

KNOWLEDGE ABOUT FOOD SAFETY AND HANDLING PRACTICES - LESSONS FROM THE SERBIAN PUBLIC UNIVERSITIES

POZNAVANJE VARNE HRANE IN RAVNANJE Z NJO - IZKUŠNJE SRBSKIH JAVNIH UNIVERZ

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ABSTRACT

Introduction: Education about food safety is important for public health, and the best place to provide it is a university environment. The aim of the research was to assess food safety knowledge and self-reported food handling practices among students in Serbia.

Keywords:

food safety, self-reported food handling practices, Serbia, university students

Methods: The research was performed from October to December 2020, using an electronic survey among students at the University of Belgrade, University of Niš, and University of Novi Sad.

Results: The average students' age was 21 (SD=1.7), and genderwise the proportion was 54% women and 46% men. The average score for self-reported food handling practices was 45.7% (SD=15.7), and for food safety knowledge 57.9% (SD=15.7). The results showed that students whose field of study is health-related (e.g. nutrition, chemistry, biology, medicine and pharmacy) had the highest score for self-reported food handling practices (48.8%) and for food safety knowledge (57.7%). As for age, the senior students showed the highest score for food safety (57.2%), followed by third-year students (53.8%), second-year (51.9%), and first-year students (49.9%).

Conclusions: The first-year students and those whose field of the study was not health-related showed the lowest score in the answers to the questions about food handling practices and food safety knowledge. However, the longer students study, the more knowledge they have, which is not the case for those whose studies are non-health-related.

IZVLEČEK

Uvod: Poznavanje pomena varne hrane je pomembno za javno zdravje, najboljše mesto za to pa je univerzitetno okolje, ki lahko v prihodnosti veliko prispeva k širjenju teh znanj. Namen raziskave je oceniti poznavanje varnosti hrane in praks ravnanja z njo med študenti v Srbiji.

Ključne besede:

varna hrana, prakse ravnanja s hrano, Srbija, študenti univerzitetnega študija

Metode: Raziskava je potekala od oktobra do decembra 2020 z elektronsko anketo med študenti Univerze v Beogradu, Univerze v Nišu in Univerze v Novem Sadu.

Rezultati: Povprečna starost študentov je bila 21 let (SD = 1,7), po spolu pa je bilo razmerje 54 % žensk in 46 % moških. Povprečni rezultat pri praksi ravnanja z živili je bil 45,7-odstotni (SD = 15,7), pri znanju o varnosti živil pa 57,9-odstotni (SD = 15,7). Rezultati kažejo, da so študenti, katerih študijska smer je povezana z zdravjem (npr. prehrana, kemija, biologija, medicina in farmacija), dosegli najvišjo oceno za prakse ravnanja s hrano (48,8 %) in poznavanje varne hrane (57,7 %). Kar zadeva starost, so študenti zaključnih letnikov dosegli najvišjo oceno za znanje o varnosti živil (57,2 %), sledijo jim študenti tretjih letnikov (53,8 %), študenti drugih (51,9 %) in študenti prvih letnikov (49,9 %).

Zaključki: Študenti prvih letnikov in študenti, katerih študijska smer ni povezana z zdravstvom, so dosegli najnižje število točk pri odgovorih na vprašanja o praksah ravnanja s hrano in znanju o varnosti hrane. Vendar dlje kot študenti študirajo, več znanja imajo, kar pa ne velja za tiste, katerih študij ni povezan z zdravstvom.

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1 INTRODUCTION

Up until 2018, the Serbian system of food control was at an unenviable level, and thus there was a lot of space for numerous failures, often with very serious consequences for people's health (1). However, as of 1 January 2018, the use of a new integrated system of management and control of food safety, developed with EU support, was implemented.

In Serbia, as well as in other countries round the world, foodborne illnesses or food poisoning are becoming a major health problem of primary importance (2). The diseases caused by food poisoning, both in developing countries such as Serbia and in the developed countries of Europe and the USA, can cause significant morbidity and mortality from foodborne illnesses (3).

