



Food safety knowledge and hygiene practices among veterinary medicine students at Trakia University, Bulgaria



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ABSTRACT

The results from the first survey on food safety knowledge, attitudes and hygiene practices (KAP) among veterinary medicine students in Bulgaria are reported in this study. It was designed and conducted from September to December 2015 using structured questionnaires on food safety knowledge, attitudes and practices. Data were collected from 100 undergraduate veterinary medicine students from the Trakia University, Bulgaria. It was observed that the age and the gender did not affect food safety knowledge, attitudes and practices. There was no significant difference ($p > 0.05$) on food safety knowledge and practices among students based on the years of study. A high level of food safety knowledge was observed among the participants (85.06%), however, the practice of food safety was above average (65.28%) while attitude toward food safety was high (70%). Although there was a significant awareness of food safety knowledge among respondents, there is a need for improvement on food safety practices, interventions on food safety and foodborne diseases.

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Introduction

Global occurrence of foodborne illnesses is of public health importance as both developed and developing countries are affected. In a recent report conducted by the World Health Organization (WHO), it was revealed that 1 in 10 people fall ill globally due to foodborne diseases while more than 91 million people are affected in developing countries despite various research and intervention measures toward food safety [1]. Similarly, 2.2 million children die of diarrhea annually in developing countries [2]. Occurrence of foodborne diseases however, is more prevalent in developing countries due to poor hygiene, lack of potable drinking water, contaminated inappropriate food storage facilities and lack of food safety education [3]. According to European Food Safety Authority, more than 5000 foodborne outbreaks have affected over 69 000 people [4]. The burden of foodborne diseases is global and therefore requires global efforts in terms of collaboration, funding, awareness, and commitment from various governments especially

in developing nations and policy makers. Food safety awareness and education should be emphasized and encouraged among citizens. This is because most foodborne disease outbreaks occur at home, restaurants, and/or at social functions. Due to the continuous increase and the emergence and re-emergence of foodborne diseases, the WHO created the Foodborne Disease Burden Epidemiology Reference Group (FERG) in 2006 to investigate the global burden of foodborne diseases. Various studies were carried by this group since then including various consultations on how to mitigate these diseases affecting developed and developing nations alike.

Food handlers and consumers are important factors in foodborne disease outbreaks due to mishandling of food during preparation, processing or storage [5]. Similarly, meta analytical study by Patil et al. [6] it was stated that knowledge, attitude, and practice of food safety among food handlers contribute to food poisoning. Food handlers are individuals such as students, workers, parents who prepare and/or serve prepared food. Understanding the perception of food handlers is of significant importance in food safety education. There are many factors influencing the occurrence of foodborne diseases in developing countries which when properly addressed, can lead to reduced incidence of these diseases. Firstly, homes in developing countries serve as key contributors

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to foodborne disease outbreaks due to contamination of raw food with prepared food, lack of food safety awareness, poor personal hygiene, improper food handling, and preparation at home. Food intended for consumption can be contaminated in various ways. Contamination can occur from the farm, during transportation to consumers, and even through the consumers themselves. When food gets to the house of consumers, factors such as storing raw food together with prepared food in the refrigerator could cause contamination. Use of unwashed cutting boards could also lead to cross contamination. Consumers and food handlers are encouraged to maintain good personal hygiene in order to prevent spread of foodborne diseases. For example, proper hand wash after visiting a toilet is a key to prevention of introduction of microorganisms into food.

Veterinary medicine plays a significant role in food safety. Among the several courses taught to students in veterinary medicine at Trakia University is food safety. This course has been taught for several years. However, no previous study has been carried out to evaluate food safety knowledge, attitudes and practices among these students. This survey therefore aimed to evaluate the knowledge, attitude and practices of students studying veterinary medicine and the effects of age, gender and education level on food safety knowledge.

Materials and methods

Research design

The study was designed and conducted from September to December 2015 using structured questionnaires on food safety knowledge, attitudes and practices. This study involved 100 students currently enrolled in veterinary medicine education at the Trakia University, Bulgaria. Surveyed students had not taken the course of food safety.

Questionnaire design and data collection

The questionnaire used in this study comprised 64 items developed based on previous methods [5,7–9]. Questionnaires were sent to the consented participants via a Google document link. Each questionnaire was made up of four sections. Section 1: Demographic section to collect information about age, gender, marital status and years of study. Section 2 was on food safety knowledge of participants and comprised 20 questions. Section 3 examined 20 questions on food safety attitudes among participants while section 4 assessed food safety hygiene practices with 20 questions. The questionnaire took approximately 20 min to complete.

