



Original Article

Evaluation of Knowledge and Practices of Individuals Living with Livestock on Brucellosis: A Study from Eastern Anatolia Region, Turkey

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Abstract

Brucellosis is one of the most important zoonoses, which can be seen at higher risk, especially in livestock. This study aimed to evaluate the demographic characteristics and practices of people occupied in livestock on brucellosis. This cross-sectional survey was conducted between February 2023 and May 2023. The participants were asked questions about their socio-demographic information, level of knowledge about brucellosis, and basic practices during livestock. The mean age of the 204 participants included in the study was 41.53 ± 15.66 years, and 64.7% (n=132) were male. Most participants were shepherds (45.1%). While all participants stated that they had heard of brucellosis and that the disease was transmitted from animals to humans, 12 (5.9%) stated that they had brucellosis before. No participants had received training on brucellosis. While all participants thought that brucellosis could be transmitted by consuming milk directly without boiling it, 98% thought that brucellosis could be transmitted from cheese made without boiling milk, and 96.6% from butter. The proportion of those who thought that the disease could be transmitted by touching abortion material or sick animals with bare hands was low (7.8% and 3.9%, respectively). The fact that the participants had some incorrect information and approaches about foodborne transmission, that they had not received any training on zoonotic infections, that they did not comply with the hygiene rules in contact with waste material, and that wrong practices in the case of new animal participation in the herd reveals that more information and action is needed for the eradication of brucellosis.

Keywords: Brucellosis, Contagion, Livestock, Dairy products, Zoonosis

Introduction

Brucellosis is an important zoonotic disease that is widespread in humans and animals (Dadar et al., 2021). With approximately 500,000 new human brucellosis cases reported each year, it is a major health problem in many regions, especially in the Middle East and Southeast Asian countries (Dadar et al., 2018; Dadar et al., 2021). The disease affects all age groups and both sexes. While great progress has been made in controlling the disease in many countries, there are still regions where the infection persists in domestic animals, so transmission to the human population occurs frequently. Furthermore, the expansion of the livestock industry, rapid urbanization, and lack of hygiene measures in livestock and food processing are reasons why brucellosis remains a public health hazard (Corbel et al., 2006). Human brucellosis is frequently caused by *Brucella melitensis*, *Brucella abortus*, and *Brucella suis species*. These pathogens are intracellular, persistent in the host animal, and can be carried for life. Brucellosis affects mostly sexually active livestock and can cause late-trimester abortions, weakening of offspring, placentitis and epididymitis, and infertility. While sick animals shed the pathogenic microorganism with uterine discharge, vaginal discharge, and milk, it may spread to other animals in the herd by ingestion of contaminated material (Arif et al., 2017; Yagupsky and Baron, 2005; Ficht, 2003; England et al., 2004; Bercovich, 1998). Clinically, in humans, corrugated fever, night sweats, chills, fatigue, headache, and arthralgia are common symptoms in the acute phase. After multiplying in the lymphatic tissue, the bacteria can spread through the bloodstream and multiply in the kidney, liver, spleen, or joints, causing both localized and systemic infections. Any tissue or system in the body may be involved (Kydyshov et al., 2022).

The risk group for brucellosis includes animal breeders, veterinarians, farmers, slaughterhouse workers, butchers, shepherds, those working in the meat industry or in laboratories, while the disease is more common in those who consume fresh milk

and dairy products and those living in rural areas (Özcan and Şahin, 2012; Babaoğlu and Demir, 2017). There are many reasons for the prevalence of brucellosis in Turkey. Some of these reasons include a lack of recognition of symptoms in animals, inadequate protection and control measures, lack of notification of sick animals to the relevant units, and insufficient knowledge of the society about the ways of transmission and prevention of the disease (Büke, 2000). In this study, it was aimed to evaluate the demographic characteristics, knowledge levels, and practices about brucellosis of people who were engaged in animal husbandry and who applied to Bingöl State Hospital.

Materials and method

Study area

The study was conducted from February 2023 and May 2023 around Bingöl town and its surrounding area, which is located in Eastern Anatolia Region, Turkey. Bingöl province is located between 38°27' and 40°27' east longitude and 41°20' and 39°54' north latitude in the Upper Euphrates section of the Eastern Anatolia Region, with an area of 8,125 km². Bingöl is bordered by Muş to the east, Erzincan and Erzurum to the north, Elazığ and Tunceli to the west, and Diyarbakır to the South. It is known that agriculture and animal husbandry are common sources of livelihood in this province (URL 1).

