

ORIGINAL ARTICLES

A RETROSPECTIVE DEMOGRAPHIC STUDY OF WILD MUSHROOM INTOXICATIONS IN THE REGION OF VARNA, BULGARIA

Tsonka Dimitrova

Department of Biology, Faculty of Pharmacy, Medical University of Varna, Bulgaria

ABSTRACT

INTRODUCTION: Recently, there has been a rising interest in the cases of wild mushroom poisonings. There are relatively few publications dealing with the demographic aspects of the patients experiencing intoxications after wild mushroom consumption at regional level.

AIM: Our purpose was to retrospectively analyze some demographic characteristics of the patients with acute wild mushroom poisonings in the region of Varna, Bulgaria.

MATERIALS AND METHODS: We performed an epidemiological investigation of all consecutive patients with acute wild mushroom intoxications in the region of Varna hospitalized in the Clinic of Toxicology, Naval Hospital of Varna during the period between January 2005 and December 2022. There were a total of 672 hospitalized patients, 330 males aged between three and 84 years and 342 females aged between four and 85 years. We analyzed their annual dynamics during these 18 years and identified numerous gender and age differences in this contingent.

RESULTS: The number of the male, female and all the patients considerably diminished during the second nine-year period—from 191 down to 139, from 212 down to 130, and from 403 down to 269, respectively. The mean patients' age was highest in 2016 and in 2015 and lowest in 2011 and in 2008. There were 33 cases with two family members, ten cases with three family members, three cases with four family members, and one case with five family members among the hospitalized patients in a total of 12 years. There were no lethal cases.

CONCLUSION: There were considerable differences in terms of age and gender characteristics of the patients hospitalized for acute wild mushroom intoxications in the region of Varna during the period between 2005 and 2022.

Keywords: *wild poisonous mushrooms, annual dynamics, gender and age differences, region of Varna, Bulgaria*

Address for correspondence:

Tsonka Dimitrova
Faculty of Pharmacy
Medical University of Varna
84 Tzar Osvoboditel Blvd
9002 Varna, Bulgaria
e-mail: tsonka72@abv.bg

Received: April 17, 2023

Accepted: June 2, 2023

INTRODUCTION

Wild and cultivated mushrooms are popular worldwide due to their rich nutritional and medicinal value. There are, however, numerous poisonous wild mushrooms, which have been garnering recently a rising scientific interest.

Most wild mushroom poisonings occur in Eastern Europe and in the conifer forests of Germany, Poland, and Finland (1). Between 1953 to 1962, there



were 138 documented poisonings with two fatalities in Poland. From 1994 to 2002, the Swedish poison center received 706 calls related to gyromitra mushrooms, with no fatalities. From 2001 to 2011, poison centers in the USA received 82140 calls related to wild mushrooms 448 of which involved gyromitrin mushrooms.

During the period from 2010 to 2020, according to the Foodborne Disease Outbreak Surveillance System, there were a total of 10036 wild mushroom poisoning outbreaks in China resulting in 38676 diseases and 788 deaths (2). These intoxications occurred all over the country and their incidence rate was highest in the Southwest and Central China.

The results from a retrospective investigation at an emergency department in Bern, Switzerland, from January 2001 to October 2017, revealed a total of 51 wild mushroom poisonings (3). There were no fatalities.

Food poisoning caused by accidentally eating *Chlorophyllum molybdites* has become more frequent in recent years in China (4). In 2019, there were 55 food intoxication incidents caused by consuming this mushroom in China.

AIM

The aim of the present study was to retrospectively analyze a series of demographic characteristics of the patients hospitalized for acute wild mushroom

intoxications in the region of Varna, Bulgaria, during the period between January 1, 2015 and December 31, 2022.

MATERIALS AND METHODS

We performed an epidemiological investigation of all the consecutive patients with wild mushroom intoxications in the region of Varna hospitalized in the Clinic of Toxicology, Naval Hospital of Varna during the period between January 1, 2005 and December 31, 2022. We analyzed the annual dynamics of these hospitalizations according to patients' gender and age.