Meta analysis (4) highlights the heterogeneity between food groups, and the fact that many factors influence consumers' product preferences and purchasing decisions, and this can also be considered a health problem. There are numerous studies emphasizing that food handlers of all ages consider that they know how to handle food safely, but their self-reported food handling behaviors do not support this supposition (5-8). Food mishandling is more common in some consumer groups than in others (9, 10). Young male adults (18-29 years old), men, and individuals with education higher than high school are more likely to have risky food handling than others (11-13). This age group (18-29 years old) is not considered to be "at risk" for foodborne illness. However, the consequences of their unhygienic food practices become serious when they start providing care for other household members who are at risk, such as pregnant women, young children, and ageing adults (14, 15).

Accordingly, relevant research has been done to date in Greece (16), Slovenia (17), Bulgaria (18), Spain (19), Sweden (20), Turkey (10, 21, 22), Jordan (23), Lebanon (24), Saudi Arabia (25, 26), Malaysia (27-29), Canada (30), Australia, and the UK (31). The reports from the listed countries indicated a significant level of awareness of food safety knowledge among a similar profile of respondents but with a constant need for new educational initiatives. This should involve the promotion of more optimal

behaviors, improvement in food safety practices, and interventions on food safety. The majority of the research showed that a university environment is an ideal place for implementing the strategy of prevention of the diseases caused by improper food handling, since they will be the ones who will cook, train, and be parents in the future.

It is interesting to point out that a related study had already been done among the cadets of the Military Academy in Serbia (32). The evaluation of the level of food safety knowledge among them showed relatively good knowledge of some food safety issues, including prevention of cross contamination in the kitchen, hand and personal hygiene. Another similar research (33) evaluated self-reported food handling practices and food safety knowledge among undergraduate students in Serbia, with the aim of determining whether the university curriculum influences the food safety outcome among participating students.

Considering previous studies, this research will focus on the assessment of knowledge about food safety and self-reported food handling practices among students of the three public universities in Serbia - University of Belgrade, University of Niš, and University of Novi Sad. The analyzed universities are the largest academic and scientific institutions in Serbia in terms of the number of students, departments, faculties, and staff.

2 METHODS

2.1 Study population

The study was conducted from October to December 2020. An email requesting students' participation and containing the link to the survey was sent to 1,000 students in Novi Sad, Belgrade, and Niš by the University's Registrar's Office. The population was from different fields of study (health-related and non-health-related) and years of study (second, third and fourth years). Out of 1,000 filled questionnaire forms, 930 (79.5%) were filled correctly (respondents answered all questions) and were used for further statistical analysis.

Table 1 presents a sample design which includes information about the sample and population, sampling error, and confidence level.

Table 1. Sample design research data.

Collection method	Self-administrated questionnaire		
Sampling unit	Students over 18 years of age		
City	Novi Sad	Belgrade	Niš
Sampling error	3.8%	5%	3.2%
Confidence level	95%	99%	95%
Sampling unit	140,500 per year		

2.2 Questionnaire

The questionnaire was developed by incorporating questions selected from an updated, reliable, and valid instrument produced by Byrd-Bredbenner et al. (9), and used in similar studies done in Serbia (32, 33). Appropriate modifications were made to some of the selected questions, as regards adjustments to specific eating habits in Serbia. The questionnaire was subjected to a preliminary validation (81 students, 27 per city) to assess its clarity, the suitability of wording, and the average time needed for its completion. Based on this pilot study, necessary modifications were identified and resolved, but its results were not included in the final survey.

The final questionnaire consisted of four parts: introduction, demographic characteristics, self-reported food handling practices, and food safety knowledge questions. The demographic characteristics included gender, age, field of study and year of study, campus, residential area and status, involvement in cooking, and parental employment. The self-reported food handling practices section included 16 questions, while the food safety knowledge section included 14 questions. Most of the items were multiple-choice questions.