Study protocol

This cross-sectional survey was conducted as a face-to-face interview. Individuals over the age of 18 years who applied to Bingöl State Hospital between February 2023 and May 2023 and who were engaged in animal husbandry were included in the study.

Since there hasn't been any research on brucellosis in the area chosen for the study, the necessary sample size was calculated using the assumption that 50% of the population is aware of the disease. As a result, the sample size was calculated with

0.05 absolute precision and a 95% confidence interval. Cochran's sample size formula for categorical data is used to calculate this (Bartlett, 2001). Where t is the value for each tail at the chosen alpha level of 0.025 or 1.96. This presumption led to the inclusion of 384 individuals in total for the study. Although 384 people were asked to complete the questionnaire, only 212 people agreed to answer the survey questions. In addition, 8 participants who answered less than 50% of the survey questions were excluded from the research sample.

Participants were informed about the purpose of the study and that it was voluntary. The questionnaire form consisted of two parts. The first part included questions about the socio-demographic information of the participants (age, gender, occupation, educational status, etc.); the second part included questions about their level of knowledge about brucellosis and their basic practices during animal husbandry.

Statistical Analysis

The data obtained as a result of the study were transferred to the computer and analyzed with SPSS (Statistical Package for Social Sciences) 16.0 package program. In descriptive analyses, frequency data were given as number (n) and percentage (%), and numerical data were given as arithmetic mean \pm standard deviation (minimum-maximum). The chi-square test and Fisher's exact chi-square test were used to compare categorical data. The statistical significance level was accepted as $p < 0.05$ for all tests.

Results

The mean age of the 204 participants included in the study was 41.53 ± 15.66 years, 64.7% ($n=132$) were male, and 35.3% ($n=72$) were female. The majority of the participants stated that they lived in the village (73%), 49.5% were primary school graduates, and 39.7% had never attended school. In

terms of occupation, 45.1% were shepherds, and 35.3% were farmers. Cows (30.9%) and cattle (18.6%) were the most regularly fed animal species as livestock among the participants (Table 1).

All of the participants stated that they had heard of brucellosis and that the disease is transmitted from animals to humans, while 12 (5.9%) stated that they had had brucellosis before. Half of the patients who had brucellosis stated that they continued to consume unboiled milk or dairy products. All of the participants stated that they had not received any education about diseases transmitted from animals to humans. 100% of the participants thought that brucellosis could be transmitted from direct consumption of unboiled milk, 98% from cheese made without boiling, 96.6% from butter, and 78.4% from yogurt made without boiling. The proportion of those who thought that the disease could be transmitted by touching abortion material or sick animals with bare hands was low (7.8% and 3.9%, respectively) (Table 2).

Eight (3.9%) of the participants stated that their livestock had brucellosis (62.5% ovine and 37.5% bovine). Of those whose animals had brucellosis, 62.5% stated that they did not know what kind of symptoms the disease showed in animals. While 194 (95.1%) of the participants stated that they slaughtered their animals in case of disease for any reason, no participant said that they would take the sick animal to the veterinarian. Five of the participants reported that their animals had had a litter, that they disposed of the waste materials by burying them deep in the soil, and that they did not use gloves during this process. Of the 105 participants who milked, 95 (90.5%) milked with bare hands, and 10 (9.5%) milked with a machine, and all participants stated that they washed their hands after milking. When asked about their attitudes when a new animal was to be added to the herd, 96.2% said that they immediately added the animal to the herd, while 3.8% said that they kept the new animal separated from the herd for two weeks and added the new animal to the herd after there was no negative situation (Table 3).

Table 1. Demographic characteristics of the participants, their occupations, and the types of livestock

Variables		n (%)
	Age (years); (mean±SD; min-max)	41.53±15.66 (18-81)
Gender	Female	72 (35.3)
	Male	132 (64.7)
Marital status	Married	191 (93.6)
	Single	13 (6.4)
Place of residence	District	55 (27)
	Village	149 (73)
Childbearing status	No	17 (8.3)
	one child	35 (17.2)
	two children	55 (27)
	three children	30 (14.7)
	≥ four children	67 (32.8)
Education status	None	81 (39.7)
	Primary School	101 (49.5)
	Middle School	17 (8.3)
	High School	4 (2)
	University	1 (0.5)
Occupation	Shepherd	92 (45.1)
	Farmer	72 (35.3)
	Housewife	16 (7.8)
	Other	24 (11.8)
Type of livestock	Cow	63 (30.9)
	Cattle	38 (18.6)
	Sheep	26 (12.7)
	Goat	16 (7.8)
	More than one type of livestock	61(29.9)

