).
- Average variance extracted (AVE): Values over 0.5 are acceptable (Hair et al, 2009; Baumgartner and Homburg, 1996).
- Composite reliability (CR): it expresses the shared variance for the latent variables that comprise the observed indicators. According to Hair et al (2009), all the latent variables in the model need to have a CR of at least 0.7 each.

In cases when average variance extracted is below 0.5, but composite reliability exceeds it, the reliability of the latent variable is acceptable (Lam, 2012). After the validation of the measuring model, the next step was structural equations modelling, expressing the relationship of the explanatory dimensions of the mushroom consumer model and the factors of attitudes to consumption.

The modelling of structural equations involves a multi-step process, which combines factor analysis and a multivariate regression analysis, and provides an estimate of mutual relationships. Structural equations modelling can be considered an extension of general linear modelling, which is capable of testing multiple regression calculation tests at the same time; therefore, it is suitable for modelling a more complex relationship between the variables (Neumann and Bódi, 2012).

The starting point of the procedure is a theoretical model, which plots the relationship between the variables.

The model describes the relationships between the dependent and independent variables, and estimates the multivariate regression equations that are dependent on each other, exploring cause and effect relationships (Hair et al, 2006).

Data were processed and analysed using IBM SPSS Statistics 25 and IBM AMOS SPSS 26 Graphics statistical packages.

In order to assess the validity of the structural model, there are several tests available, including χ^2/df , CFI, RMSEA, and TLI. The interpretation of the indicators is assisted by the following relevant literature: Marsh & Hocevar (1985), Wheaton et al (1977), Baumgartner and Homburg (1996), Hu and Bentler (1999), Hair et al. (2009), Blunch (2008), Schumacker and Lomax (2004).

Table 9: Primary research aims, materials and methods used for constructing a mushroom consumer model

Research aims and hypotheses	Materials	Methods
<p>Aim 9. Constructing a mushroom consumer model</p> <p>H6. Factors having an impact on mushroom consumption are interrelated and interdependent..</p> <p>H6a.: Medicinal and functional properties correlate with general nutritional habits.</p> <p>H6b.: Medicinal and functional properties strongly correlate with the origin of the mushrooms.</p> <p>H6c.: The price of mushrooms and the origin of the mushrooms are strongly correlated.</p> <p>H7. Negative attitudes have a negative impact on mushroom consumption.</p> <p>H8. Prices have a significant impact on attitudes to mushroom consumption.</p> <p>H9. Nutritional habits have a significant impact on attitudes to mushroom consumption.</p> <p>H10. Sensory properties have a significant impact on attitudes to mushroom consumption.</p> <p>H11. Origin of the mushrooms have a significant impact on attitudes to mushroom consumption.</p> <p>H12. National cuisine has a significant impact on attitudes to mushroom consumption.</p> <p>H13. Medicinal and functional properties have a significant impact on shaping attitudes to mushroom consumption.</p>	<p>Questionnaire survey of mushroom consumers in Hungary, N=1785</p>	<p>Principal component analysis</p> <p>Confirmatory factor analysis</p> <p>Cronbach alpha coefficient</p> <p>Spearman–Brown coefficient</p> <p>Composite reliability</p> <p>General variance extracted</p> <p>Structural Equations Modelling</p> <p>SEM indicators:</p> <ul style="list-style-type: none"> - Relative Chi-square - Comparative fit index - Root-mean square error approximation - Tucker–Lewis index

Source: own research

3. RESULTS

3.1. Survey of the situation and conditions of mushroom producers in Hungary

Hungary is one of the historically most significant mushroom producers in Europe. There is a slow but steady increasing tendency; 90% is *Agaricus bisporus* and 7-8% is oyster mushrooms. Interestingly, 75% are sold fresh and 25% in canned form. The remaining few per cents are mostly shiitake, reishi, shaggy mane, and sheathed woodtuft mushrooms. (FRUITVEB 2017). Currently, 18 to 20 larger mushroom producers are registered, along with around 250 smaller farmers, employing approximately 4500 persons in total (NAK, 2018). According to Kerek and Marselek (2010), these are the principal mushroom producing locations in Hungary:

- Budapest and its vicinity, traditional region for *Agaricus bisporus* (Budafok, Budatétény, Kőbánya)
- Eger and its vicinity (Kerecsend, Demjén, Korona mushroom cooperative),
- Győr and its vicinity (Máriakálnok and Szigetköz),
- Pécs and its vicinity (on the decline),
- Kecskemét (oyster mushrooms)

3.1.1. Study of the factors affecting the quality and quantity of produced mushrooms

Based on the quantity of mushrooms produced, there is no significant difference between micro businesses and small or medium-sized businesses regarding the importance of the factors of production technology. Cleanliness and the quality of the compost are the most important (Figure 3).

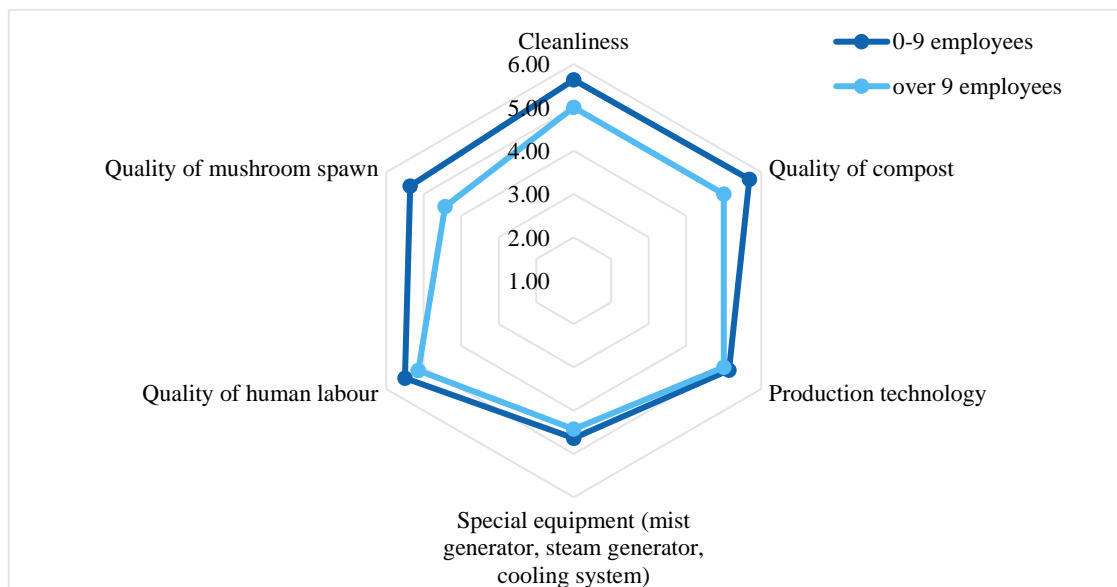


Figure 3: Factors considered important for the quality of mushrooms produced, n=33

Source: own research

According to data from Dunn–Bonferroni post hoc test (Table 10), quality of human labour, cleanliness and quality of compost have greater impact on the quality of mushrooms produced than other factors.

Table 10: Analysis of the differences in factors impacting quality*

Production factors	Groups with no significant differences	
	1	2
Special equipment: mist generator, steam generator, cooling systems, etc	2.328	
Production technology	3.241	3.241
Quality of mushroom spawn	3.741	3.741
Quality of human labour		3.793
Cleanliness		3.931
Quality of compost		3.966
Test statistics	6.690	2.959
p-value**	.035	.565

* Table summarising Dunn-Bonferroni post hoc tests, after significant Mann-Whitney test results. **Empirical level of significance for the analysis of differences between groups (comprising factors that are not significantly different, by columns)

Source: own research

Friedman test was conducted to rank the factors contributing to the quality of mushrooms (Table 11). Based on the order of rank averages of the factors and the means of the responses, it was concluded that business managers consider the quality of compost, cleanliness, and the quality of human labour the most important.