Statistical analysis

Collected data were analyzed using Social Package for Social Scientist (SPSS) version 21. Incomplete responses were not included for statistical analysis. Analysis carried out include descriptive statistics and analysis of variance (ANOVA) at 95% confidence level. Independent t-test was used to show relationship between age, gender and food safety knowledge while ANOVA was used to find out impact of education on food safety knowledge.

Results and discussion

Demographic responses

Only 90 out of all 100 students that consented to this study have correctly filled the questionnaire (90% response rate). The results of demographic variables showed that 94.4% of the respondents

Table 1
Demographic information of respondents.

Demographic variables	n	%
Age		
21–25 years old	85	94.4
26–30 years old	5	5.6
Gender		
Male	40	44.4
Female	50	55.6
Marital status		
Single	74	82.2
Married	2	2.2
Engaged	13	14.4
Divorced	1	1.1
Year of study		
<1 year	10	11.1
1–2 years	13	14.4
3–5 years	66	73.3
6 years	1	1.1

were within the age range of 21–25 years while 5.6% were between 26–30 years of age as shown in Table 1. However, no significant difference in food safety knowledge was observed between the age groups. Gender status revealed that 55.6% of the respondents were female vs 44.4% male similarly to other studies of Hassan and Dimassi [7] and Takeda et al. [10] that studied food safety knowledge among university students in Lebanon and Japan. Similarly, Ovca et al. [11] and Lazou et al. [12] observed 49.1% and 67.1% responses from female students. Osaili et al. [13] stated that females as future mothers play significant role in prevention of foodborne diseases. In our study, gender did not influence food safety knowledge unlike the study of Hassan and Dimassi [7] demonstrating that both males and females had equal food safety knowledge. While 82.2% of respondents were single, 14.4% were engaged, 2.2% – married and 1.1% – divorced. Educationally, 73.3% of the respondents had education for 3–5 years, 14.4% 1–2 years, 11.1% less than 1 year and 1.1% 6 years.

Food safety knowledge

As shown in Table 2, 94.4% of the respondents were aware of food poisoning. More than 50% of the respondents never experienced food poisoning because of knowing how to prevent it. Similarly, 81.1% of respondents always used gloves while handling food to reduce risk of food contamination. Almost all respondents believed that food poisoning can have significant health and economic effects on the society. A very large proportion (95.6%) of the respondents admitted that children, pregnant women and older individuals are more at risk of food poisoning because they have weak immune systems compared to healthy individuals. In this survey, the majority of the respondents agreed that hand washing before cooking reduces the risk of food contamination while almost three quarters of the respondents believed that washing of hands after handling raw food prevents foodborne disease. Over 95% of the respondents agreed that diarrhea can be transmitted through contaminated food. The majority of the respondents affirmed that microorganisms can be found on the surface of human skin, nose and mouth of healthy handler while 91.1% agreed that personal hygiene can prevent food contamination and that contaminated water can be a vehicle for foodborne disease transmission. More than three quarters (75.6%) of the students supposed that storing raw and cooked food together can cause contamination of food. Of all respondents, 96.7% responded that food handlers having diarrhea, flu and sore throat can pose risk of food contamination. However, 45.6% of the respondents disagreed that leftover food that smells good is still safe to eat. Among the respondents, 86.7%

Table 2
Food safety knowledge among respondents.

