

Uncovering Zoonosis Awareness among Students and Employees in Jordan University

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Abstract: This study aims to determine the level of knowledge of consumers on two types of zoonotic diseases (*Brucellosis* and *listeriosis*) and the level of awareness of the pathogens causing this kind of food zoonosis and their method of transmission to humans. The research sample consisted of 2185 students and 320 employees from Jordan University, the research sample was collected using an online questionnaire, students from the college of agriculture helped to clear and simplify the questions to the participants. The data were analyzed using SPSS 17 for windows. Chi square test was applied in order to determine whether a statistical difference between the participants existed or not. This paper investigates Jordan's consumers' awareness of two major microbial food- zoonotic diseases (*Brucellosis* and *listeriosis*) as important zoonotic problems. The awareness varies among pathogens and the variations appear to be related to differences in the number and severity of illnesses associated with these pathogens, a pretested self-administered questionnaire was used anonymously among representative samples among university students from the college of agriculture. According to the current study 58.1% of the sample knows what a zoonotic disease is, 68.5% know that pathogens could be associated with food, 24.3% know that the presence of *Brucella* pathogens in food can cause disease, while 25.4% know about its mode of transmission, 22.6% have heard of *Listeriosis* while 26.0% of the sample know about its mode of transmission.

Key words: Awareness • Zoonotic • *Brucellosis* • *Listeriosis* • Jordan

INTRODUCTION

Zoonosis, diseases and infections that are naturally transmissible between vertebrate animals and humans, are among the most frequent and dreaded risks to which mankind are exposed. The emergence and re-emergence of zoonosis and its potentially disastrous impact on human health are a growing concern around the globe [1].

More than 6 out of 10 human infectious diseases come from animals (Zoonosis), Zoonotic diseases tend to be most prevalent in places where awareness about the disease, prevention and control are low [2].

Brucellosis is the commonest zoonotic disease with worldwide expansion, representing a serious public health problem in many countries, especially those around the Mediterranean Sea, Middle East and South America [3]. *Brucellosis* is a highly contagious zoonotic disease affecting humans and a wide range of animals, including

all domestic ruminants. There are ten known *Brucella* species and five of them have been isolated from human cases. The World Health Organization [4] estimates that more than 500,000 new human cases of *brucellosis* occur worldwide annually; however, the number is probably underestimated because of underreporting and misdiagnosis. The vast majority of human cases are acquired through consumption of contaminated dairy products or contact with infected animals, in particular ruminants, thus the control of ruminant *brucellosis* is key to the prevention of human infection [5].

Listeriosis is a bacterial zoonotic infection caused by *Listeria monocytogenes* [6] *Listeria monocytogenes* was isolated from brined white cheese (BWC) sold in Jordan [7]. Awaisheh [8] confirmed cases of *L.monocytogenes* in ready to eat meals using the PCR, this study aimed to find out the level of awareness against foodborne zoonotic diseases (*Brucellosis* and *Listeriosis*).

MATERIALS AND METHODS

Sampling: University instructors from different colleges in Jordan University were invited via email to recruit students in their introductory level general education courses to complete the online survey. Employees in the university were also invited to complete the online survey via email. The online survey was shared in different Facebook groups by students in the college of agriculture. Most participating instructors awarded extra credit points to students that completed the survey. From January 2015 to June 2016.

Questionnaire and Data Collection: The questionnaire was designed by Dr. Firas Hayajneh, in the Department of animal production Jordan University according to relevant literatures [9, 10] the questionnaire was reviewed by members of the college of agriculture, the questionnaire was pre-tested among 100 people who did not participate in the study and was modified as necessary.

The questionnaire consisted of 38 questions in three sections. The first section included sample demographic characteristics, including age, sex, education, occupation, marital status, place of residency, high school education stream, college of study, year of study.

The second and third parts of the questionnaire was adapted from published, reliable and valid questionnaire (The coefficient of reliability was 0.92) to assess students' knowledge about basic food safety principles and foodborne pathogens and diseases [9]. The second section involved items that related to participants awareness of foodborne zoonosis, the third part involved specific questions about the two infectious diseases *brucellosis* and *listeriosis* (Table 1).