Table 11: Friedman rank of factors impacting quality

Factor	Rank average
Quality of compost	3.97
Cleanliness	3.93
Quality of human labour	3.79
Quality of mushroom spawn	3.74
Production technology	3.24
Special equipment: mist generator, steam generator, cooling system.	2.33

Source: own research

Therefore, there was no significant difference between businesses of different sizes regarding the perceived importance of factors contributing to the quantity of mushrooms produced. Cleanliness, quality of mushroom spawn, and quality of compost are regarded most important.

The quality of human labour is, understandably, rated of higher importance by micro businesses and primary producers, as they generally lack equipment and technology (Figure 4). Similarly, technology is rated of higher importance by larger businesses.

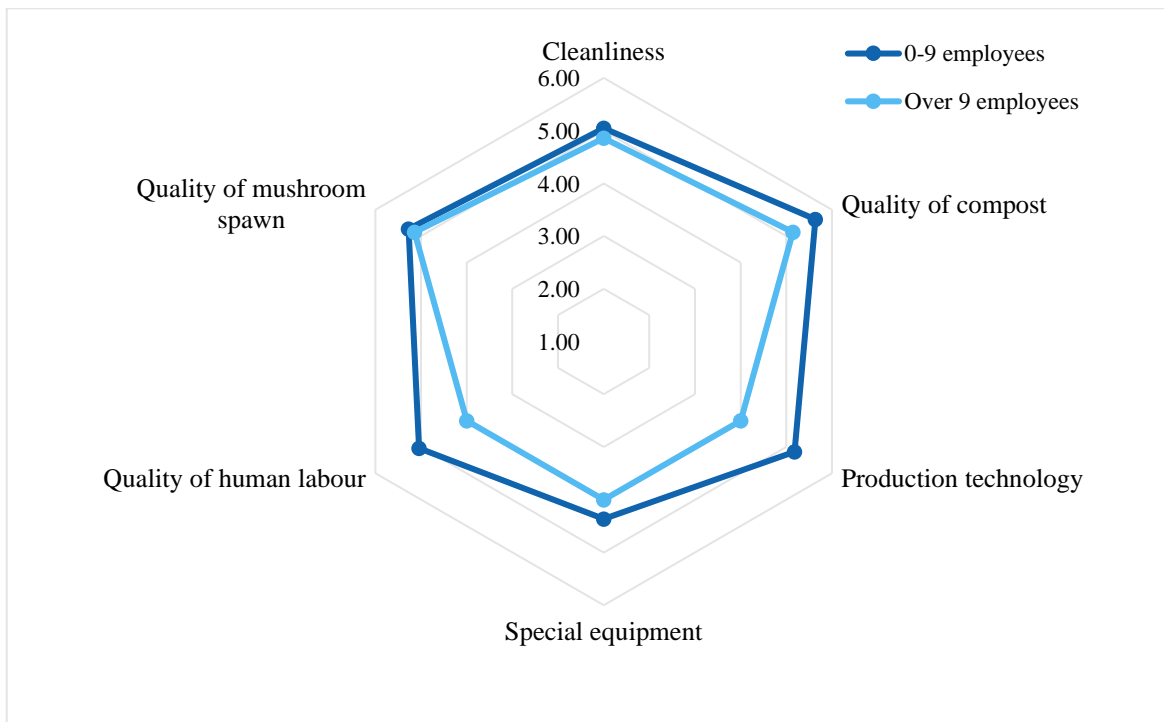


Figure 4: Perceived importance of factors impacting quantity of mushrooms produced
Source: own research

Due to the small sample size, the Dunn-Bonferroni post hoc test did not detect any significant differences between the factors. Friedman test was run to rank the factors impacting quantity (Table 12). The order of rank averages and the means of responses revealed that business managers consider the quality of compost, the quality of mushroom spawn and production technology the most important factors impacting quantity.

Table 12: Friedman ranking of factors impacting quantity

Factor	Rank average
Quality of compost	4.31
Quality of mushroom spawn	3.97
Production technology	3.52
Cleanliness	3.22
Quality of human labour	3.31
Special equipment (mist generator, steam generator, cooling system)	2.67

Source: own research

3.1.2. The marketing activity of the mushroom sector in Hungary

The marketing activity of Hungarian businesses is generally low; 32% of micro businesses have no online presence, and 25% of small and medium sized enterprises are not engaged in online marketing activity (Figure 5).

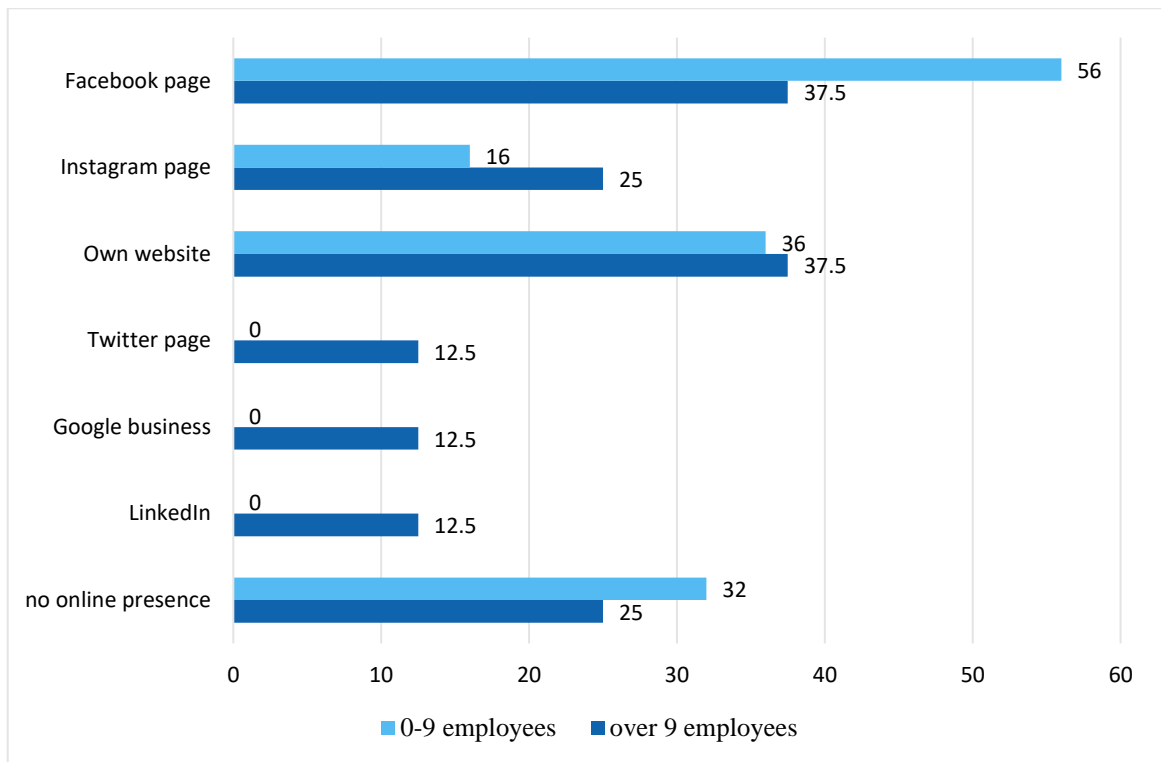


Figure 5: Percentage of businesses using online marketing platforms

Source: own research

1.4.1. Development potential of the Hungarian mushroom sector

The present study proved that mushroom producers have significantly different opinions on the improvement potential of their competitiveness: according to micro businesses, campaigns to promote mushroom consumption as well as EU and national subsidies would be key for development. At the same time, however, small and medium businesses emphasise national subsidy systems (Figure 6).

