

ORIGINAL ARTICLES

WILD EDIBLE MUSHROOM USAGE BY INHABITANTS WITH DIFFERENT EDUCATIONAL LEVEL IN THE REGION OF VARNA

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ABSTRACT

INTRODUCTION: Wild edible mushrooms are used worldwide and in Bulgaria as well. Recent ethnomycological studies indicate that wild edible mushroom usage depends on the educational level of the populations.

AIM: The purpose of this study was to assess certain mushroom usage practices by inhabitants with different educational level in the region of Varna, Bulgaria.

MATERIALS AND METHODS: We performed an anonymous inquiry study of 200 adult individuals, 100 males and 100 females, living in the region of Varna by using 12 specific facts about wild edible mushroom usage focusing on the respondent's educational level. Statistical data processing was done by means of descriptive and correlation analysis.

RESULTS: There was a prevalence of the positive attitude towards wild edible mushrooms among respondents from Varna region regardless of their level of education. The respondents with primary and secondary education were more likely to cook fresh mushrooms than those with higher education. Drying, preservation, and freezing were rare among all of the respondents. There was statistically significant correlation between a respondent's educational level, on the one hand, and traditional wild edible mushroom usage including cooking, drying, preservation, and freezing, on the other hand.

CONCLUSION: This study demonstrated some interesting characteristics of the attitude towards wild edible mushrooms among the participants with secondary, elementary, and higher education from the region of Varna and the extent of usage of common mushrooms in relation to their educational level. Further ethnomycological research could contribute to the improvement of the awareness of these mushrooms among the population in Bulgaria.

Keywords: *wild edible mushrooms, usage, inquiry, education, region of Varna*

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INTRODUCTION

Wild mushrooms are a vital source of income and food for many poor communities and of value to recreational foragers (1).

The bibliometric investigation of 200 European publications primarily from Turkey, Poland, Spain, and the Czech Republic released between 2001 and 2016, concerning the mushroom contamination by



specific elements includes 492 wild-growing and cultured mushroom species in 26 countries in Europe and the concentrations of 74 related elements (2). Many studies underline the necessity to assess the risk to human health arising from the consumption of contaminated mushrooms from different habitats.

Using a newly proposed classification system for the categorization of mushroom species and the assignment of a final edibility status, 2786 mushroom species from 99 countries are examined after accessing 9783 case reports from more than 1100 sources

inhabitants with different educational level on the territory of the region of Varna, Bulgaria.

MATERIALS AND METHODS

In 2020, our study covered a total of 200 adult individuals, 100 males and 100 females, with elementary, secondary, and higher education and with main residence in the region of Varna. It concerned their attitude to and common practices of wild edible mushroom usage.

Respondents' distribution according to sex and educational level is shown in Table 1.

Table 1. Respondents' distribution according to sex and education.

Education	Males		Females		Total	
	n	%	n	%	n	%
Secondary	36	45.57	43	54.43	79	39.50
Elementary	14	37.84	23	62.16	37	18.50
Higher	50	59.52	34	40.48	84	42.00

(1). A total of 2189 edible mushroom species are identified of which 2006 can be consumed safely, while another 183 require some form of pretreatment prior to safe consumption, or are related to allergic reactions. There are 471 species of uncertain edibility due to missing or incomplete evidence of consumption as well as 76 unconfirmed species due to unresolved, varying opinions on their edibility and toxicity.

Recently, some noteworthy data on mushrooms in Southeastern Europe, in adjacent regions and in Bulgaria in particular, have been reported (3,4). During the last years, there have been several ethnobotanical studies in Bulgaria (5). The results from the ethnobotanical investigation of the usage of medicinal plants and mushrooms in the Bulgarian North Black Sea coast area reveal the impact of the educational level of the local population (6). This population demonstrates a steady positive attitude towards the use of medicinal plants and herbal remedy treatment (7) without outlining any regional and local differences (8). The application of medicinal plants for decorative purposes by the local population on the Bulgaria North Black Sea coast is analyzed (9).