RESULTS

There were a total of 672 patients, 330 males and 342 females. Males were aged between three and 84 years and females were aged between four and 85 years.

We established a considerable reduction in the number of the hospitalized male and female patients as well in the total number of patients during the entire second nine-year period. This is evident from Table 1 and Table 2.

The annual dynamics of all patients' age during the 18-year period is demonstrated in Table 3. The mean patient age was highest in 2016 and in 2015 and lowest in 2011 and in 2008. There was a great range in terms of age in the studied group as seen from Ta-

Table 1. Annual dynamics of the number and relative share of males, females, and the total number patients in 2005–2013.

Year	Males		Females		Total	
	n	%	n	%	n	%*
2005	16	40.00	24	60.00	40	5.95
2006	40	56.34	31	43.66	71	10.57
2007	21	44.68	26	55.32	47	6.99
2008	33	49.25	34	50.75	67	9.97
2009	30	44.78	37	55.22	67	9.97
2010	14	42.42	19	57.58	33	4.91
2011	8	38.10	13	61.90	21	3.13
2012	17	56.67	13	43.33	30	4.46
2013	12	44.44	15	55.56	27	4.02
Total	191	47.39	212	62.61	403	100.00

* The total annual percentage is calculated towards the number of all the patients during the entire 18-year period.

Table 2. Annual dynamics of the number and relative share of males, females, and the total number of patients in 2014–2022.

Year	Males		Females		Total	
	n	%	n	%	n	%*
2014	30	62.50	18	37.50	48	7.14
2015	16	45.71	19	54.29	35	5.21
2016	9	40.91	13	59.09	22	3.27
2017	15	65.22	8	34.78	23	3.42
2018	15	50.00	15	50.00	30	4.46
2019	18	54.55	15	45.45	33	4.91
2020	16	64.00	9	36.00	25	3.72
2021	15	42.86	20	57.14	35	5.21
2022	5	27.78	13	72.22	18	2.68
Total	139	51.67	130	48.33	269	100.00

* The total annual percentage is calculated towards the number of all the patients during the entire 18-year period.

ble 3. This means that a many different age groups were affected.

There were a total of 47 cases with more than one family member among the patients hospitalized on the occasion of wild mushroom intoxication in a

Table 3. Annual dynamics of patients' age in 2005–2022 (in years).

Year	Mean	SD	Minimum	Maximum
2005	47.07	14.57	18	78
2006	44.53	21.20	7	85
2007	44.62	17.88	12	85
2008	42.57	18.57	10	82
2009	49.16	19.24	7	80
2010	45.61	17.02	13	84
2011	39.05	16.37	15	73
2012	43.43	20.86	9	83
2013	47.48	17.76	13	78
2014	46.44	18.50	8	83
2015	50.51	17.50	20	74
2016	52.73	18.37	14	79
2017	49.22	16.22	22	78
2018	48.20	19.12	12	60
2019	48.88	20.23	3	84
2020	49.48	18.88	15	78
2021	47.83	21.66	4	82
2022	44.89	17.37	17	77

total of 12 years. In 2019, there was one family with five hospitalized members. The annual dynamics of the number and relative share of 46 hospitalized cases with two or three family members during these years is shown in Table 4. The relative share of all hospitalized cases with more than one member from the same family was greatest in 2021 and in 2012 and lowest in 2022 and in 2015.

There were no lethal cases.

DISCUSSION

To our knowledge, this is the first longitudinal investigation of these demographic characteristics of patients with acute wild mushroom intoxications in Bulgaria.

There are several recent publications by foreign authors that are devoted to the demographic characteristics of patients with wild mushroom intoxications.