The questions were related to knowledge of the disease and its mode of transmission, the answers were (Yes I know the disease or its mode of transmission to man, no I don't know the disease or its mode of transmission).

Methods: An online questionnaire was designed to be used anonymously, validated and pretested, then reviewed by experts from the college of agriculture/ Jordan University the questionnaire was originally drafted in Arabic and was tested for consistency. The structured survey was developed to elicit the general information of food poisoning, food-borne diseases, causes of food poisoning and the methods of transmission of *brucellosis* and *listeriosis* in Jordan during the period From January 2015 to June 2016.

Table 1: Questions asked to students and employees in Jordan University.

		N	%
1. Do you know what is a zoonotic disease	Yes	1455	58.1
	No	1050	41.9
2. Do you know what causes zoonotic diseases	Yes	1360	54.3
	No	1139	45.5
3. Do you know that zoonotic diseases caused by microbes like (<i>Brucella</i> and <i>Listeria</i>)	Yes	1451	57.9
	No	1035	41.3
4. Do you know which pathogens are common between man animal	Yes	1826	72.9
	No	679	27.1
5. Do you know that these microbes can be introduced to man through contaminated food	Yes	1715	68.5
	No	790	31.5
6. Do you know that zoonotic diseases can be transferred to man through direct contact with infected animal	Yes	1451	57.9
	No	1035	41.3
7. Which type of food is associated with foodborne zoonosis	Food of animal origin (Milk, meat, eggs)	651	26.0
	Food of plant origin (Vegetables and fruits)	1854	74.0
8. Have you heard of Brucellosis	Yes	609	24.3
	No	1896	75.7
9. Do you know that <i>brucellosis</i> could be introduced to man through food contaminated with these pathogens (<i>Brucella</i>)	Yes	636	25.4
	No	1869	74.6
10. Have you heard of <i>Listeriosis</i>	Yes	565	22.6
	No	1940	77.4
11. Do you know that <i>Listeriosis</i> could be introduced to man through food contaminated with these pathogens (<i>Listeria</i>)	Yes	651	26.0
	No	1854	74.0
12. How often do you consume food from restaurants (Shawarma, falafel)	1/week	773	30.9
	2 times/week	683	27.3
	>2 times a week	754	30.1
	Nil	292	11.7

A total of 2505 students employees were randomly selected from different cities in Jordan. The questionnaire was prepared in such a way that questions and responses were simple and direct. The representative samples (Students and employees) filled up the questionnaire, with help from the students who participated in the pilot study. The representative samples took about 10–15 min to help complete the questionnaire. A pilot study using 100 questionnaires, which were collected from students from the college of agriculture using face to face interviews, was used to evaluate and modify the questions in the questionnaire. These students helped in the process of collecting the questionnaires later on.

Statistical Analysis: The data collected was properly coded and entered into an excel spreadsheet, which was entered later on into SPSS version 17; SPSS Inc. Chicago.

The independent variables were tested for significance using the chi square test, the variables (High school type, Education, College of study, how often do you eat ready to eat food) were found to significant ($p < 0.05$). Binomial logistic regression was used to rank the most significant independent (Factors or predictors) variables. Using the Hosmer –Lemeshow goodness-of-fit test the independent variables (High school type, Education, College of study, How often do you eat ready to eat food) were found to significant ($p < 0.05$).

RESULTS

The responses to questions (Have you heard of *brucellosis*/ *Listeriosis*, can *brucellosis*/ *Listeriosis* be transmitted to man through his food) are shown in Table 1. 24.3% of the respondents heard of *brucellosis* and 25.4% know that it can be transported to man through his food, on the other hand 77.4% of the respondents haven't heard of *listeriosis* and don't know that it could be transported to man through his food. (Table 1)

Demographic Characteristics of Respondents: A total of 2505 students and employees participated in the investigation. Ages of the study participants ranged from 18 and 57 years. About half of the subjects (53.4%) of subjects were females, 57.5% of the students came from the capital city Amman. 72.7% of the participants were single. 47.1% of the students passed the scientific stream of the secondary education. 57.7% came from the capital city Amman. (Table 2).