AIM

Our study aims to analyze certain practices of traditional usage of wild edible mushrooms by the

The majority of male and female respondents were with higher education followed by those with secondary one.

The respondents filled out anonymously an inquiry containing 12 specific items related to their methods of gathering, preparation, and consumption of wild edible mushroom available in the region of Varna. Statistical data processing was performed using descriptive and correlation analysis. Statistical significance was set at $p < 0.05$.

RESULTS

The results from the analysis of the role of education in the respondents' wild edible mushroom usage are systematized in five figures.

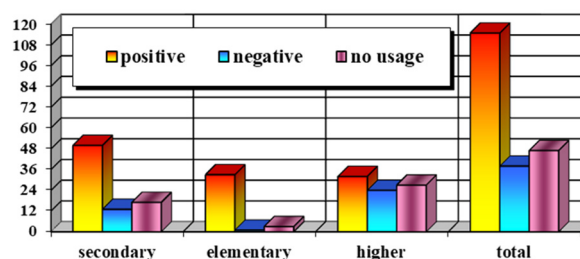


Fig. 1. Distribution of the respondents with different attitude towards the mushrooms according to educational level.

The distribution of the respondents with secondary, elementary, and higher education according to their attitude towards these mushrooms is shown on Fig. 1.

There was predominantly positive attitude towards these mushrooms among the respondents with secondary (n=50), with elementary (n=33), and with higher education (n=32). The total relative share of all these respondents amounted to 57.50%. The negative attitude towards the mushrooms was 3.85 times less frequent among the subjects with secondary education and only one person with elementary education shared that opinion.

We established a statistically significant correlation between secondary education, on the one hand, and a positive attitude towards wild edible mushrooms, on the other hand (Pearson's coefficient $\chi^2=28.795$; $p<0.0001$).

The distributions of the respondents with different educational levels in terms of the various manners of fresh wild edible mushroom preparation for food such as cooking, drying, preservation, and freezing are displayed on Fig. 2 through Fig. 5.

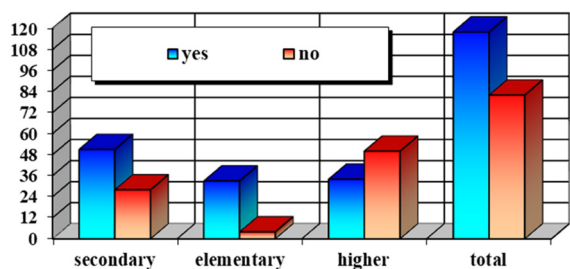


Fig. 2. Distribution of the respondents who cook or do not cook mushrooms according to educational level.

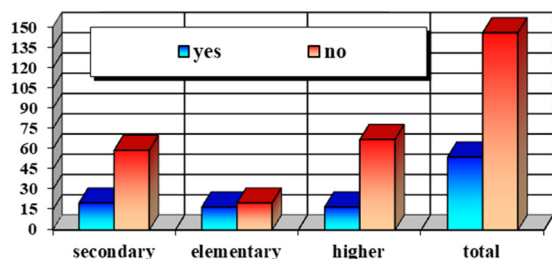


Fig. 3. Distribution of the respondents who dry or do not dry mushrooms according to educational level.

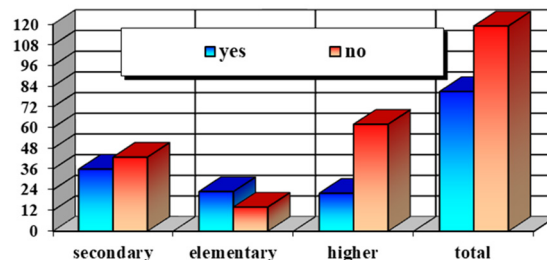


Fig. 4. Distribution of the respondents who preserve or do not preserve mushrooms according to educational level.