No.	Food safety knowledge	Yes		No		I cannot remember		I do not know	
		n	%	n	%	n	%	n	%
B1	Aware of food poisoning	85	94.4	1	1.1	2	2.2	2	2.2
B2	Experienced food poisoning	31	34.4	56	62.2	3	3.3		
B3	Aware of how to prevent food poisoning	86	95.6	1	1.1	1	1.1	2	2.2
B4	Use of gloves while handling food reduces the risk of food contamination	73	81.1	13	14.4	3	3.3	1	1.1
B5	Food poisoning can have health and economic effects on the society	88	97.8	1	1.1	NR	NR	1	1.1
B6	Children, pregnant women and older individuals are more at risk of food poisoning	86	95.6	1	1.1	NR	NR	3	3.3
B7	Hand washing before cooking reduces the risk of food contamination	88	97.8	1	1.1	1	1.1	NR	NR
B8	Washing of hands after handling raw food prevents foodborne disease	67	74.4	16	17.8	4	4.4	3	3.3
B9	Diarrhoea can be transmitted through contaminated food	87	96.7	1	1.1	NR	NR	2	2.2
B10	Microorganisms can be found on the surface of human skin, nose and mouth of healthy handlers	88	97.8	1	1.1	NR	NR	1	1.1
B11	Personal hygiene can prevent food contamination	82	91.1	6	6.7	1	1.1	1	1.1
B12	Contaminated water can be a vehicle for foodborne disease transmission	82	91.1	4	4.4	NR	NR	4	4.4
B13	Storing raw and cooked food together can cause contamination of food	68	75.6	6	6.7	4	4.4	12	13.3
B14	Food handler having diarrhea, flu and sore throat can pose risk of food contamination	87	96.7	NR	NR	1	1.1	2	2.2
B15	Leftover food smelling good is still safe to eat	29	32.2	41	45.6	13	14.4	7	7.8
B16	Dishing, serving and tasting food with unprotected hands can cross contaminate food	78	86.7	9	10.0	1	1.1	2	2.2
B17	Unkempt and dirty nails can easily spread bacteria	89	98.9	1	1.1	NR	NR	NR	NR
B18	Uncovered abrasion or cuts on fingers and hands can cause cross contamination of food	81	90.0	1	1.1	3	3.3	5	5.6
B19	Foodborne illness can be acquired from consumption of contaminated food	85	94.4	3	3.3	NR	NR	2	2.2
B20	Inadequate cooking of raw food like meat, chicken and vegetable can cause outbreak of foodborne illness	71	78.9	12	13.3	3	3.3	4	4.4

NR = no response.

agreed that dishing, serving and tasting food with unprotected hands can cross contaminate food. Almost all respondents came to the understanding that unkempt and dirty nails can easily spread bacteria. In this study, 90% of the students stated that uncovered abrasion or cuts on fingers and hands can cause cross contamination of food. Additionally, 94.4% agreed that foodborne illness can be acquired from consumption of contaminated food and 78.9% of them affirmed that inadequate cooking of raw food like meat, chicken and vegetable can cause outbreak of foodborne illness. The high level of food safety knowledge observed among participants was similar to results of Ferik et al. [14] who established food safety knowledge of university students but unlike the results of the study of Hassan and Dimassi [7].

Food safety practices

Among the respondents, as shown in Table 3, more than 90% frequently wash their hands before and after cooking. Approximately 48.9% of the respondents declared that they sometimes consume food kept at room temperature for long. Those that responded use frequently their hand to cover their mouth while coughing and sneezing were 92.2% of the studied cohort, and 44.4% announced that they—frequently taste and dish out food with unprotected hands. before eating 90% of the respondents frequently wash fruits and vegetables. The share of those who frequently read labels with the use by and/or expiry date of packaged food before purchasing was 72.2% while 48.9% of the respondents frequent read condition of use and storage of packaged food. Half of the students never wash eggs before cooking or frying them. 91.1% of the respondents frequently wash and rinse cutting boards, knives and plates used for raw meat before using them for other food. Almost three quarters of the respondents (73.3%) frequently defrost food outside the refrigerator. 47.8% of the respondents never wear accessories like rings, bracelets when cooking food. More than half (51.1%) never use an apron when cooking. The greater part (54.4%) of the respondents frequently store raw chicken or meat separately from food. The majority of surveyed students (87.8%) frequently wash dishes with detergent and water or in a dishwasher after preparing food and before new usage. Almost all respondents frequently wash their hands before handling raw food (93.3%). The respondents

frequently cover their cut with bandage and use gloves (97.8%) and frequently keep food unrefrigerated for more than 2 h (96.7%). Those that of the respondents frequently protect raw food from insects and rodents were 87.8% and about 66.7% of the respondents frequently protect cooked from insects and rodents.

Food safety attitude

In Table 4, the results of this survey showed that 90% of respondents usually wash hands after going to toilet to prevent cross contamination. For 95% of the respondents, food safety knowledge is important, and 91.1% agreed that consumption of expired food can cause foodborne illness. More than three quarters of the students (77.8%) claimed that defrosted food should not be frozen again while the proportion of these believing that it is not safe to store raw and cooked food together was 63.3%. Cooking cutlery should be properly sanitized to prevent cross contamination according to 96.7% of the respondents. The same percentage of respondents claimed that food and personal hygiene training is important to them. Almost all (92.2%) students claimed that clean hand towels should be used to wipe hands after washing and that it is important to read food label before purchase (93.3%). According to 42.2% of the respondents the best place to store raw meat or chicken in the refrigerator is on the bottom shelf. Less than half of the study cohort (37.8%) affirmed that reheating food could cause cross contamination. The majority however (87.8%) agreed that proper cooking of food could prevent contamination. Eggs should be properly washed before cooking or frying for 45.6% of the respondents while 87.8% say that frequent hand washing help to prevent foodborne disease. More than three quarters of the respondents say that chopping different meat on the same cutting board should be avoided. 95.6% of the respondents believed that bacteria multiply easily at room temperature. More than half of the students (63.3%) agreed that food poisoning is more common in developing than in developed countries. The majority of the respondents did not agree that food preparation area must be cleaned before and after preparing food, that towel used in the toilet can be used in the kitchen (82.2%) and that towel used to clean food contact surfaces could be sometimes used to clean hands (81.1%).