Table 2: Demographic characteristics of the participants

Characteristic	N	%
Age group, years		
19~24	1718	68.5
25~35	468	18.7
36~50	293	11.7
≥51	26	0.01
Gender		
Male	1174	46.9
Female	1331	53.1
Education		
Basic	216	8.6
Secondary	461	18.4
Bachelor degree	1676	66.9
Higher studies	152	6.1
Residency		
Amman	1495	59.6
Zarqa	268	10.7
Irbid	200	8
Al Balqa	180	7.2
Ajloun	55	2.2
Jerash	192	7.7
Mafraq	36	1.4
Kerak	38	1.5
Tafelah	14	0.06
Maan	16	0.06
Aqaba	11	0.04
Occupation		
Employee	320	13
Student	2185	87
Work in other sector	290	9.1
Work in agricultural sector	30	15.2
Other	1902	75.7
Marital status		
Married	383	27.3
Single	1822	72.7

Factors Associated with Knowledge of Brucellosis: All factors were tested using the chi square test. The factors (Education, high school type, college of study, How often do you eat ready to eat food) showed significance ($p < 0.05$) (Data not shown in tables).

Binomial logistic regression analysis indicated that educational level, high school type, college of study for students and how often a person consumes ready to eat food were predictors of awareness of *brucellosis* (Table 3).

Binomial logistic regression analysis indicated that educational level, high school type, college of study for students and how often a person consumes ready to eat food were predictors of awareness of *brucellosis* mode of transmission (Table 4).

Table 3: Factors associated with general knowledge of brucellosis

Characteristic	N		Yes	No	Odds ratio	P value	95% C.I. for odds ratio	
							Lower	Upper
How often do you eat ready to eat food	2505	1/wk	175	598	1.335	$P \leq 0.05$	0.897	1.986
		2/wk	173	510	1.065	$P \leq 0.05$	0.710	1.598
		>2/wk	185	569	1.130	$P \leq 0.05$	0.750	1.701
		Nil	75	217	1.00	$P \leq 0.05$	0.861	1.653
Education	2505	Basic school	40	176	1.00	$P \leq 0.05$	1.072	4.208
		High school	69	392	2.124	$P \leq 0.05$	1.400	4.751
		Bachelor	440	1236	2.579	$P \leq 0.05$	1.107	3.300
		Higher studies	60	92	1.911	$P \leq 0.05$	0.00	0.00
High school	2505	Agricultural	108	129	0.640	$P \leq 0.05$	0.404	0.969
		Scientific	324	857	0.873	$P \leq 0.05$	0.783	1.488
		Literature	78	424	0.626	$P \leq 0.05$	0.874	1.892
		Other	99	486	1.00	$P \leq 0.05$	0.804	1.366
College of study	2505	Medicinal	175	71	0.508	$P \leq 0.05$	1.988	1.621
		Scientific	604	334	0.720	$P \leq 0.05$	0.00	0.00
		Other		321	1.00	$P \leq 0.05$	0.00	0.00

Dependent variable=knowledge of brucellosis, means difference $P \leq 0.05$, Hosmer limshow test results ($X^2 = 12.06$, $df=7$, $Sig=0.061$)