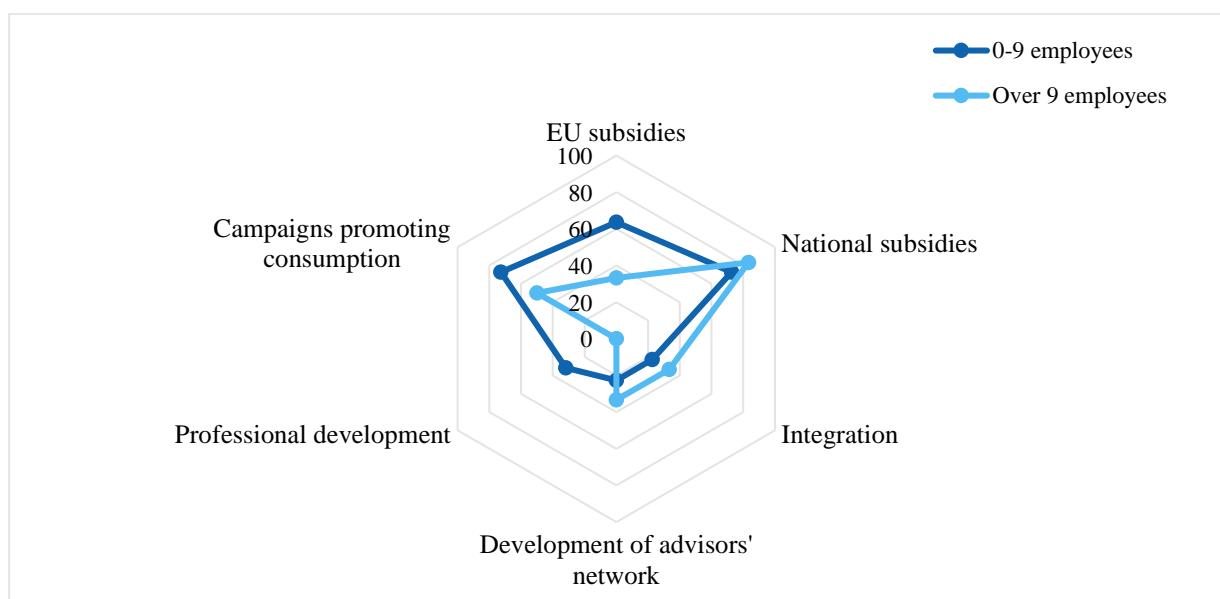


Figure 6: Mushroom producers' opinion on possibilities of increasing competitiveness

Source: own research

1.4.2. SWOT analysis of the mushroom sector

The SWOT analysis of the Hungarian mushroom sector was prepared using primary and secondary sources, and is summarised in Table 13.

Table 13: SWOT analysis of the mushroom sector in Hungary

<p style="text-align: center;">STRENGTHS</p> <ul style="list-style-type: none"> - Hungary has historical traditions in producing mushrooms - Adequate quality - Cheap and abundant labour - Increasing domestic consumption - High quality mushroom products - Easy access to geothermal energy, high number of sunny hours 	<p style="text-align: center;">WEAKNESSES</p> <ul style="list-style-type: none"> - Certain inadequacies in mechanisation and technology - Technology lagging behind international standards - Private enterprises and small family farms lack capital for necessary investments - Labour intensive technology - Low standard and ineffective marketing activities - Lack of comprehensive strategy of the sector - Low effectiveness of campaigns - Inadequate quantities of organic compost - Mushroom spawn raw materials are sourced from abroad
<p style="text-align: center;">OPPORTUNITIES</p> <ul style="list-style-type: none"> - Adequate professional training at secondary and higher level - Decree 13/2019 (II.11) on Amendment of Building Regulations - National and EU subsidies - Involvement of national and foreign investments in mushroom production and processing - Campaigns aimed at increasing sales and consumption - Making use of renewable energy resources in production and processing - Increasing demand for organic products and healthful ingredients - Introducing additional species - Large potential markets for produce: Germany, Austria, Romania, Russia 	<p style="text-align: center;">THREATS</p> <ul style="list-style-type: none"> - Increasing competition from Poland - Increasing costs of compost used for production - Increasing costs of soil cover - Large quantities of imported (canned and dried) mushroom products available - Cheap but low quality imported canned products from China available in abundance

Source: own research

3.2. Survey of mushroom consumption habits in Hungary

3.2.1. Segmenting mushroom consumers

Cluster analysis of Hungarian mushroom consumers was conducted based on opinions about the choice of mushrooms available and consumer consciousness.

Principal component analysis method was used to collapse items about attitudes to mushroom consumption based on the correlation of replies. The statistical analysis yielded four separate components (Table 7).

1. Medicinal and functional properties,
2. Consumption for enjoyment,
3. Supplementary food source,
4. Negative opinion of choices available.

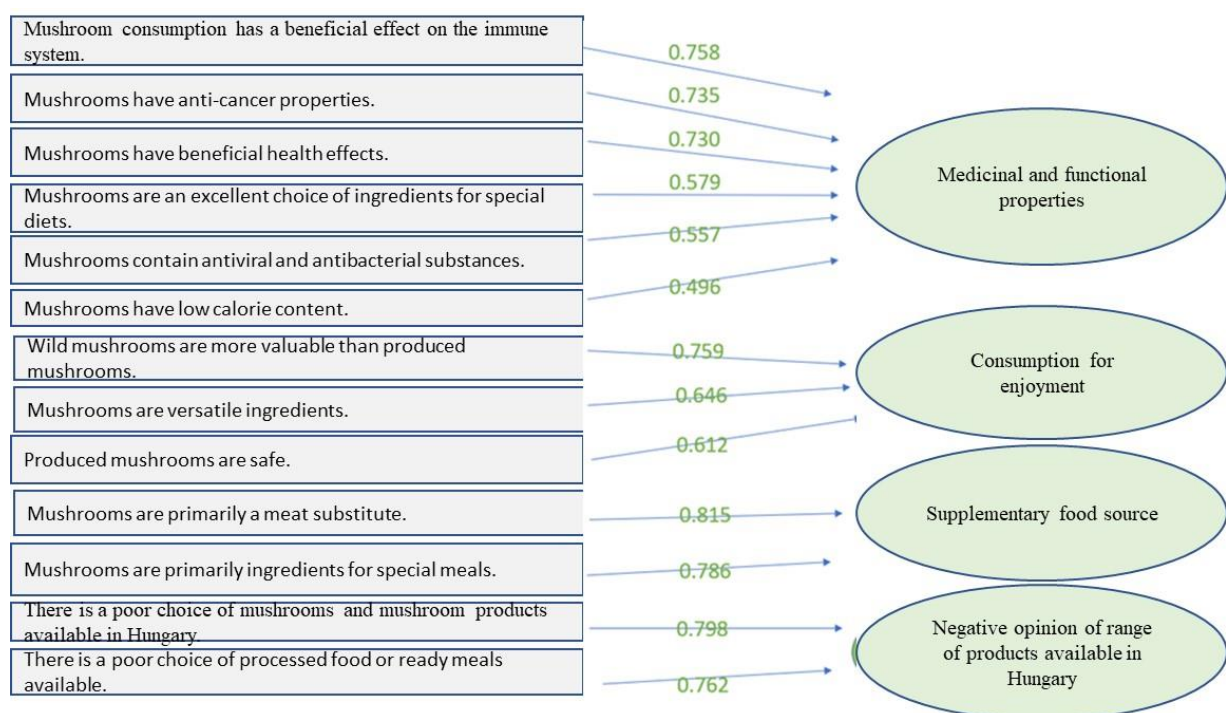


Figure 7: Principal component analysis of statements regarding the role of mushrooms in nutrition

Source: own research

Three clusters were identified based on the four dimensions analysed (Figure 8):

- Health-conscious consumers,
- Indifferent consumers,
- Average consumers.

Health-conscious consumers are most informed about the medicinal and functional properties of mushrooms; at the same time, they have the lowest opinion about the range of products available. On the other hand, average consumers are not dissatisfied with the choice of mushrooms, are somewhat aware of their health effects and properties, and they consider mushrooms of a supplementary part of their diet (Figure 8).