2.3 Statistical analysis

IBM SPSS Statistics v18 software was used for all the statistical analyses. The demographic characteristics represented the independent variables. Food-safety and handling knowledge and practices outcomes represented the dependent variables. Each multiple-choice item had one correct answer that was assigned a score of 1 point, while 0 points were assigned to all the wrong answers. A T-test and Analysis of Variance (ANOVA) were conducted to compare the mean sum of the correct responses of every section of the questionnaire.

3 RESULTS

A total of 930 undergraduate students participated in the study: 54% females and 46% males. The study sample was composed 30% of students from health-related fields of study (nutrition, biology, chemistry, medicine, and pharmacy) and 69% from non-health-related fields of study (arts, engineering, law, and business) (Table 2). The mean student age was 21 (SD=1.7). Four percent of them were first years, 41% were second years, 29% were third years, and 25% were fourth years. Around 68% of the students lived with their parents. Only 6% of the students reported that they cook their own meals daily. Of all the students, 30% of them had a working mother.

The overall food handling practices score was the sum of the correct responses in the self-reported food handling practices section for each student, and its mean value

Table 2. Demographic characteristics of the study population (N=930).

Demographic variables		% ^a
Gender	Male	45.1
	Female	54.9
Age group	18-20	67.9
	21-23	33.1
Field of study	Health-related	30.8
	Non-health-related	69.2
Year of study	First	4
	Second	41.1
	Third	29.8
	Fourth	25.1
Campus	Novi Sad	32.4
	Belgrade	43.5
	Niš	24.1
Residential area	City	51.2
	Suburb	38.5
	Rural area	10.3
Cooking habits	Cook daily	9.6
	Sometimes	33.4
	Rarely	30.7
Maternal employment	Never	26.0
	Works	30.7
	Housewife	69.3

^a relative percentage based on valid values

was 45.7% (SD=15.7). The mean score and the significance levels for each variable are presented in Table 3. In terms of food handling, female students scored significantly ($p<0.001$) better than male students. Also, students in health-related fields scored significantly ($p<0.001$) better than non-health-related ones. In addition, the residence area had a significant ($p=0.006$) effect with City scoring the highest, and Rural area the lowest. Moreover, students having working mothers scored better than those whose mothers are housewives, and the significance was border-line significant ($p=0.05$). On the other hand, age, year of study, campus, residential status, and cooking habits were not significantly associated with practice and knowledge scores ($p>0.05$).

The mean food-safety knowledge score was 57.9% (SD=15.1). The mean score and the significance levels for each variable are presented in Table 3. There was no statistically significant difference ($p=0.106$) between female and male students. Students in health-related fields scored significantly ($p=0.001$) better than non-health-related ones. The higher the year of study, the higher the knowledge score was. Senior students scored the highest, followed by third years, second years and first years, and the difference was border-line significant ($p=0.07$). Students living with parents scored significantly ($p=0.09$) higher than those living alone or with friends. Students who cook daily scored significantly ($p=0.001$) lower than those who cook less frequently or never.

Table 3. Mean scores for self-reported food handling practices and food safety knowledge sections per demographic characteristics.

Demographic variables	Self-reported food handling practices		Food safety knowledge	
	Mean±SD ^a	Sig.*	Mean±SD ^a	Sig.*
Age	18	44.7±13.2	0.370	0.127
	19	44.8±14.4		
	20	43.2±14.4		
	21	42.8±13.6		
	22	43.5±15.1		
	23	44.4±15.0		
Gender	Male	43.4±13.8	0.001	0.113
	Female	47.4±14.3		
Field of study	Health-related	48.8±13.3	0.001	0.001
	Non-health-related	42.9±13.8		
Year of study	First	42.3±13.7	0.635	0.07
	Second	44.3±13.9		
	Third	45.8±14.7		
	Fourth	48.4±14.1		
Campus	Novi Sad	45.8±15.1	0.251	0.316
	Belgrade	44.5±13.8		
	Niš	44.1±12.9		
Residence area	City/Town	55.8±15.1	0.006	0.112
	Suburban area	51.3±14.3		
	Rural area	32.5±19.1		
Residential status	Parents	48.6±12.7	0.909	0.009
	Friends/roommates	44.9±15.1		
	Alone	46.1±14.3		
Cooking habits	Daily	48.1±15.7	0.605	0.001
	Sometimes	45.3±15.1		
	Rarely	43.9±13.8		
	Never	43.1±14.1		
Maternal employment	Works	48.1±15.1	0.05	0.09
	Housewife	45.1±14.8		