Table 3
Food safety practices among respondents.

No.	Food safety practices	Never		Sometimes		Frequently	
		n	%	n	%	n	%
C1	Do you wash your hands before and after cooking	2	2.2	3	3.3	85	94.4
C2	Do you consume food kept at room temperature for long	31	34.4	44	48.9	15	16.7
C3	Do you use your hand to cover your mouth while coughing or sneezing	2	2.2	5	5.6	83	92.2
C4	Do you taste and dish out food with unprotected hands?	14	15.6	36	40.0	40	44.4
C5	Do you wash fruits and vegetables before eating	NR	NR	9	10.0	81	90.0
C6	Do you read labels with the use by and/or expiry date of packaged food before purchasing	3	3.3	22	24.4	65	72.2
C7	Do you read conditions of use and storage of packaged food	2	2.2	44	48.9	44	48.9
C8	Do you wash eggs before cooking or frying them	45	50.0	25	27.8	20	22.2
C9	Do you wash and rinse cutting boards, knives and plates used for raw meat before using them for other food	NR	NR	8	8.9	82	91.1
C10	Do you defrost frozen food outside the refrigerator	3	3.3	21	23.3	66	73.3
C11	Do you wear accessories like rings, bracelets when cooking food?	43	47.8	22	24.4	25	27.8
C12	Do you use an apron when cooking	46	51.1	34	37.8	10	11.1
C13	Do you store raw chicken or meat separately from food	10	11.1	31	34.4	49	54.4
C14	Do you wash dishes with detergent and water or in a dishwasher preparing food	3	3.3	8	8.9	79	87.8
C15	Do you wash your hands before handling raw food	1	1.1	5	5.6	84	93.3
C16	Do you wash dishes with detergent and water or in a dishwasher after preparing food and before new usage	10	11.1	47	52.2	33	36.7
C17	Do you cover your cut with bandage and use gloves	NR	NR	2	2.2	88	97.8
C18	Do you keep food unrefrigerated for more than 2 h?	NR	NR	3	3.3	87	96.7
C19	Do you protect raw food from insects and rodents	2	2.2	9	10.0	79	87.8
C20	Do you protect cooked food from insects and rodents	6	6.7	24	26.7	60	66.7

NR=no response.

Table 4
Food safety attitudes among respondents.

No.	Food safety attitudes	Correct		Wrong		I cannot remember		I do not know	
		n	%	n	%	n	%	n	%
D1	Washing hands after going to toilet prevents cross contamination	81	90.0	2	2.2	1	1.1	6	6.7
D2	Knowledge about food safety is important to you	86	95.6	1	1.1	1	1.1	2	2.2
D3	Consumption of expired food can cause foodborne illness	82	91.1	5	5.6	NR	NR	3	3.3
D4	Defrosted food should not be frozen again	70	77.8	10	11.1	7	7.8	3	3.3
D5	It is not safe to store raw and cooked food together	57	63.3	17	18.9	4	4.4	12	13.3
D6	Cooking cutlery should be properly sanitized to prevent cross contamination	87	96.7	NR	NR	1	1.1	2	2.2
D7	Food and personal hygiene training is important to you.	87	96.7	1	1.1	NR	NR	2	2.2
D8	Clean hand towels should be used to wipe hands after washing	83	92.2	6	6.7	NR	NR	1	1.1
D9	The best place to store raw meat or chicken in the refrigerator is on the bottom shelf	38	42.2	13	14.4	9	10.0	30	33.3
D10	It is important to read food label before purchase	84	93.3	2	2.2	2	2.2	2	2.2
D11	Reheating food could cause cross contamination	34	37.8	25	27.8	9	10.0	22	24.4
D12	Proper cooking of food could prevent contamination	79	87.8	5	5.6	NR	NR	5	5.6
D13	Eggs should be properly washed before cooking or frying	41	45.6	33	36.7	5	5.6	11	12.2
D14	Frequent hand washing help to prevent foodborne diseases	79	87.8	8	8.9	1	1.1	2	2.2
D15	Chopping different meat on the same cutting board should be avoided	68	75.6	9	10.0	3	3.3	10	11.1
D16	Bacteria multiply easily at room temperature	86	95.6	1	1.1	2	2.2	1	1.1
D17	Food poisoning is more common in developing countries than developed countries	57	63.3	14	15.6	8	8.9	11	12.2
D18	Food preparation area must be cleaned before and after preparing food	16	17.8	74	82.2	NR	NR	NR	NR
D19	Towel used in the toilet can be used in the kitchen	16	17.8	74	82.2	NR	NR	NR	NR
D20	Towel used to clean food contact surfaces should be used to clean hands	15	16.7	73	81.1	1	1.1	1	1.1