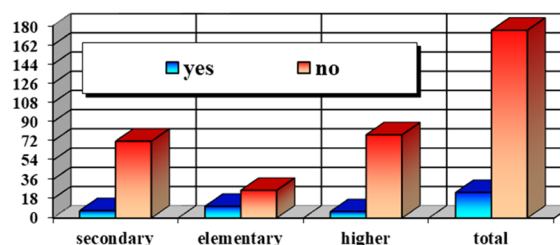


Fig. 5. Distribution of the respondents who freeze or do not freeze mushrooms according to educational level.

The distribution of the respondents with secondary, elementary, and higher education who cook fresh mushrooms is demonstrated on Fig. 2.

The respondents with secondary education (51 versus 28) and, especially, those with elementary education (33 versus 4) preferred cooking fresh mushrooms. However, most respondents with higher education (50 versus 34) responded negatively to this question. Nevertheless, the positive responses prevailed over the negative ones among respondents as a whole (in 59% of the cases).

The analysis of the relative share based on data indicated that only 27% of the respondents as a whole, 25.32% of the individuals with secondary, 20.24% of those with higher, and 45.95% of those with elementary education resort to drying fresh mushrooms (Fig. 3).

As shown on Fig. 4, the negative answers to the question about fresh mushroom preservation prevailed not only among respondents as a whole (in 59.50% of the cases), but also among the individuals with secondary (43 versus 36) and, particularly, among those with higher education (62 versus 22 subjects). Obviously, this was not a very popular

manner of wild edible mushroom usage among the participants.

Freezing fresh wild edible mushrooms was more rarely applied by the respondents as a whole (12% only) (Fig. 5). The negative answers to this question by respondents with elementary education were 2.36 times fewer than the positive ones, by those with secondary education—10.29 times fewer, and by those with higher education—13 times fewer. Therefore, this manner of fresh mushroom preservation was mostly ignored by the participants.

We found several statistically significant correlations between secondary educational level, on the one hand, and wild edible mushroom cooking (Pearson's coefficient $\chi^2=26.864$; $p<0.0001$), wild edible mushroom preservation (Pearson's coefficient $\chi^2=15.185$; $p<0.001$), wild edible mushroom freezing (Pearson's coefficient $\chi^2=13.628$; $p<0.001$), and wild edible mushroom drying (Pearson's coefficient $\chi^2=8.800$; $p=0.012$), on the other hand.

DISCUSSION

We determined certain differences between the respondents with these three educational levels concerning the individual attitude towards and the practical use of wild edible mushrooms in the region of Varna.

We established an increasing interest in the ethnomycological features of these mushrooms which are assessed by means of different sociological methods and field studies in some recent foreign publications available.

A mushroom's biological content exerts a positive effect upon human welfare which is called *non-green revolution* (10). Its economic and social components provide long-term food nutrition, regeneration, and environmental conservation of valuable resources. There is evidence that mushrooms could be a healthy food alternative to meat.

Morchella conica Pers. is one of six wild edible mushrooms that are widely used by people in countries in Asia and Europe for their nutritional value (11). *Morchella conica* is rich in bioactive compounds responsible for antidiabetic activity by targeting protein tyrosine phosphatase 1B and thus it might be a potential source for production of antidiabetic drugs.

Four macrofungi species ecologically related to birch (*Betula* sp.) were collected closely to the town of Vimperk in the Bohemian Forest, the Czech Republic (12). The lifestyle of two species such as *Lecaninum scabrum* and *Leccinum versipelle* is mycorrhizal, forming edible fruiting bodies, while the lifestyle of the other two such as *Fomitopsis betulina* and *Inonotus obliquus* is parasitic and they are used in alternative medicine.

The results from the study of the traditional ethnomycological knowledge in three municipalities of Lika-Senj County (Perušić, Gospić, and Lovinac) of the Central Lika Region (continental Croatia) revealed five mushroom taxa belonging to five families and quite large differences in terms of this knowledge between these areas (13). The usage of the parasitic mushroom *Taphrina pruni* (Fuckel) Tul. as a snack is outlined.