Note: ^a knowledge score, relative percentage based on valid values; *statistical significance $p < 0.05$

Students from health-related fields of study reported the highest average self-reported food handling practices (48.8%) and food safety knowledge (57.7%) scores (Table 3). The difference between these students and their counterparts from non-health-related fields of study was significant ($p < 0.05$) for both self-reported food handling practices and food safety knowledge parts. This could be due to the presence of modules and courses relevant to food safety, hygiene and microbiology in the curricula of health-related fields of study.

Fourth-year students reported higher food safety knowledge scores (57.2%), followed by third-year (53.8%), second-year (51.9%) and first-year (49.9%) students, and the difference was border-line significant ($p = 0.07$) (Table 2). This can be attributed to the fact that as the students, especially in health-related fields of study, stay longer in the field of study, they cover more aspects of food safety (16, 24). Male and female students were equally (-54%)

knowledgeable in terms of food safety (Table 3); however, female participants responded significantly ($p < 0.001$) better (46%) than males (42%) in terms of self-reported food handling practices. This conforms to the findings from previous studies, in which females outperformed male university students (9, 16, 24).

Students from the campus of Novi Sad had the highest score (45.8%) for the questions regarding self-reported food handling practices, followed by those from Belgrade (44.5%), and Niš (44.1%), whereas for the food safety questions, the highest score was reported for the students from the campus in Belgrade (54.5%), followed by Novi Sad (53.3%), and Niš (52.9%). No statistical significance has been found (Table 3).

Students living with their parents scored better (Table 3) than those living alone or with friends or roommates; however, the difference was only significant ($p = 0.009$) for the food safety knowledge questions. This can be

attributed to the fact that when students live with their parents, someone else who is more experienced (most often, the mother) will handle the food preparation, resulting in better food handling and an opportunity for students to observe and learn more about food safety.

Detailed scores on the self-reported food handling practices and food safety knowledge questions are presented in Tables 4 and 5. In the self-reported food handling practices section, the highest score was for hand washing; 89% of the participants reported that they wash their hands with soap and water before eating or preparing food. On the other hand, the lowest score was

for how to check that a burger is cooked enough; only 8.7% of the participants reported that they use a thermometer to check the temperature at the center.

From the detailed insight into the scores for responses to the 16 questions related to self-reported food handling practices, it can be concluded that the students from Novi Sad had the highest score, for as many as 10 questions, followed by the students from Belgrade, and then Niš. At the same time, the students from Novi Sad showed the best knowledge about the use of a thermometer for checking the temperature at the center of the item.

Table 4. Score distribution for questions related to self-reported food handling practices.