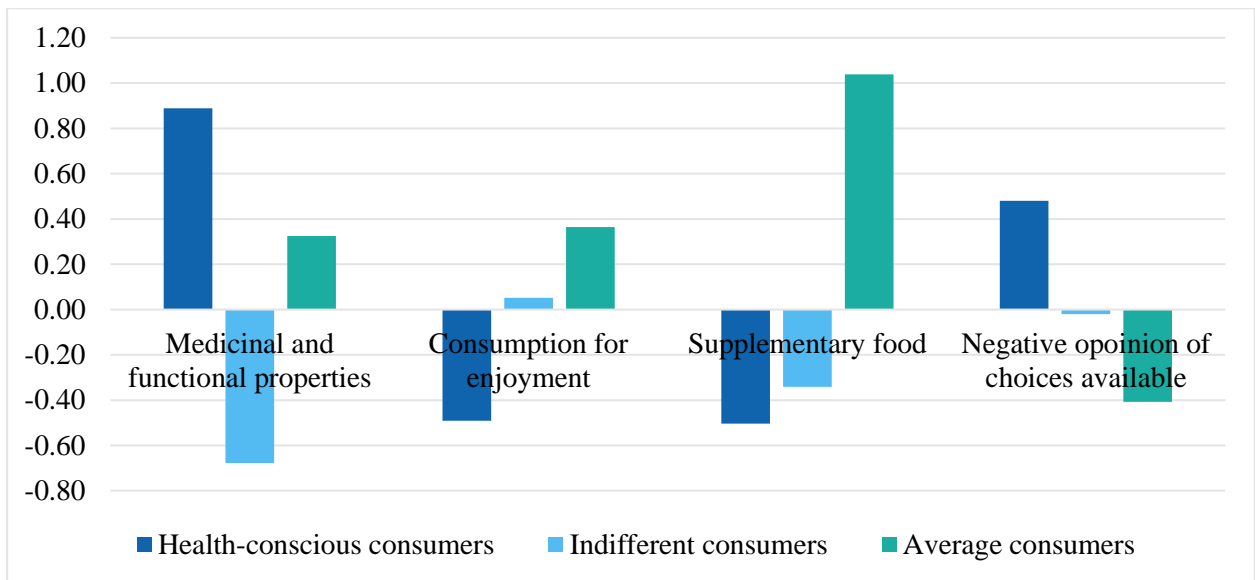


Figure 8: Characteristics of the clusters generated based on level of consciousness in consumption

Source: own research

Health-conscious mushroom consumers tend to have a higher representation of the 31 to 40 years and 41 to 50 years of age groups than the other two attitude groups, at 19.3% and 25.1% respectively. Indifferent consumers comprise a high ratio of consumers aged 21 to 30 (42.6%) (Figure 9).

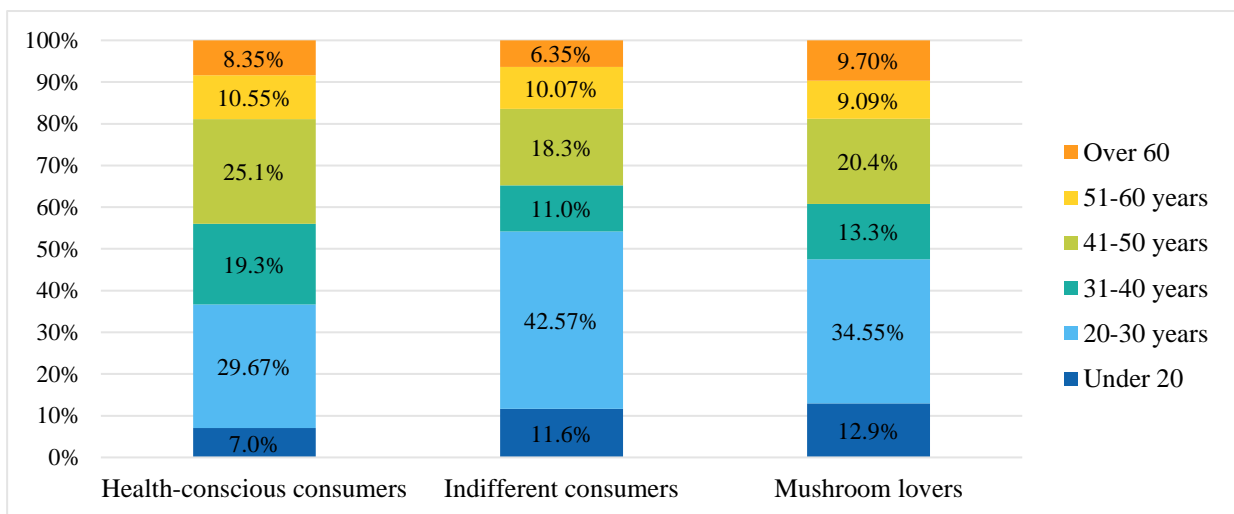


Figure 9: Age distribution within clusters generated based on level of consciousness in mushroom consumption

Source: own research

Health-conscious mushroom consumers have a lower representation of secondary school graduates than the other groups (47.3%). The proportion of higher education graduates is significantly higher (20.9%) in this cluster than in the case of indifferent consumers and average consumers. (Figure 10).

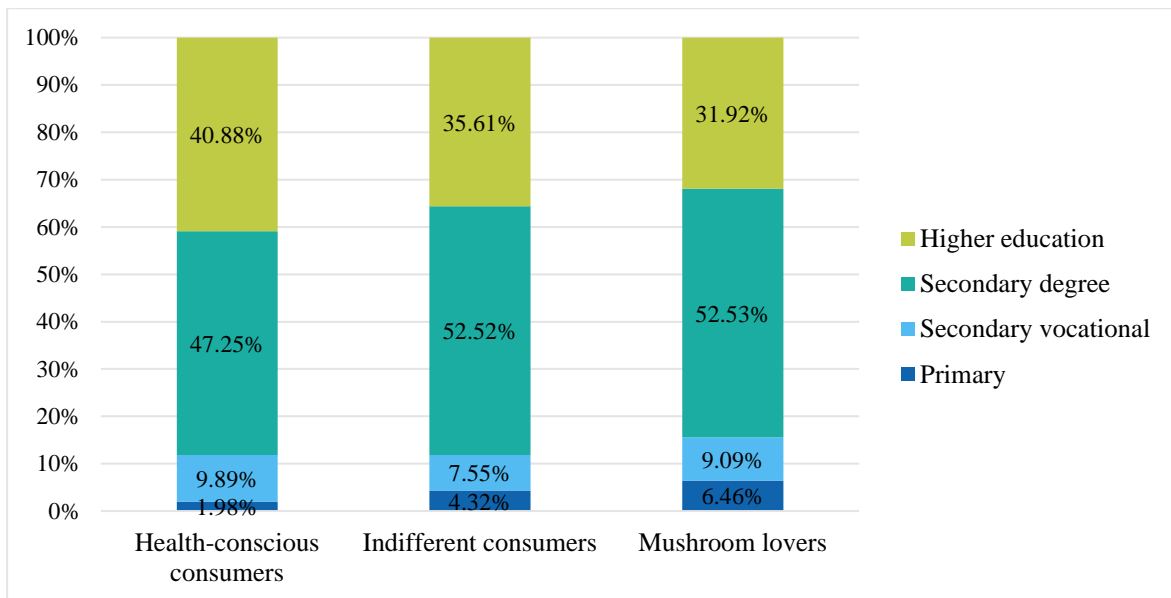


Figure 10: Distribution by educational level within clusters generated based on level of consciousness in mushroom consumption

Source: own research

Health-conscious mushroom consumers tend to be married or in a partnership (59.3%) Indifferent mushroom consumers have a higher proportion of single people than the other attitude groups (43.9%). (Figure 11).