The evaluation of three wild edible mushroom species such as *Imlera badia*, *Boletus subtomentosus*, and *Xerocomellus chrysenteron* sampled in 60 different environmentally loaded localities in Slovakia in terms of the health risks related to mercury content arising from their ingestion shows that this consumption represents a serious threat for children and adults (14).

The results from a survey questionnaire among a total sample of 408 participants from Marmara region in Turkey demonstrated that mushroom consumption accounted for 13.2% of meat consumption during the mushroom collection period (10). For every 1% increase in consumption of two mushroom species, *Macrolepiota procera* var. and *Lactarius semisanguifluus*, meat consumption diminishes by 4.39% and 2.97%, respectively.

The analysis of the traditional consumption of edible wild or cultivated mushrooms by 45 adults from the indigenous peasant community of Benito Juarez, Oaxaca, Mexico, revealed a high mushroom consumption frequency (>3 times per week) that significantly correlated with lower lipids, saturated fatty acids, energy and sodium intake, as well as with higher cobalamin and zinc intake (15). Triglycerides and total cholesterol levels as well as diastolic blood pressure are significantly lower in adults who consume edible mushrooms every day. These associations promote healthier diets in indigenous com-

munities by keeping or increasing wild or cultivated edible mushroom consumption. Wild edible mushrooms could play a more essential role in community nutrition and health when their unique functional and medicinal properties are considered.

The role of 19 wild edible mushrooms in meeting the household, food and nutrition needs of indigenous communities under the biodiversity-rich landscape of the Achanakmaar-Amarkantak Biosphere Reserve of Central India was examined (16). There were remarkable differences between Baiga, Gond, Kol, and Oraon ethnic communities as well as in terms of the location (buffer, core and transition zone) effect on the utilization pattern of these mushrooms. They were collected, consumed and surplus is marketed by the communities. The average number of wild mushrooms harvested annually by households was 5–35 kg. Policy implications ensuring the coherence and coordination of these local communities for conservation and sustainable utilization of wild edible mushrooms in this area were discussed.

A total of 192 participants aged between 25 and 87 years from the local population of Union Territory of Jammu and Kashmir, India, had knowledge of fourteen wild edible mushrooms that were mainly utilized for culinary and medicinal purposes (17).

Knowledge on wild mushroom edibility and mushroom use as sources of food and medicine among the tribes in the state of Kerala, India, was mainly based on the traditional knowledge of these indigenous people and folk taxonomy (18). *Auricularia auriculata*, *Boletus edulis*, *Ganoderma lucidum*, *Agaricus bisporus*, *Lentinus edodes*, and *Lentinus squarrosulus* were therapeutically significant mushroom species used in this region.

During an ethnomycological investigation on wild mushrooms in 11 markets in Pu'er Prefecture, Southwest Yunnan, China, 101 species belonging to 22 families and 39 genera were studied and about 76% of them were ectomycorrhizal fungi (19). Men had a deeper mushroom knowledge than women. Mushroom species and recorded amounts showed correspondence between the markets and the natural habitats in different months.

A structured questionnaire was applied to assess mushroom utilization by 250 study participants, 200 females and 50 males, in six local government

areas of Cross River State, Nigeria (20). Some 205 respondents (82% of the cases) utilized mushrooms as food supplement. Of them, 108 (43.20%) always consumed mushrooms, while 142 (56.80% of the cases) did it from time to time during the year. The mushrooms constituted a part of family menu for 234 users (93.60%), were used in place of meat by 197 subjects (78.80%), and as remedy—by 208 respondents (83.20%). These mushrooms are the most cost-effective source of a healthier diet tackling diversification, food insecurity, and malnutrition for the families in this region.