Questions	Multiple-choice responses	Correct responses		
		Novi Sad	Belgrade	Niš
(1) At home, what is most practiced after using a cutting board to slice raw meat and need to cut tomatoes afterwards?	Use the board as it is	1.8%	3.3%	3.4%
	Wipe the board with a paper towel	1.9%	3.4%	3.6%
	Wash the board with soap and water	36.1%	45.9%	40.4%
	Use a different cutting board	60.9%	54.1%	50.5%
(2) On campus, how do you dry your hands after washing them?	Paper towel	87.1%	87.8%	85.6%
	Hot air electrical dryer	5.9%	5.2%	6.9%
	Leave them to dry on their own	2.9%	2.3%	3.4%
	Your clothes	2.1%	2.7%	2.1%
(3) In the fridge (not freezer) of your house, where is the raw meat stored?	Top shelf	57.4%	56.1%	56.9%
	Medium shelf	8.4%	5.8%	6.7%
	Lowest shelf	30.2%	34.2%	31.7%
(4) If you have a sore on the back of your hand, do you prepare food?	Yes, but after putting a bandage on it	33.6%	34.9%	35.1%
	Yes, but after putting on a glove	12.1%	15.6%	15.6%
	Yes, but after bandaging the sore and putting on a glove	29.4%	28.1%	27.9%
	No, I do not prepare food until the sore heals	23.1%	19.4%	17.6%
(5) When you cut raw meat and need to use the knife again, what do you do?	Reuse the knife as it is	1.4%	2.2%	3.2%
	Rinse the knife with cold water	17.5%	15.0%	16.1%
	Wash the knife with soap and water	76.1%	78.1%	77.3%
	Wipe the knife with a cloth	3.2%	2.9%	1.9%
(6) Do you take off jewelry when preparing food?	Yes	79.3%	76.8%	75%
	No	19.1%	21.5%	23.4%
	Not applicable	1.4%	1.3%	1.1%
(7) At home, how do you check that a burger is cooked enough?	By checking the color	40.1%	35.9%	39.3%
	By checking the firmness	36.1%	40.0%	38.4%
	By measuring the temperature at the center	8.7%	8.1%	8%
	By checking the cooking time	12.1%	11.5%	11.1%
(8) At home, you fry eggs until the:	Egg white is solid and the yolk is semi-solid	24.2%	22.8%	23.9%
	Egg white and yolk are semi-solid	7.3%	6.7%	8.8%
	Egg white and yolk are solid	56.2%	58.3%	57.7%

Questions	Multiple-choice responses	Correct responses		
		Novi Sad	Belgrade	Niš
(9) During your supermarket shopping, when do you place refrigerated meat in your cart?	At the beginning of shopping	7.2%	9.6%	10.2%
	About halfway through the shopping	8.4%	10.2%	11.9%
	At the end of the shopping	59.7%	57.5%	54.2%
	It does not matter	22.8%	20.6%	22.8%
(10) At home, how do you defrost frozen meat/chicken?	Heat it in a microwave	17.2%	12.7%	18.9%
	Put it under running water for 1 h	14.3%	19.7%	18.1%
	Leave it on the kitchen counter for 1h	38.5%	31.2%	33.1%
	Leave it in the fridge for a few hours	28.8%	26.5%	27.1%
(11) Do you have a thermometer in your fridge?	Yes	55.2%	53.7%	54.6%
	No	43.7%	44.2%	44.3%
(12) If your roommate or family member is going to be several hours late for a hot meal, where do you leave the meal?	In the fridge	30.1%	27.3%	38.5%
	In a cool oven	24.2%	22.5%	23.1%
	In a warm oven	32.3%	37.8%	39.7%
	On the counter	13.0%	12.5%	9.6%
(13) When preparing food, you wash your hands after touching which of these?	Your face	36.9%	33.4%	32%
	Clean pots and counter	9.1%	8.6%	7.1%
	Utensils being used in food preparation	33.7%	31.2%	31.7%
	I do not wash my hands after touching any of the above	15.7%	15.2%	14.8%
(14) At home, how do you treat fresh fruit and vegetables?	Dip them in water and salt	5.8%	5.9%	5.7%
	Wash them with soap	16.7%	16.9%	16.6%
	Wash them under running water	71.4%	70.9%	71.1%
	Boil them	3.5%	3.7%	3.8%
(15) How often is the kitchen sink drain in your home sanitized?	Daily	52.1%	48.6%	46.7%
	Weekly	23.9%	24.4%	22.1%
	Never	2.9%	2.4%	3.9%
	Only when I wash food in the sink	10.1%	12.6%	13.8%
(16) How do you wash your hands before cooking or eating?	Soap and water	97.1%	97%	96.9%
	Water only	1.5%	1.4%	1.3%
	Hand sanitizer	0.9%	1.1%	1.2%
	I do not wash my hands	0.3%	0.2%	0.2%

Note: The best practices are highlighted in bold.