Table 4: knowledge of food-borne transmission of brucellosis

Characteristic	N		Yes	No	Odds ratio	P value	95% C. I. for odds ratio	
							Lower	Upper
How often do you eat ready to eat food	2505	1/wk	183	590	0.895	$P \leq 0.05$	0.922	2.031
		2/wk	190	493	1.076	$P \leq 0.05$	0.695	1.552
		>2/wk	186	568	1.062	$P \leq 0.05$	0.773	1.738
		Nil	76	216	1.00	$P \leq 0.05$	0.00	0.00
Education	2505	Basic school	54	162	1.590	$P \leq 0.05$	0.408	1.562
		High school	76	385	1.610	$P \leq 0.05$	0.793	2.704
		Bachelor	436	1240	1.205	$P \leq 0.05$	0.726	2.198
		Higher studies	70	82	1	$P \leq 0.05$	0.00	0.00
High school type	2505	Agricultural	110	127	0.758	$P \leq 0.05$	0.358	.857
		Scientific	336	845	0.826	$P \leq 0.05$	0.737	1.397
		Literature	81	421	0.983	$P \leq 0.05$	0.862	1.869
		Other	109	476	1.00	$P \leq 0.05$	0.00	0.00
College of study	2505	Medicinal	176	108	0.867	$P \leq 0.05$	1.568	2.354
		Scientific	541	397	0.826	$P \leq 0.05$	0.00	0.00
		Other	238	725	1.00	$P \leq 0.05$	0.00	0.00

Dependent variable=knowledge of brucellosis, means difference $P \leq 0.05$, Hosmer and Lemeshow Test ($X^2 = 6.14$, $df= 7$, $X^2 = 0.524$)

Table 5: General knowledge of Listeriosis

Characteristic	N		Yes	No	Odds ratio	P value	95% CI for Odds ratio	
							Lower	Upper
How often do you eat ready to eat food	2505	1/wk	164	610	1.240	$P \leq 0.05$	0.823	1.867
		2/wk	167	515	0.964	$P \leq 0.05$	0.637	1.456
		>2/wk	168	586	1.033	$P \leq 0.05$	0.682	1.566
		Nil	65	227	1.00	$P \leq 0.05$	0.859	1.657
Education	2505	Basic school	43	174	1.041	$P \leq 0.05$	0.510	2.126
		High school	59	402	1.093	$P \leq 0.05$	0.578	2.067
		Bachelor	412	1263	1.063	$P \leq 0.05$	0.597	1.894
		Higher studies	51	101	1.00	$P \leq 0.05$	0.00	0.00
High school	2505	Agricultural	99	138	0.783	$P \leq 0.05$	0.496	1.237
		Scientific	311	870	0.811	$P \leq 0.05$	0.584	1.126
		Literature	67	435	1.264	$P \leq 0.05$	0.844	1.892
		Other	86	497	1.00	$P \leq 0.05$	0.00	0.00
College of study	2505	Medicinal	180	64	0.432	$P \leq 0.05$	0.809	1.848
		Scientific	547	260	0.872	$P \leq 0.05$	0.301	.619
		Other	856	278	1.00	$P \leq 0.05$	0.00	0.00

Dependent variable=knowledge of brucellosis, means difference $P \leq 0.05$, Hosmer and Lemeshow Test ($X^2 = 14.45$, $df= 7$, $Sig= 0.068$)

Table 6: knowledge of food-borne transmission of Listeriosis

Characteristic	N		Yes	No	Odds ratio	P value	95% C. I. For odds ratio	
							Lower	Upper
How often do you eat ready to eat food	2505	1/wk	191	582	1.00	$P \leq 0.05$	1.121	2.506
		2/wk	194	489	1.066	$P \leq 0.05$	0.860	1.942
		>2/wk	187	567	1.222	$P \leq 0.05$	0.844	1.914
		Nil	78	214	1.297	$P \leq 0.05$	0.807	1.566
High school	2505	Agricultural	105	132	0.669	$P \leq 0.05$	0.639	1.605
		Scientific	345	836	0.919	$P \leq 0.05$	0.680	1.319
		Literature	93	409	0.65	$P \leq 0.05$	0.789	1.753
		Other	108	477	1.00	$P \leq 0.05$	0.00	0.00
Education	2505	Basic school	62	154	1.00	$P \leq 0.05$	0.765	3.130
		High school	73	388	1.297	$P \leq 0.05$	0.895	3.146
		Bachelor	452	1224	1.126	$P \leq 0.05$	0.733	2.259
		Higher studies	64	88	1.42	$P \leq 0.05$	0.00	0.00
College of study	2505	Medicinal	180	64	0.840	$P \leq 0.05$	0.856	1.951
		Scientific	587	260	0.656	$P \leq 0.05$	0.375	0.778
		Other	856	238	1.00	$P \leq 0.05$	0.00	0.00

Dependent variable=knowledge of brucellosis, means difference $P \leq 0.05$, Hosmer and Lemeshow Test ($X^2=12.41$, $df=7$, $sig=0.88$)

Binomial logistic regression analysis indicated that educational level, high school type, college of study for students and how often a person consumes ready to eat food were predictors of awareness of *Listeriosis* (Table 5).