Among ten rural communities in the Kilum-Ijim mountain forest reserve, Northwest Region, Cameroon, between 2014 and 2015, eight edible mushrooms species, such as *Polyporus tenuiculus*, *Termitomyces microcarpus*, *Termitomyces striatus*, *Laetiporus sulphureus*, *Auricularia polytricha*, *Polyporus dictyopus*, *Termitomyces* sp. 1, and *Termitomyces* sp. 2 were used as food and medicine, while another nine species, such as *Daldinia concentrica*, *Ganoderma applanatum*, *Auricularia polytricha*, *Lentinus squarrosulus*, *Termitomyces microcarpus*, *Polyporus dictyopus*, *Trametes versicolor*, *Vascellum pretense*, and *Xylaria* sp. were applied as medicine in traditional health care (21). On the other hand, the non-edible species were considered food from Satan. Elderly men and women play an essential role in primary health care services in these communities.

The study of wild mushroom usage and consumption in three communities in Amealco de Bonfil, Querétaro, México, from August 2013 to November 2014, included 33 mushrooms species registered by 100 informants (22). Most mushrooms were utilized as food by households, a few were used for commercial purposes, one species was applied in medicine, another one had veterinary usage and the last one was used as a toy. People harvested mushrooms in the forest predominantly during the rainy season. Both mushroom searching and collection enhanced the family ties.

There are differences between Wixarika and Mestizo populations groups in Western Mexico identified through 150 semi-structured interviews at various knowledge level concerning both wild mushroom usage and consumption (23).

Within an ethnomycological investigation in two communities in La Malintzi National Park, Tlaxcala, Mexico, a total of 178 wild mushroom specimens were collected and identified as non-edible by locals corresponding to 103 species belonging to 45 genera (24). The most significant species were *Amanita muscaria*, *Neoboletus aff. erythropus*, *Xerocomellus chrysenteron*, and *Suillus tomentosus*. The respondents mentioned mainly two mushroom usages—as an insecticide and as medicine.

The evaluation of the nutritional value and biological properties of 24 Chilean wild edible mushroom samples revealed that the species *C. lebre*, *B. loyo* and *G. gargal* exhibited interesting nutritional value and biological properties as well as a potential to be utilized as a dietary nutritional supplement (25).

The concentrations of water-soluble polysaccharides in freeze-dried and hot-air-dried fruiting bodies of five wild edible mushroom species, such as *Armillaria mellea*, *Leccinum aurantiacum*, *Suillus luteus*, *Lactarius deliciosus*, and *Boletus badius*, range from 36.3 ± 0.7 mg/g dry weight to 105.9 ± 3.9 mg/g dry weight (26). The method of drying significantly affects the quantity of the water-soluble polysaccharides, while hot-air drying slightly increases their antioxidant potential.

The results from the estimation of the element content of several wild edible and inedible mushroom species collected from the Belgrad Forest and the Ilgaz Mountain National Park in Turkey demonstrated that some of these species should be consumed in a controlled manner as copper concentration of *Bovistella utriformis* and cadmium levels of *Bovistella utriformis*, *Agaricus campestris*, *Armillaria ostoyae*, and *Pleurotus ostreatus* exceeded the legal limits determined by authorities (27).

The study of the bioactive compounds, chemical composition, and antioxidant activity of two wild edible mushrooms, such as the parasol mushroom (*Macrolepiota procera*) and the honey fungus (*Armillaria mellea*), collected from Northern Morocco and Portugal indicated that the climatic and geographic conditions of the collection site affect biomolecule compounds and antioxidant properties of these wild edible mushrooms (28). Thus, it can contribute to the elaboration of nutraceutical, nutritional and phar-

maceutical databases of the mushrooms consumed worldwide.

CONCLUSION

Our inquiry investigation identified some interesting characteristics of the usage of wild edible mushrooms by the inhabitants with secondary, elementary, and higher education in the region of Varna. In our modest opinion, further ethnomycological research could contribute to the further improvement of the awareness of these mushrooms among the population in Bulgaria.

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