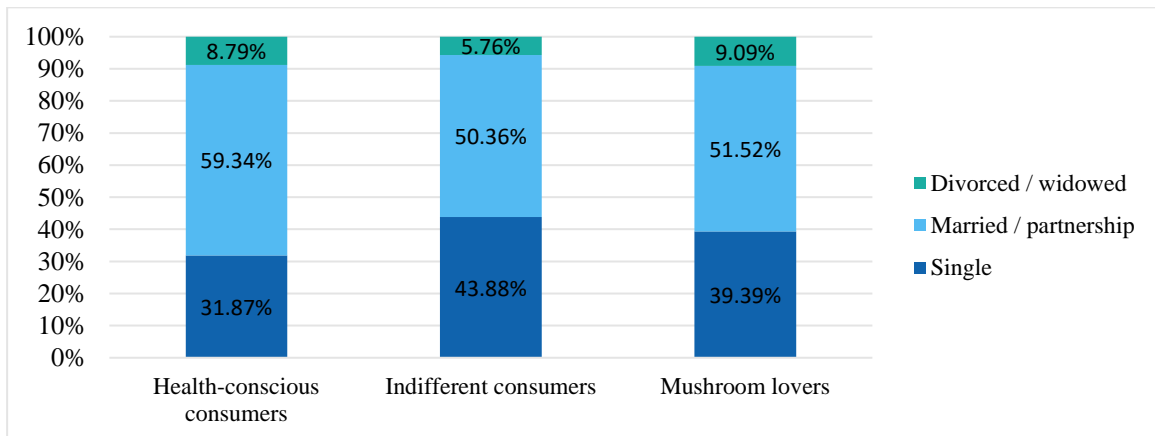


Figure 11: Distribution of family status within clusters generated based on level of consciousness in mushroom consumption

Source: own research

Location does not seem to show significant difference among the three clusters ($\text{Chi}^2=13.07$, $p=0.109$). Indifferent consumers comprise mostly respondents living in the capital city (34.9%), but also have a high representation of town dwellers (34.4%). Health-conscious consumers and average consumers have a similar distribution (Figure 12.).

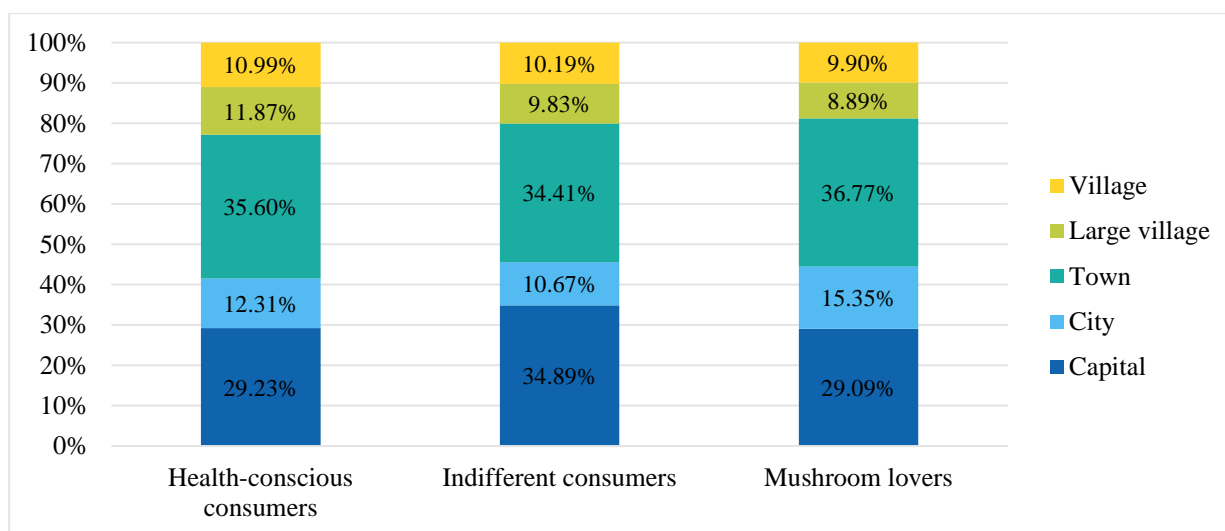


Figure 12: Distribution by location within clusters generated based on level of consciousness in mushroom consumption

Source: own research

3.2.2. Recent changes in mushroom consumption

Kruskal-Wallis test was applied to explore differences between age groups, educational levels and occupations, complemented with a Dunn-Bonferroni post hoc test in cases when the first test revealed a significant difference. According to the latter test, respondents below 20 years of age had a significantly lower increase in the amount of mushrooms consumed over the past five years than all of the other age groups (Table 14).

Table 14: Changes in mushroom consumption in the past five years, by age groups*

Age groups	Groups showing no significant differences	
	1	2
Below 20	772.321	
20-0 years of age		862.867
61-70 years of age		913.935
41-50 years of age		921.586
31-40 years of age		943.138
51-60 years of age		956.020
Over 70 years of age		958.385
Tests statistics		9.775
P value**		.082

*Table summarising results of Dunn-Bonferroni post hoc test, after significant results produced by the Kruskal-Wallis test ** Empirical level of significance for the analysis of differences between groups (comprising factors that are not significantly different, by columns)

Source: own research

According to Dunn-Bonferroni post hoc tests conducted, respondents living in partnerships and divorced people had a higher increase in mushroom consumption over the past five years than single respondents (Table 15).

Table 15: Changes in mushroom consumption in the past five years, by family status*

Family status	Groups showing no significant differences	
	1	2
Single	840.802	
Married or in partnership		917.254
Divorced / widowed		964.223
Test statistics		1.150
P value**	.	.284

* Table summarising results of Dunn-Bonferroni post hoc test, after significant results produced by the Kruskal-Wallis test **Empirical level of significance for the analysis of differences between groups (comprising factors that are not significantly different, by columns)

Source: own research

According to Dunn-Bonferroni post hoc tests conducted, respondents living in cities had a higher increase in mushroom consumption than respondents living in the capital, in towns or in villages. (Table 16).

Table 16: Changes in mushroom consumption in the past five years, by location*

Geographical location	Groups showing no significant differences	
	1	2
Capital	859.722	
Village	865.551	
City	885.712	
Large village	907.448	907.448
Town		989.097
Test statistics	1.773	2.568
P value**	.621	.109

*Table summarising results of Dunn-Bonferroni post hoc test, after significant results produced by the Kruskal-Wallis test . **Empirical level of significance for the analysis of differences between groups (comprising factors that are not significantly different, by columns)

Source: own research

According to Dunn-Bonferroni post hoc test results, respondents consuming all kinds of meals, moderate balanced diets and healthful diets, as well as vegetarians, have a higher increase in mushroom consumption over the past 5 years than vegans, junk food consumers and followers of the traditional national cuisine. (Table 17).

Table 17: Changes in mushroom consumption in the past five years, by nutrition habits*

Nutrition habits	Groups showing no significant differences	
	1	2
Vegan	749.477	
Junk food	750.325	
Traditional cuisine	832.078	
International cuisine	911.553	911.553
All kinds of meals		920.627
Vegetarian		923.830
Moderate, balanced diet		928.494
Healthful diet		947.147
Test statistics	4.427	.337
P value**	.219	.987

* Table summarising results of Dunn-Bonferroni post hoc test, after significant results produced by the Kruskal-Wallis test **Empirical level of significance for the analysis of differences between groups (comprising factors that are not significantly different, by columns)

Source: own research

According Dunn–Bonferroni post hoc test results, respondents with higher education have a higher increase in mushroom consumption over the past five years than respondents with secondary and primary education (Table 18).

Table 18: Changes in mushroom consumption in the past five years, by educational background*

Educational background	Groups showing no significant differences	
	1	2
Primary	773.565	
Secondary vocational	839.556	
Secondary degree	856.177	
Higher education		965.722
Test statistics	2.264	-
P value**	.322	.