Binomial logistic regression analysis indicated that educational level, high school type, college of study for students and how often a person consumes ready to eat food were predictors of awareness of *Listeriosis* mode of transmission (Table 6)

DISCUSSION

The role of university students studying in different colleges in preventing food-borne zoonotic diseases is very crucial to Jordanian community; these students will be working in different positions in governmental and private sector and will be the future decision makers in Jordan.

The female students have an extra role in the prevention of food borne zoonotic diseases in Jordan because of their future roles as mothers and food preparers for household members [11].

This study was a population-based cross-sectional study, utilising a representative sample design and based on an online survey; the goal of the study was to assess whether university students and employees have knowledge of *Brucellosis* and *Listeriosis* as food-borne zoonotic diseases and the method of transmission of these food-borne diseases.

The study revealed that the majority of the sample in this study have low information about *brucellosis* and *listeriosis*. *Listeria monocytogenes* was found in Shawrma

meals [12] and *Brucellosis* is considered endemic in many Middle Eastern countries including Jordan [5] for this reason good education through possible media like television radio and other media like the social networks (Facebook, Twitter,...) are an urgent need to help protect Jordanian population from the dangers hidden behind the delicious looking ready to eat meals.

Listeria monocytogenes is a serious foodborne pathogen that has been isolated from different dairy food products; several foodborne outbreaks of *listeriosis* have been associated with consumption of cheese [7, 14]. *L. monocytogenes* was isolated from 41 samples (17.1%): 23 from beef and 18 from poultry samples [8].

The majority of studies investigating food safety awareness in different continents revealed that young people are in need of information regarding the safety of their food [9, 13].

Young consumers in Turkey scored 58.1 points for food safety awareness [15]. Sharif and Al-Malki [16] reported a good food poisoning knowledge percentage score for Taif University students, Saudi Arabia (75%); but it was found that students had low knowledge on some important factors related to food poisoning.

The current study used the same validated questionnaire used by Byrd-Bredbenner [9] and reported similar high knowledge for young adults with education beyond high school, they also found that participants had less knowledge about common foodborne disease pathogens, which is similar to our findings. (Tables 3- 6).

University students who had passed the agricultural stream secondary school exam are more aware of the food borne problems, also it is clear from the results in

Tables (3-6) that the education level has a role in determining the level of awareness of food-borne pathogens. The college of study has also a role in determining the knowledge students have about foodborne diseases, students from medicinal colleges had more knowledge about food-borne diseases Tables (4-6).

In this study, respondents were more aware of *brucellosis* than *listeriosis*, 24.3% of the sample have heard of *brucellosis* and 25.4% understand its mode of transmission, on the other hand 22.6% of the sample have heard of *listeriosis* and 26% understand its mode of transmission (Tables 3- 6)

CONCLUSIONES

This study demonstrated that the present level of awareness of food-borne zoonosis caused by *Brucella* and *Listeria spp* in Jordan among Jordan University students and employees is still very low; further effective health education campaigns for major infectious diseases are urgently needed. In addition, older and less educated individuals were less knowledgeable about these diseases which indicate a need to educate these people against such an important issue that threaten their lives through media. Education programs should target these individuals and provide more acceptable patterns of publicity for them. This study might also be useful for planning policies for the prevention and control of major infectious diseases.

A campaign to educate the public about foodborne zoonotic diseases should be done because more people depend on ready to eat foods in Jordan like Humos, Falafel, Sawarma. University students from colleges having more knowledge about these problems like agriculture college students can have a role in these campaigns.

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