Regarding the availability of vaccination for brucellosis in animals, the majority of the participants (95.6%) stated that they had heard about the vaccine, and 25 (25%) of them stated that they had brucella vaccination for their animals. The distribution of information about brucellosis transmission routes was statistically similar in the groups of participants with and without previous brucellosis ($p>0.05$). There was no significant difference in terms of correct responses and practices between the gender groups; however, males had a higher level of correct responses regarding transmission through yogurt (Table 4). The comparison of brucellosis knowledge status

according to the educational status of the participants is presented in Table 5. The rate of having their animals vaccinated against brucellosis and treating sick animals was found to be statistically significantly higher in the participants who graduated from any school compared to the participants who did not graduate from any school (p values; $p=0.028$; $p=0.033$, respectively). The rate of separating the animal that miscarriage from other animals was found to be statistically significantly lower in the participants who graduated from any school compared to the participants who did not graduate from any school ($p=0.041$).

Table 2. Participants' knowledge about brucellosis and brucellosis transmission

Variables	n, (%)
Have you heard of brucellosis before? (Yes)	204 (100)
Where did you get your information about brucellosis?	
From a doctor	153 (75)
Family members	31 (15.2)
From neighbors	12 (5.9)
Relatives	6 (2.9)
From the veterinarian	2 (1)
Have you ever had brucellosis? (No)	192 (94.1)
Has anyone in your family ever had brucellosis? (No)	135 (66.2)
Can brucellosis be transmitted from animals to humans? (Correct answer)	204 (100)
Can brucellosis be transmitted from cheese made without boiling milk? (Correct answer)	200 (98)
Can the disease be transmitted if cheese made after boiling milk is consumed at an early stage without having to be salted for a certain period of time? (Correct answer)	31 (15.2)
Can you get brucellosis from yogurt made without boiling milk? (Correct answer)	44 (21.6)
Can brucellosis be transmitted from butter made without boiling milk? (Correct answer)	197 (96.6)
Can brucellosis be transmitted from cream made without boiling milk? (Correct answer)	202 (99)
Can you get brucellosis by drinking milk without boiling it? (Correct answer)	204 (100)
Can you get brucellosis from eating herbed cheese? (Correct answer)	29(14.2)
Can you get brucellosis from poorly cooked red meat? (Correct answer)	5 (2.5)
Can brucellosis be transmitted by touching the miscarried fetus, its membranes, and uterine fluid with bare hands? (Correct answer)	16 (7.8)
Can brucellosis be transmitted by touching brucellosis-infected animals with bare hands? (Correct answer)	196 (96.1)

Discussion

Brucellosis is an endemic zoonosis in Turkey, especially in Central Anatolia, Eastern and Southeastern Anatolia regions. According to national data, although the number of patients has decreased in certain periods, human and animal brucellosis has not yet been brought under control (Atay and Metintaş, 2018; TR Ministry of Health General Directorate of Public Health, 2023). The objective of this single-center study was to evaluate the brucellosis knowledge, practices, and demographic traits of individuals who work in animal husbandry whom live in the Eastern Anatolia Region, Turkey. Possible common routes of transmission of brucellosis are acquisition of infection from a contaminated environment, occupational exposure, and foodborne transmission. Foodborne transmission is the main source of transmission for urban populations. Consumption of fresh milk or products prepared

from unboiled milk is the main source of infection for most populations. Sheep, goat, cow, or camel milk contaminated with *B. melitensis* is particularly dangerous if consumed in large volumes, as it may contain a high concentration of microorganisms. Cream, butter, or ice cream prepared from such milk also carries a high risk. Soft cheeses made from sheep or goat milk with the addition of rennet are a common source of infection, especially in the Middle East and Mediterranean countries. Such cheeses should be stored in cool conditions for at least six months before consumption. Yogurt and sour milk are less dangerous (Corbel et al., 2006). Also, *Brucella* genus bacteria are zoonotic pathogens that cause abortion and fetal loss in animals (Hajibemani and Sheikhalislami, 2020). According to a study conducted in Iran (Moosavy et al., 2018), the primary factors contributing to the risk of human brucellosis were identified as occupation, food consumption, and easy availability of

unpasteurized milk. These findings highlight the inadequate understanding of the disease, especially in urban regions of Iran (Moosavy et al., 2018).