The distribution of the results, for the questions regarding food safety knowledge, is shown in Table 5. In the field of food safety, the students had the highest scores (82.7%) for the best way of cleaning the kitchen counter. However, only 10.1% knew that a person with diarrhea should not prepare food for others.

Table 5. Score distribution for questions related to food safety knowledge.

Questions	Multiple-choice responses	Correct responses		
		Novi Sad	Belgrade	Niš
(17) Which of the following scenarios for cleaning kitchen counters is the BEST?	Soap, then water, then sanitizer	82.7%	81.3%	80.1%
	Sanitizer, then water	8.2%	8.2%	8.7%
	Brush, then sanitizer	4.9%	5.9%	5.7%
	Water, then drying	2.5%	2.9%	1.8%
(18) While washing your hands, it is enough to rub them for...?	10 seconds	24.1%	23%	23.1%
	20 seconds	32.7%	33.4%	30.7%
	30 seconds	27.4%	28.7%	25.9%
	40 seconds	5.2%	4.3%	4.7%
(19) Freezing kills harmful germs in food.	True	31.0%	29.3%	30.2%
	False	67.8%	69.1%	67.2%
(20) Which food is the LEAST likely to cause food poisoning?	Baked potato left on the kitchen counter overnight	27.8%	27.3%	26.1%
	Leftover chicken eaten cold	16.3%	15.8%	16.1%
	Chocolate cake left on the kitchen counter overnight	37.1%	38.6%	36.9%
	Slices of pizza left on the counter overnight	17.1%	16.6%	18.8%
(21) What is the recommended temperature for freezers?	-18 °C	72.5%	73.4%	72.1%
	18 °C	4.2%	3.9%	4.1%
	8 °C	5.9%	5.6%	5.7%
	0 °C	14.2%	13.9%	14%
(22) What is the recommended temperature for fridges?	-4 °C	11.3%	10.3%	9.9%
	4 °C	68.2%	67.9%	67.8%
	12 °C	10.1%	11.1%	10.7%
	16 °C	6.6%	6.3%	6%
(23) Which food does NOT need to be refrigerated?	Fruit salad	4.8%	4.5%	4.3%
	Open can of peas	6.9%	6.4%	6.1%
	Raisins	82.2%	80.2%	79.9%
	Chocolate pudding	6.1%	5.5%	5.7%
(24) How can food be made safe if it has salmonella bacteria in it?	Cook it well	65.9%	66%	65.7%
	Freeze it for 3 days	7.3%	7%	7.1%
	Such food cannot be made safe	5.2%	4.9%	5%
	Don't know	19.3%	19.6%	19.9%
(25) For a burger to be safe to eat, it needs to be cooked until its internal temperature reaches:	52 °C	12.4%	11.4%	12.9%
	71 °C	33.1%	33.6%	32.9%
	121 °C	27.3%	28.7%	29.3%
	130 °C	10.4%	9.4%	8.4%
(26) The microorganisms that cause most foodborne illnesses are:	Bacteria	62.8%	63.5%	62.1%
	Viruses	9.9%	10.9%	9.1%
	Parasites	8.4%	8.9%	8%
	Fungi	14%	13.8%	15.1%

Questions	Multiple-choice responses	Correct responses		
		Novi Sad	Belgrade	Niš
(27) Which of these individuals should NOT prepare food for other people?	A person with diarrhea	10.1%	9.9%	9.7%
	A person with severe acne	19.7%	22.1%	20.1%
	A person with HIV	14.5%	13.1%	17.1%
	A person with a cold	51.8%	49.8%	46.3%
(28) Which food do pregnant women, infants, and children need NOT to avoid?	Soft cheeses	38.4%	39.9%	36.1%
	Raw or undercooked eggs	14.1%	13.7%	11.3%
	Undercooked hot dogs	2.6%	1.3%	4.6%
	Canned vegetables	41.3%	42.9%	44.1%
(29) Which of these individuals are the LEAST likely to get food poisoning?	Old people	13.1%	16.1%	15.1%
	Pregnant women	8.3%	14.9%	10.6%
	Teenagers	63.7%	60.7%	59.9%
	Cancer patients	14.9%	8.3%	12.1%
(30) Most disease-causing bacteria can grow within a temperature range between:	5-60 °C	30.7%	31.3%	29.9%
	20-40 °C	39.1%	40.3%	37.9%
	40-60 °C	13.9%	8.9%	16.3%
	30-70 °C	8.8%	10.8%	7.9%

Note: The correct answers for the knowledge questions are highlighted in bold.