* Table summarising results of Dunn-Bonferroni post hoc test, after significant results produced by the Kruskal-Wallis test . **Empirical level of significance for the analysis of differences between groups (comprising factors that are not significantly different, by columns)

Source: own research

3.2.3. Model of mushroom consumers

Principal component analysis (Table 19) was used in order to complete the explorative analysis of latent constructs during the construction of the mushroom consumer model (Figure 13). Reliability of the latent constructs was confirmed using the Cronbach alpha coefficient, which was above 0.6 on all cases and can thus be considered reliable. In three cases, Spearman-Brown coefficients were calculated to reveal the internal consistency of latent components comprising two statements, which are also reliable as they are above 0.6. The following indicators were used to confirm the reliability latent constructs:

- average variance extracted (AVE),

- composition reliability (CR)

AVE indicator is acceptable when its value exceeds 0.5; three latent variables proved to be below this threshold:

- medicinal and functional properties,
- sensory assessment,
- three variables forming a target variable (frequency of mushroom consumption, mushrooms are wholesome, mushrooms are interesting).

Composition reliability (CR) exceeded 0.7 in all cases, thus proving all latent variables reliable (Table 19.).

Table 19: Assessment of the reliability of latent constructs in the mushroom consumer model

Statements	1	2	3	4	5	6	Cronbach alpha	CR	AVE
Mushrooms have anti cancer properties	0.695						0.706	0.795	0.343
Mushrooms support the immune system	0.652								
Mushrooms have high vitamin D content	0.592								
Mushrooms have high fibre content	0.454								
Mushrooms have antibacterial and antiviral properties	0.409								
Colour		0.803					0.705	0.806	0.426
Texture		0.760							
Fragrance		0.439							
Size		0.355							
Mushroom prices			0.939				0.794*	0.879	0.675
Price			0.649						
Interesting				0.672			0.645	0.756	0.394
Wholesome				0.662					
Frequency of consumption				0.488					
Producer					0.897		0.649*	0.768	0.505
Country of origin					0.511				
Low calory content						0.667	0.661*	0.772	0.504
Excellent for healthy diets	0.358					0.550			
Variance explained %	19.97	13.41	9.42	7.97	5.70	5.48	—	—	—

KMO = 0.763, Bartlett test: Chi-Square=7 343.437, p<0.001, total variance explained = 61.95%, Table includes only principal factor loads that are above 0.3. *Spearman–Brown coefficient, Principal component 1. = Medicinal and functional properties; Principal component 2: Sensory assessment; Principal component 3: Price; Principal component 4. = Attitude; Principal component 5. = Origin; Principal component 6. = Nutritional habits

Source: own research

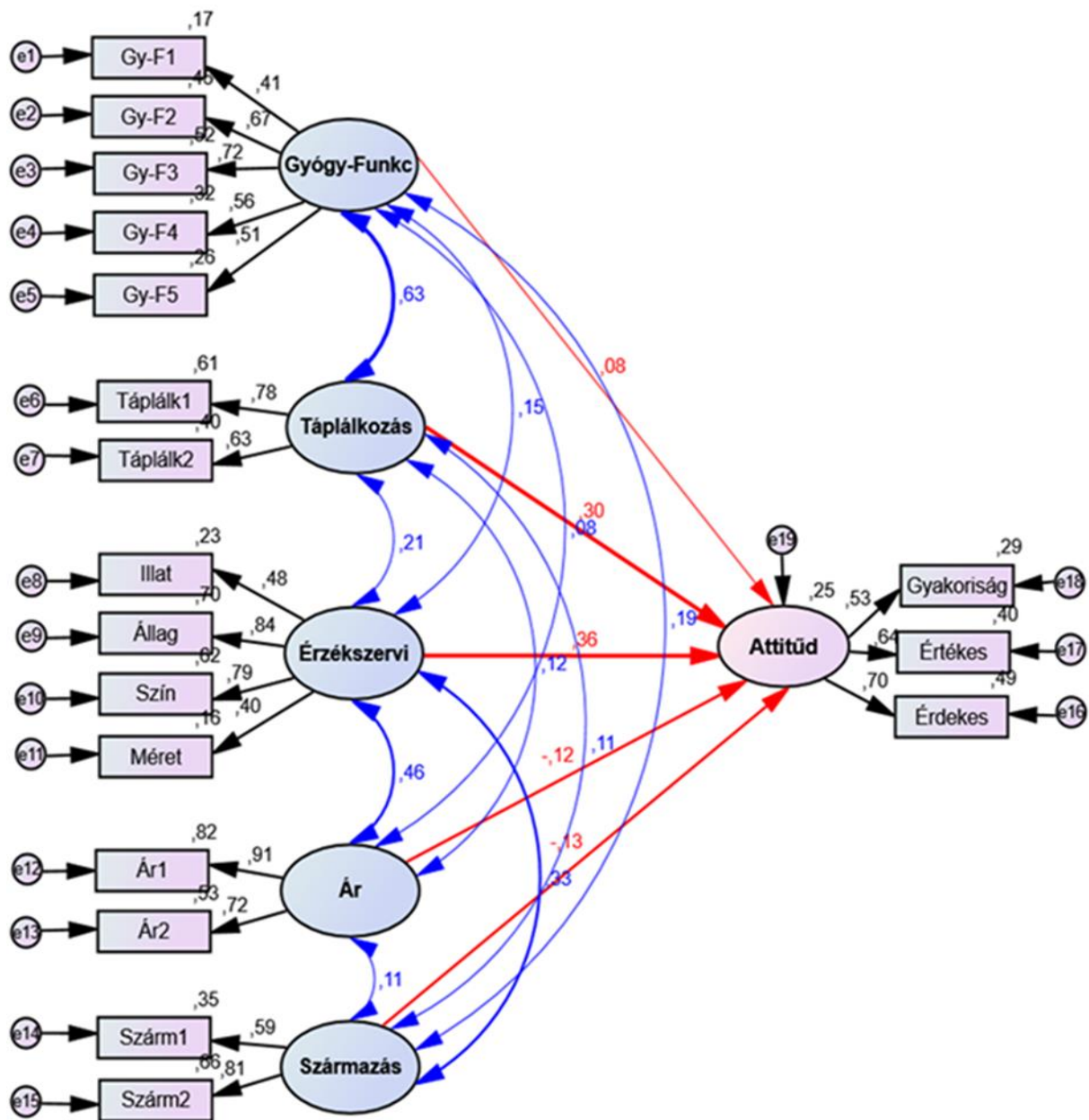


Figure 13: Structural mushroom consumer model*

*gyógy-funkc = medicinal and functional, táplálkozás, táplálk. = nutrition, érzékszervi = sensory, ár – price, származás, szárm= origin, illat= fragrance, állag=texture, szín=colour, méret=size. gyakoriság= frequency, értékes=valuable, érdekes=intresting

Source: own research

While validating the hypothetical model, confirmatory factor analysis was used to confirm the reliability of latent constructs that had emerged from the principal component analysis.

Compliance test was conducted to test the hypothetical structural mushroom consumer model.

The compliance indicators of the structural mushroom consumer model confirm that the model covers the data adequately (Table 20).

Table 20: Indicators used in the compliance test of the structural mushroom consumer model

Compliance indicator	Acceptance criteria	Estimated value by factor analysis	Assessment
χ^2/df Relative Chi square, absolute compliance indicator	≤ 5 (MARSH-HOCEVAR 1985; WHEATON ET AL. 1977)	3.928	Criterion satisfied
CFI Comparative fit index	$\geq 0,90$ (BAUMGARTNER-HOMBURG 1996)	0.951	Criterion satisfied
RMSEA Root-mean square error approximation	$\leq 0,08$ (HU-BENTLER 1999; HAIR et al. 2009) $\leq 0,10$ (BLUNCH 2008)	0.041	Criterion satisfied
TLI Tucker-Lewis index	$\geq 0,90$ (BAUMGARTNER-HOMBURG 1996), $\geq 0,95$ (SCHUMACKER-LOMAX 2004)	0.938	Criterion satisfied

Source: own research

Maximum Likelihood estimation method was used to check the relationship between the latent variables of the model and the attitudes to mushroom consumption. All relationships were found to be significant.