According to the Healthcare Cost and Utilization Project database, in 2016, 1328±100 emergency department visits and 100±22 hospitalizations were associated with accidental poisonous wild mushroom ingestions in the USA (5). There were 832 male and 496 female patients. There was a prevalence of the patients aged between one and 17 years (548 cases) and between 18 and 44 years (511 cases). There were 180 patients aged between 45 and 60 years.

Table 4. Annual dynamics of the total number and relative share of the cases with more than one member from the same family.

Year	Two Members		Three Members		Four Members		Total	
	n	%	n	%	n	%	n	%
2005	5	12.50	0	0	0	0	5	12.50
2006	4	5.63	1	1.41	1	1.41	6	8.45
2007	2	4.25	2	4.25	0	0	4	8.51
2008	4	5.97	1	1.49	1	1.49	6	8.95
2012	2	6.67	2	6.67	0	0	4	13.34
2013	3	11.11	0	0	0	0	3	11.11
2014	3	6.25	1	2.08	0	0	4	8.33
2015	1	2.86	1	2.86	0	0	2	5.72
2017	3	13.04	0	0	0	0	3	13.04
2019	1	3.03	1	3.03	0	0	2	6.06
2021	4	11.43	1	2.86	1	2.86	6	17.15
2022	1	5.56	0	0	0	0	1	5.56
Total	33	4.91	10	1.49	3	0.45	46	7.00

The analysis of the National Poison Data System annual publications of wild mushroom intoxications from 1999 to 2016 in the USA identified 133700 cases (7428 per year) of mushroom exposure, mainly by ingestion (6). The cases were usually unintentional (83%; $p < 0.001$), caused no or only minor harm (86%; $p < 0.001$), and affected mainly children aged less than six years (62%; $p < 0.001$).

The retrospective analysis of data from the Israel Poison Information Center in Rambam Health Care Campus, Haifa, during the period between 2010 and 2021 revealed that only 4% of the cases of exposures to biological agents were caused by wild mushrooms (7). Males were statistically significantly more affected than females ($p < 0.004$). The relative shares of patients aged above 18 years and below six years were greatest (41% and 39%, respectively). In 2017–2021, there were 128 cases of raw wild mushroom consumption, mainly by children under six years of age.

Between January 2015 and December 2020, 44 patients at a mean age of 20.13 ± 15.39 years with wild mushroom poisoning were admitted to a tertiary care institute in North-Eastern India (8). There were 23 males and 21 females. Seventeen patients were aged between 19 and 60 years, 15—between two and 12 years, and 12—between 13 and 18 years.

Among 193 patients with wild mushroom poisoning at a mean age of 43.1 ± 16.2 years from March 21, 2014 to March 21, 2018 in Kermanshah province, Western Iran, there were 99 males (51.30%) and 94 females (48.70% of the cases) (9). Most patients were aged between 21 and 40 years (72 ones) and between 41 and 60 years (68 ones).

In 2018, there was an outbreak of cyclopeptide-containing wild mushroom poisoning among 283 patients in Kermanshah province, Western Iran (10). There were 143 males and 140 females. Some 133 patients were aged between 20 and 39 years, 98 patients—between 40 and 59 years, 28 patients—between 13 and 19 years, and 24 patients were ≥ 60 years old.

During the period from 2015 to 2018, a total of 65 wild mushroom poisoning patients at a mean age of 35.68 years were hospitalized in Razi Hospital, Qaemshahr, Mazandaran, Iran (11). There were 33 males and 32 females. Some 33 patients were ≤ 31 years.

The results from the retrospective study of 8158 children with acute poisoning during the period from March 2010 to March 2020 in the Loghman Hakim Hospital in Tehran, Iran, registered a total of 28 lethal cases, 19 boys and nine girls (12). Of them,

there were two children deceased due to wild mushroom consumption.

CONCLUSION

We could draw the conclusion that there are considerable differences in terms of the age and gender characteristics of the patients hospitalized on the occasion of acute wild mushroom intoxications in the region of Varna during the period between 2005 and 2022. This study represents a component of a comprehensive epidemiological and clinical research project on this topic.