4 DISCUSSION

In the last 15 years, a range of research (10, 16-18, 20-33) has been conducted in order to assess the knowledge, attitudes, and practices related to food safety among students, and at universities, and they have all had a similar contribution, which can be seen in the continuity of the conducted studies and the results of this research. The study proved that students from the University of Novi Sad had better knowledge related to self-reported food handling practices, whereas students from Belgrade had better knowledge regarding food safety basics. In the previous study (33), students from both universities had the same score for self-reported food handling practices, but students from the University of Novi Sad had a better knowledge than students from Belgrade regarding food safety basics. In our study, the overall food handling practice score was the sum of the correct responses in the self-reported food handling practices section for each student and its mean value was 45.7% (SD=15.7), while the mean score for the food-safety knowledge was 57.9% (SD=15.1). A similar finding was reported in Lebanon (24), Greece (16), and Serbia (32, 33). Lazou et al. (16) reported that the mean scores of food safety knowledge and self-reported food handling practices among Greek university students were 60% and 44% (16), in Lebanon they were 53% and 44% (24), and in Serbia they were 56% and 46% (32, 33).

In terms of self-reported food handling, female students scored significantly ($p < 0.001$) better than male students. On the other hand, there was no statistically significant

difference between female and male students regarding food-safety knowledge. Similar results have been determined for female students in Lebanon (24) and Serbia (33), and the opposite was seen for students of Veterinary Medicine in Bulgaria (18).

Regarding the results of fields of study, students from health-related fields of study reported the highest average self-reported food handling practices and food safety knowledge compared with students of non-health-related fields of study. A similar finding was reported in Lebanon (24), Greece (16), and Serbia (33).

4.1 Study limitations and recommendations for future research

One of the limitations of the research is the methodological difference relative to previous studies. Despite the differences, all the studies so far have concluded that the results are similar regarding food safety and self-reported food handling practices among students. Nevertheless, the sample size should be increased in the future. This would include respondents from other public and private universities in Serbia and neighboring countries. As a result, the complete picture of the study would have a bigger sample size and outcomes would be even more important, comparable, and interesting to analyze.

It is of note that this study was performed before the onset of the COVID-19 outbreak, which is currently ongoing at the time of writing this paper. Future research should analyze if the hand hygiene knowledge and handling practices

among students and among other groups of food handlers was significantly improved, due to numerous instructions, guidelines and videos that have been presented during this pandemic (34, 35). Despite the limitations of this study, which require further research, we can draw certain conclusions from the findings summarized in the next chapter.

5 CONCLUSION

This research was conducted in Serbia and examined students from the largest national public universities in Novi Sad, Belgrade, and Niš, regarding food safety and self-reported food handling practices. On the one hand, as currently observed, a high level of students' awareness of food safety contributes to the higher consumption of food, but it also represents a risk that can be caused by food handling, and thus a greater proneness to food poisoning. On the other hand, if observed long-term, this is an advantage, since the target group will act as parents in the future, and they will prepare food and meals. The research results point to the fact that there is a strong correlation between the participants' demographic characteristics and self-reported food handling practices, as well as food-safety knowledge, which is in accordance with the results of previous studies. The contribution of the research reflects a great need for education on food safety for young people. A university environment is an ideal place for this, and the students are the target group where it is possible to apply the strategy of preventing diseases caused by incorrect food handling, as well as education on food safety and food handling practices.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist with regard to this study.

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ETHICAL APPROVAL

Ethical approval does not apply to the current study, since no personal data that could identify the respondents was used.

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