Table 3. Participants' knowledge of brucellosis symptoms in livestock and their practices for situations where the risk of brucellosis increases

Variables	n (%)
Have your animals been diagnosed with brucellosis (confirmed by a veterinarian)? (No)	196 (96.1)
Which of kind your animals were diagnosed with brucellosis?	
Goat	4 (50)
Cow	3 (37.5)
Sheep	1 (12.5)
How did you know your livestock had brucellosis? (n=8)	
I didn't know (Veterinarian diagnosed)	5 (62.5)
There was a miscarriage of livestock	1 (12.5)
Fertility decreases/infertility occurs	1 (12.5)
The milk of the animal decreases	1 (12.5)
What do you do when your animals get sick for any reason?	
I'll slaughter the animal right now	194 (95.1)
Nothing	7 (3.4)
I medicate and treat them	3 (1.5)
I take it to the veterinarian	0 (0)
Did your animals have a miscarriage? (No)	199 (97.6)
Which of your animals had miscarriages?	
Goat	3 (60)
Sheep	1 (20)
Cow	1 (20)
How do you dispose of biological waste material when your animals miscarry?	
I dig deep, and I bury.	5 (100)
I throw it in the household waste	0 (0)
Do you wear gloves when removing biological waste material? (No)	5 (100)
Do you wear gloves when giving birth to animals? (n=105) (No)	105 (100)
How do you do milking (n=105)?	
I do it with my bare hands	95 (90.5)
I do it by machine	10 (9.5)
Do you wash your hands after milking? (Yes)	105 (100)
What is your approach when introducing new animals into your herd? (n=105)	
Without waiting for time, I immediately add it to the other animals	101 (96.2)
I keep them separated from the herd for two weeks and then reintroduce them to the animals after there is no negative situation.	4 (3.8)
Do you disinfect your stable at regular intervals? (Yes)	66 (32.4)

Table 4. Comparison of Brucellosis Knowledge Level and Behaviors of Participants Based on Gender

	Female (n=72)	Male (n=132)	P-value
If cheese made after boiling milk is consumed in the early stages without the need to be preserved in specific salt content, does it transmit disease? (Correct answer)	10 (13.9)	21 (15.9)	0.701*
Does disease transmit from yogurt made without boiling the milk (making yogurt without boiling the milk once it reaches a certain temperature)? (Correct answer)	49 (68.1)	111 (84.1)	0.008*
Does disease transmit from butter made without boiling the milk? (Correct answer)	69(95.8)	128(97.0)	0.699**
Does disease transmit from herb cheese (if the milk is not boiled) when consumed? (Correct answer)	14 (19.4)	15 (11.4)	0.114*
Does disease transmit by touching the miscarriage, its membranes, or the uterine fluid with bare hands? (Correct answer)	8 (11.1)	8 (6.1)	0.200*
What do you use to milk your animals?			
Bare hand	5 (15.6)	5 (6.8)	0.169**
With the help of a machine	27 (84.4)	68 (93.2)	
Do you vaccinate your animals against brucellosis? (Yes)	11 (35.5)	14 (20.3)	0.105*
I euthanize the sick animal to prevent the transmission of brucellosis to other animals (Yes)	64 (88.9)	111 (84.1)	0.348*
I isolate the animal that has had a miscarriage from the other animals (Yes)	66 (91.7)	117 (88.6)	0.496*
If my animal gets brucellosis, I treat it (Yes)	8 (11.1)	20 (15.2)	0.423*
I disinfect the stables at regular intervals (Yes)	21 (29.2)	45 (34.1)	0.472*

*: Pearson Chi-square Test **: Fisher Exact Test

Table 5. Comparison of Brucellosis-Related Knowledge and Practices by Educational Status of Participants

	Not Graduated from a School (n=81)	School Graduate (n=123)	P-value
If cheese made after boiling milk is consumed in the early stages without the need to be preserved in specific salt content, does it transmit disease? (Correct answer)	11 (13.6)	20 (16.3)	0.602*
Does disease transmit from yogurt made without boiling the milk (making yogurt without boiling the milk once it reaches a certain temperature)? (Correct answer)	63 (77.8)	97 (78.9)	0.854*
Does disease transmit from butter made without boiling the milk? (Correct answer)	80 (98.8)	117 (95.1)	0.248**
Does disease transmit from herb cheese (if the milk is not boiled) when consumed? (Correct answer)	11 (13.6)	18 (14.6)	0.833*
Does disease transmit by touching the miscarriage, its membranes, or the uterine fluid with bare hands? (Correct answer)	9 (11.1)	7 (5.7)	0.159*
What do you use to milk your animals?			
Bare hand	6 (12.0)	4 (7.3)	0.513**
With the help of a machine	44 (88.0)	51 (92.7)	
Do you vaccinate your animals against brucellosis? (Yes)	8 (15.7)	17 (34.7)	0.028*
I euthanize the sick animal to prevent the transmission of brucellosis to other animals (Yes)	74 (91.4)	101 (82.1)	0.064*
I isolate the animal that has had a miscarriage from the other animals (Yes)	77 (95.1)	106 (86.2)	0.041*
If my animal gets brucellosis, I treat it (Yes)	6 (7.4)	22 (17.9)	0.033*
I disinfect the stables at regular intervals (Yes)	22 (27.2)	44 (35.8)	0.198*