REFERENCES

1. Horowitz KM, Kong EL, Horowitz BZ. Gyromitra mushroom toxicity. In: StatPearls (Internet). Treasure Island, FL: StatPearls Publishing, 2021.
2. Li W, Pires SM, Liu Z, Liang J, Wang Y, Chen W, et al. Mushroom poisoning outbreaks - China, 2010-2020. *China CDC Wkly*. 2021;3(24):518-22. doi: 10.46234/ccdcw2021.134.
3. Keller SA, Klukowska-Rötzler J, Schenk-Jaeger KM, Kupferschmidt H, Exadaktylos AK, Lehmann B, et al. Mushroom poisoning - a 17 year retrospective study at a level I university emergency department in Switzerland. *Int J Environ Res Public Health*. 2018;15(12):2855. doi: 10.3390/ijerph15122855.
4. Wang N, Zhao Z, Gao J, Tian E, Yu W, Li H, et al. Rapid and visual identification of Chlorophyllum molybdites with loop-mediated isothermal amplification method. *Front Microbiol*. 2021;12:638315. doi: 10.3389/fmicb.2021.638315.
5. Gold JAW, Kiernan E, Yeh M, Jackson BR, Benedict K. Health care utilization and outcomes associated with accidental poisonous mushroom ingestions - United States, 2016-2018. *MMWR Morb Mortal Wkly Rep*. 2021;70(10):337-41. doi: 10.15585/mmwr.mm7010a1.
6. Brandenburg WE, Ward KJ. Mushroom poisoning epidemiology in the United States. *Mycologia*. 2018;110(4):637-41. doi: 10.1080/00275514.2018.1479561.
7. Lewinsohn D, Lurie Y, Gaon A, Biketova AY, Bentur Y. The epidemiology of wild mushroom poisoning in Israel. *Mycologia*. 2023;115(3):317-25. doi: 10.1080/00275514.2023.2177471.
8. Tiewsoh I, Bhattacharya PK, Barman B, Barman H, Rappthap K, Sangla L, et al. Delayed liver toxicity and delayed gastroenteritis: A 5 year retrospective analysis of the cause of death in mushroom poisoning. *J Family Med Prim Care*. 2022;11(5):1963-9. doi: 10.4103/jfmprc.jfmprc_1806_21.
9. Janatolmakan M, Ganji MR, Ahmadi-Jouybari T, Rezaeian S, Ghowsi M, Khatony A. Demographic, clinical, and laboratory findings of mushroom-poisoned patients in Kermanshah province, west of Iran. *BMC Pharmacol Toxicol*. 2022;23(1):72. doi: 10.1186/s40360-022-00614-1.
10. Karami Matin B, Amrollahi-Sharifabadi M, Rezaei S, Heidari A, Kazemi-Karyani A. Epidemiology and economic burden of an outbreak of cyclopeptide-containing mushroom poisoning in the West of Iran. *Front Public Health*. 2022;10:910024. doi: 10.3389/fpubh.2022.910024.
11. Khatir IG, Hosseinijad SM, Ghasempouri SK, Asadollahpoor A, Moradi S, Jahanian F. Demographic and epidemiologic evaluation of mushroom poisoning: a retrospective study in 4-year admissions of Razi Hospital (Qaemshahr, Mazandaran, Iran). *Med Glas (Zenica)*. 2020;17(1):117-22. doi: 10.17392/1050-20.
12. Gholami N, McDonald R, Farnaghi F, Hosseini Yazdi M, Zamani N, Hassanian-Moghaddam H. Fatal outcome in acutely poisoned children with hospitalization: a 10-year retrospective study from Tehran, Iran. *Pediatr Emerg Care*. 2022;38(2):e659-63. doi: 10.1097/PEC.0000000000002429.