Attitudes to mushroom consumption and nutritional habits are positively correlated ($\beta=0.30$). The model (Figure 13) shows the strongest relationship between attitudes to mushroom consumption and sensory assessment (0.36).

No correlation can be proven between attitudes to mushroom consumption and medicinal and functional properties ($p=0.099$).

There is negative correlation between attitudes to mushrooms and the origin of mushrooms ($\beta=-0.12$), and the price of mushrooms ($\beta=-1.11$).

3.2. Assessment of hypotheses

Table 21: Assessment of the hypotheses related to mushroom production

Hypothesis	Assessment
<p>H1. : There are significant differences between the development opportunities of micro, small and medium enterprises active in mushroom production.</p> <p>Microbusinesses consider promotional campaigns and national and EU subsidies key to development; whereas small and medium businesses focus on national subsidies, integration, and professional advisory associations.</p>	Confirmed
<p>H2. There are significant differences regarding the assessment of the impact of human labour as a contributing factor to the quality and quantity of mushrooms produced.</p> <p>It was not proven that the impact of human labour as a contributing factor to the quality and quantity of mushroom production varies by business size, based on opinions of business managers.</p>	Rejected
<p>H3.: There are significant differences between the online marketing activities of micro, small and medium enterprises active in mushroom production</p> <p>There are no significant differences in the online promotional activities of businesses of different sizes. Micro businesses do not use social media at all.</p>	Partially confirmed

Source: own research

Table 22: Assessment of the hypotheses related to the consumption of mushrooms

Hypotheses	Assessment
<p>H4.: Social and demographic factors have an impact on the role of mushrooms in nutrition.</p> <p>Assessment of demographic statistics conclude that respondents aged 31 to 40 (18.3%) and 41 to 50 (25.1%) are overrepresented in the group of health-conscious consumers (compared to indifferent and average consumers). Indifferent mushroom consumers have a higher representation of the age group 20 to 30 years of age (42.6%). In the group of health-conscious consumers, secondary graduates are underrepresented (47.3%) compared to the other consumer segments, whereas higher education graduates are overrepresented at 40.9%. Health-conscious consumers are also more likely to be married or in a relationship (59.3%). Indifferent consumers have a higher representation of single people (43.9%) than other consumer segments. There are no significant differences among consumer groups based on location ($\text{Chi}^2=13.07$, $p=0.109$). Indifferent consumers have a high proportion of respondents who live in the capital (34.9%) and cities (34.4%). Health-conscious and average consumers have a similar distribution by location.</p>	Confirmed
<p>H5.: Social and demographic factors and nutrition habits had different effects on mushroom consumption over the past five years.</p> <p>According to Dunn–Bonferroni post hoc tests, the following groups had a higher increase in mushroom consumption over the past five years: all age groups over 20 years old (as opposed to under 20), divorced respondents (as opposed to single people), respondents with a higher education (as opposed to primary and secondary education), respondents consuming all kinds of meals, vegetarians, moderate balanced diet and healthy diets (as opposed to vegans, junk food consumers, consumers of international cuisine and traditional cuisine) ..</p>	Confirmed

<p>H6a.: Medicinal and functional properties correlate with general nutritional habits.</p> <p>Medicinal and functional properties correlate positively with nutritional habits ($\beta=0.629$; $p<0.001$).</p>	Confirmed
<p>H6b.: Medicinal and functional properties strongly correlate with the origin of the mushrooms.</p> <p>Medicinal and functional properties correlate positively with the origins of the mushrooms ($\beta=0.186$; $p<0.001$).</p>	Confirmed
<p>H6c.: The price of mushrooms and the origin of the mushrooms are strongly correlated.</p> <p>The price of mushrooms and their origin show a weak positive correlation ($\beta=0.115$; $p<0.001$).</p>	Partially confirmed
<p>H7: Negative attitudes have a negative impact on mushroom consumption.</p> <p>Statements regarding negative preconceptions did not align into a common latent construct during principal component analysis; therefore, it is not possible to confirm or reject the hypothesis that negative preconceptions have a negative impact on mushroom consumer behaviour.</p>	Cannot be assessed
<p>H8. Prices have a significant impact on attitudes to mushroom consumption.</p> <p>There is weak negative correlation between prices and attitudes to mushroom consumption ($\beta=-0.119$, <0.001).</p>	Confirmed
<p>H9. Nutritional habits have a significant impact on attitudes to mushroom consumption.</p> <p>There is weak positive correlation between nutritional habits and attitudes to mushroom consumption ($\beta=0.298$, $p<0.001$).</p>	Confirmed
<p>H10. Sensory properties have a significant impact on attitudes to mushroom consumption.</p> <p>There is moderate positive correlation between sensory properties and attitudes to mushroom consumption ($\beta=0.363$, <0.001).</p>	Confirmed
<p>H11. Origin of the mushrooms have a significant impact on attitudes to mushroom consumption.</p> <p>There is weak negative correlation between origin of the mushrooms and attitudes to mushroom consumption ($\beta=-0.129$, <0.001).</p>	Confirmed
<p>H12. National cuisine has a significant impact on attitudes to mushroom consumption</p> <p>Statements regarding national cuisine did not align into any common latent construct during principal component analysis; therefore, it is not possible to confirm or reject the hypothesis that following the national cuisine has a positive or negative impact on mushroom consumer behaviour.</p>	Cannot be assessed
<p>H13. Medicinal and functional properties have a significant impact on shaping attitudes to mushroom consumption</p> <p>Medicinal and functional properties do not have an impact on attitudes to mushroom consumption ($\beta=0.082$, $p=0.099$).</p>	Rejected

Source: own research

4. NEW SCIENTIFIC ACHIEVEMENTS

1. **Structured interviews proved that there are significant differences in the development potential of micro, small and medium enterprises.**

Microbusinesses consider promotional campaigns and national and EU subsidies key to development; whereas small and medium enterprises focus on national subsidies, integration, and professional advisory associations.

2. **The primary and secondary research conducted has explored the complex interrelationships of the stakeholders of the mushroom sector in Hungary. The current situation of the sector and its development potential was assessed in detail.**
3. **Mushroom consumers in Hungary were segmented based on the role of mushrooms in their nutrition.**

With the help of statistical methods such as principal component analysis and cluster analysis, mushroom consumers were divided into categories based on the role that mushrooms play in their nutrition: health-conscious consumers, indifferent consumers, average consumers. These clusters were subsequently clearly defined based on certain demographic categories.

4. **Significant differences in the amount of mushrooms consumed were detected among socio-demographic groups and groups with different nutritional habits.**

Some significant differences were pointed out in the amounts of mushrooms consumed over the past five years based on nutritional habits as well as certain socio-demographic indicators.

5. **The principal factors of mushroom consumer behaviour were identified. Structural Equation Modeling, SEM was used to create a model to describe attitudes to mushroom consumption, which can be adapted to other food groups with medicinal or functional properties.**

Moderate positive correlation was indicated between nutritional habits and medicinal and functional properties, and weak positive correlation between medicinal and functional properties and the origin of mushrooms, as well as the origin and the price of mushrooms. It was concluded that prices and place of origin have a negative impact on consumer attitudes. It was statistically proven that nutritional habits and sensory assessment have a strong positive correlation with attitudes to mushroom consumption.

5. CONCLUSIONS AND SUGGESTIONS

Mushroom production is one of the youngest branches of horticulture, characterised by constant increase and innovation both in production technology and product development. Mushrooms produced in Hungary are of high quality and increasingly sought after in markets abroad. Increased exports mean that significant investments into technological development are unavoidable and essential. The sector is not only an important part of food production; in addition, it generates significant job opportunities, contributes to environmental protection, and promotes healthy lifestyles.

When making policy decisions and planning promotional campaigns aimed at increasing the popularity of mushrooms, it is essential to consider the different development possibilities of micro, small and medium enterprises. The development of the sector needs different approaches for the different needs and potential.