NR=no respons.

Effect of age on food safety knowledge among respondents

The results of the independent t-test showed no significant relationship between age and food safety knowledge ($df=88$, $t=0.831$, $p>0.05$), Table 5. food safety knowledge mean score among respondents between 21–25 years of age was 75.45 ± 4.84 while the mean of food safety knowledge score among those in the age range 26–30 years was 73.60 ± 4.51 . The findings also revealed that age did not influence responses on food safety practices ($df=88$, $t=-1.281$, $p>0.05$). The mean score of food safety practices among respondents aged between 21–25 years was 50.46 ± 3.66 vs 52.60 ± 2.97 for those aged between 26–30 years. The statistical test showed no significant association between food safety attitudes and age ($df=88$, $t=-0.712$, $p>0.05$). Mean food safety attitude score among respondents aged between 21–25 years was 71.05 ± 7.32 while for those aged between 26–30 years was 73.40 ± 2.97 .

Effect of gender on food safety knowledge

The findings demonstrated lack of significant association between gender and food safety knowledge ($df=87.80$, $t=1.66$, $p>0.05$), Table 5. The mean score of food safety knowledge among males was 76.25 ± 4.03 versus 74.62 ± 5.30 for females. There was no significant relationship between food safety practices and gender ($df=88$, $t=-1.11$, $p>0.05$) of males (50.10 ± 4.56) and females (50.96 ± 2.70). The findings disclosed there is no statistically significant relationship between food safety attitudes and gender ($t=0.79$, $df=88$, $p>0.05$). Food safety attitudes mean scores among male and female were 71.85 ± 8.80 and 70.64 ± 5.57 , respectively.

Effect of years of education on food safety knowledge

The results of one-way ANOVA show there is no significant association between food safety knowledge and education

Table 5
Effect of age, gender and years of education on food safety knowledge.

	Age		Gender			Years of education			
		Mean score	SD		Mean score	SD	Mean score	SD	
Food safety knowledge	21–25 years old	75.45	4.84	Male	76.25	4.03	<1 year	75.70	5.17
	26–30 years old	73.60	4.51	Female	74.62	5.30	1–2 year	75.69	4.17
Food safety practices	21–25 years old	50.46	3.66	Male	50.10	4.56	3–5 year	75.22	4.95
	26–30 years old	52.60	2.97	Female	50.96	2.70	<1 year	50.90	4.51
							1–2 year	51.54	2.60
							3–5 year	50.34	3.70
Food safety attitudes	21–25 years old	71.05	7.32	Male	71.85	8.80	<1 year	71.90	4.31
	26–30 years old	73.40	2.97	Female	70.64	5.57	1–2 year	73.15	3.16
							3–5 year	70.69	7.99

($df=0.054$, $p>0.05$), Table 5. The mean score of food safety practice among respondents who had education for less than 1 year was 50.90 ± 2.60 , followed by the 1–2 year group (51.54 ± 2.60) and 3–5 year group (50.34 ± 3.70). The findings proved no significant association between education and food safety practices ($df=0.754$, $p>0.05$). Food safety practices mean score among respondents who had education less than 1 year was 50.90 ± 4.51 , 1–2 year -51.54 ± 2.60 and 3–5 year -50.34 ± 3.70 . According to the results, food safety attitudes and education were not strongly correlated ($df=0.725$, $p>0.05$).

Conclusion

Although this study is limited with respect to the number of respondents, it gives an insight and direction of further studies on food safety awareness and practice. It showed that the years of study had a direct influence on food safety knowledge among participants. However, despite the high level of awareness of food safety that of the practice was low. Age and gender had no effect on awareness of food safety. Therefore, there is need for practical food safety education among the participants. Similarly, there is need to extend this study to other students in Bulgarian universities. Moreover, implementable policies on food safety in Bulgaria is recommended.

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Competing interests

None declared.

Ethical approval

Not required

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