Undoubtedly, subsidy frameworks need to be overhauled so that they respond to the producers' actual needs. In addition, well-structured export subsidies could assist in producers meeting demand from foreign markets. The wider involvement of micro businesses would be ideal for diversification and the production of species that are not suitable for mass production; in addition, they could contribute significantly to the short supply chains necessary for local sales of fresh produce.

Promotional campaigns aiming at increasing the popularity of mushrooms would benefit micro businesses the most, as they are in close contact with their consumers locally, and have no permanent partners purchasing produce in large quantities.

The mushroom sector is not only generating wholesome, healthy foodstuff that has medicinal and functional properties; in addition, it also creates job opportunities, and contributes to sustainability. Therefore, I consider that it is of strategic importance to develop this sector within the agricultural system in Hungary.

The mushroom sector in Hungary has the following weaknesses:

- Supply chains are dominated by a few leading large businesses.
- There are few modern facilities for mushroom production.
- Costs have risen significantly over the past few years; at the same time, however, wholesale prices have hardly increased.
- Subsidies are mainly channelled to large-scale producers; as smaller businesses are usually excluded from opportunities from the very start because of the lack of sufficient funds for their own share of contribution or investments.
- Similarly to other agricultural sectors, there is a low level of cooperation and integration.
- Marketing activities are of low standard.
- Hungarian consumers are poorly informed about the advantages and range of possibilities of mushroom consumption.

It is not yet possible to assess the impact of the COVID-19 pandemic on the mushroom sector. It is predicted, however, that short supply chains and the intensification of local trade are beneficial for smaller businesses. At the same time, however, reliance on imported equipment or materials (organic compost, breathable spawn bags) can easily endanger businesses in case of delays.

The mushroom sector in Hungary has the following challenges and development potential.

- Costs can be lowered by technological and technical development, as well as by increased reliance on renewable sources of energy, such as heating by thermal water.

- Strategic planning is necessary to deal with the organic waste products that are generated by the mushroom sector (used compost). This could be recycled into the fossil fuel needs of the production buildings, or further recycled as organic supplement in other branches of agricultural production.
- The generation of mushroom spawn creates a huge amount of polyethylene garbage, which needs to be disposed of properly, or substituted with other suitable materials.
- Micro and small businesses are in desperate need of financing, lower credit rates, reasonable subsidy systems, support for exports and technology, and special schemes for supporting young farmers. Trade unions or other association forms that represent the interests of the producers would be essential.
- A well-educated and motivated workforce is key to the success of the sector; therefore, training and consulting networks need to be set up or developed, as well as cooperation with producers and researchers in other countries.
- It is necessary to develop the proportion of high added value products.
- Local markets need to be protected by customs duties against the influx of lower quality canned mushrooms and other products from Asia.
- Standards of quality requirements and quality control need to be developed and implemented.
- It is essential to promote cooperation and trust among members of the supply chain.

There has been a slow increase in mushroom consumption in Hungary. During the process of creating the consumer model for this market, it was concluded that the following factors have an impact:

- the origin of the mushrooms,
- the functional and medicinal properties of the mushrooms,
- the price of mushrooms,
- nutritional habits,
- sensory assessment.

These factors have a complex web of relationships with one another. During the course of the present research project, mushroom consumers were segmented into four categories based on the role that mushrooms play in their diet. Statistical methods and procedures were used to highlight the social and demographic differences between these groups.

It was concluded that consumers in Hungary have a low level of knowledge of the properties and culinary possibilities of mushrooms, that mushrooms have a low significance in the local cuisine, and that mushrooms mostly appear in meals as an exotic ingredient or as an occasional source of variety.

Hungarian producers do not know a wide range of mushroom species and products; in addition, promotional campaigns so far have gone almost unnoticed and without any tangible effect. Ethnocentrism, i.e., the preference of local produce, does have an impact on consumption choices though.

In my opinion, we have the following challenges in order to increase mushroom consumption:

- Separate marketing strategies are needed targeted at the under 20 and over 65 age groups, similarly to examples in the USA or in Australia.
- Separate marketing strategies are needed targeted at various consumer segments.
- “School mushroom” programs, originally developed by Bio-fungi Ltd, could be further developed and introduced into educational systems from preschool all the way to secondary education.
- Marketing strategies need to emphasise the positive health effect and nutritional properties of mushrooms.
- Educational systems can contribute to developing positive attitudes and deeper knowledge for future consumers.
- It is essential to strengthen the competitiveness of local produce against imported products.

6. SUMMARY

The current doctoral dissertation provides an overview of mushroom production and consumption in Hungary.

Mushrooms are, generally speaking, controversial as a food source; their positive health effects are inarguable, nevertheless, attitudes and consumer habits vary widely across cultures and traditions.

All along the course of human history, several factors have had an impact on consumption of various species and quantities, such as ethnic or religious background, the origin of the mushrooms, its sensory properties, health effects, or attitudes and preconceptions reaching back several generations, national cuisines, and local nutritional habits.

Asian countries consume overwhelmingly species that we consider “exotic”, whereas European consumers are mostly familiar with and are attached to *Agaricus* species and consider Asian mushrooms as distant, exotic foodstuff.

Hungary used to be a mushroom producing powerhouse up until the second world war: it ranked third worldwide in terms of the quantity of mushrooms produced. Currently, production is rising slowly but steadily, accompanied by similar trends in consumption.

The aim of the current dissertation was to highlight the problems and challenges of the mushroom sector in Hungary, explore the needs and expectations of consumers about mushrooms as a healthy food choice, and analyse the factors that determine most the attitude taken towards mushrooms.

The literature review provided an extensive coverage of the agricultural, medicinal, employment, environmental and other aspects of mushroom production. In addition, changes and processes in domestic and international demand were analysed, worldwide production trends, specifics and challenges explored.

Consumer behaviour models, factors and trends related to food and functional food were discussed in detail.

The primary research segment focused on the current situation and development potential of the mushroom producer sector in Hungary, with a focus on promotional and marketing initiatives and their perceived effects. It was concluded that promotion and marketing activities need to be stepped up at all levels.

In the next step, an online survey of Hungarian mushroom consumers revealed that despite the long and strong historical traditions, currently there is low awareness of the species and properties of mushrooms. At the same time, those with a deeper knowledge are largely dissatisfied with the choices available.

The research project has also identified and analysed the various factors that influence consumer behaviour and their interdependence; subsequently, a consumer model was created.

PUBLICATIONS RELATED TO THE TOPIC OF THE DISSERTATION

Journal articles in English:

Nostratabadi S. – Vinogradov Sz. – **Almádi B.** (2020): Mushroom Farming in Iran: a Case Study of Ten Iranian Mushroom Companies, VADYBA: JOURNAL OF MANAGEMENT 36 : 2 pp. 111-117. , 7 p.

Szira Z.– Othman G. – Alghamdi H.– Varga E. – **Almádi B.** (2018): Green Awareness: Conscious Steps Taken = Zöld Tudatosság: Megfontolt Lépések, JOURNAL OF CENTRAL EUROPEAN GREEN INNOVATION 6 2 pp. 43-71., 29 p.

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Gyenge B. – Kozma T.–**Almádi B.**– Szarvas J. – Villás G.– Urvölgyi M. (2016): Technology innovation in sustainable growing and distribution of king oyster mushroom, HUNGARIAN AGRICULTURAL ENGINEERING 29p p. 5-10., 6 p. (2016)

Kozma T. – Gyenge B. – **Almádi B.** (2016): Supply chain participants in the mushroom sector and their role in the added value creation in sustainable way based on a Hungarian case study. Vadyba: Journal of Management, 28:1 pp. 119-125., (2016)

Journal articles in Hungarian:

Dunay A. – Földi A. – **Almádi B.** – Vinogradov Sz. (2021): A kínai gombatermesztés- és kereskedelem főbb sajátosságai, Gazdálkodás (accepted for publication)

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