*: Pearson Chi-square Test **: Fisher Exact Test

Having sufficient knowledge about the epidemiology of the disease is of great importance for public health as it will greatly help to take preventive measures, encourage active participation in disease control programs, and thus help to develop control strategies (Zhang et al., 2019). In the study conducted by Özcan et al. (Özcan and Şahin, 2012) in which the knowledge level of animal breeders about brucellosis disease was investigated, it was determined that the rate of animal breeders knowing brucellosis disease was 86%, and the rate of knowing that the disease is transmitted from animals to humans was 77%. In a study conducted by Bayhan et al. (Bayhan et al., 2019) on the general population in a region where brucellosis is highly endemic, 84.1% of the participants stated that they had heard of brucellosis disease before, 8.5% stated that they had been diagnosed with brucellosis before, and 50.8% stated that there were people diagnosed with brucellosis in their family or environment. In the study by Alkan et al. (Alkan et al., 2022), 95.6% of the participants said that they were aware of brucellosis. Providing pieces of training on diseases transmitted from animals to humans is an important part of disease prevention. In some studies, it was determined that a small group (between 4.1-12.5%) of livestock farmers received training and information about diseases transmitted from animals to humans (Avcı et al., 2017; Akkuş et al., 2011; Şahin et al., 2019). In our study, all of the participants stated that they had heard of brucellosis before and that brucellosis can be transmitted from animals to humans, while 5.9% stated that they and 33.8% of their family members were diagnosed with brucellosis. 3.9% of the participants stated that their animals were diagnosed with brucellosis, 62.5% of them did not know what kind of symptoms the disease showed in animals, and the diagnosis was made by a veterinarian. In addition, all participants stated that they had not received any training on diseases transmitted from animals to humans. Although the

awareness of brucellosis disease was high among the participants, the fact that they did not receive any training and did not know the basic clinical features of brucellosis in animals are important deficiencies. Similarly, it is seen in the literature that the rate of training is low. Based on our current findings, it is reasonable to claim that the effective control and eradication of zoonotic infections can be accomplished through a thorough understanding of the disease's fundamental traits, transmission routes, therapeutic options, and fundamental preventive measures. According to the findings of this study, the low level of knowledge and awareness of these people about brucellosis and their wrong practices support the distribution of zoonotic infection education programs to individuals in the agriculture and livestock sectors, because we think that such initiatives will provide positive results. This shows that although brucellosis and its transmission routes are generally known, eating habits cannot be abandoned.

In the study conducted by Babaoğlu et al. (Babaoğlu and Demir, 2017), it was determined that 74.8% of the participants did not know the transmission routes, 39.7% consumed fresh cheese, 88.5% of the milkers milked with bare hands, 40.7% had an abortion in their animals, and 30.7% did not dispose of animal wastes correctly.

In another study, 78.7% of the participants stated that brucellosis could be transmitted by eating cheese made from raw milk, 49.9% by eating yogurt made from raw milk, 43.3% by eating butter made from raw milk, and 12.3% by eating poorly cooked red meat (Bayhan et al., 2019). Avcı et al. (Avcı et al., 2017) found that 47% of the participants did not know how to protect themselves from brucellosis, 95.5% made cheese from raw milk, 13.6% consumed cheese fresh, and 86.4% consumed cheese by keeping it in salted water for less than a month. In the study of Büke et al. (Büke et al., 2000), it was determined that 3.9%

of dairy processors drank milk without boiling, and 39.3% consumed fresh cheese. In our study, 100% of the participants thought that brucellosis could be transmitted from milk consumed without boiling, 99% from cream made without boiling milk, 98% from cheese made without boiling milk, 96.6% from butter made without boiling milk, 78.4% from yogurt made without boiling milk, 15.2% from fresh consumption of cheese made by boiling milk without keeping it in salt for a certain period of time and 14.2% from herbed cheese. Although the participants had generally correct information about the foodborne transmission of the disease, they were misinformed about the fact that only boiling milk is sufficient, that it does not need to be kept in salt, and that herbed cheese is not an important source of transmission. Herbed cheese is widely consumed, especially in the Eastern and Southeastern Anatolia regions of Turkey, because it contains unique herbs and has an aromatic taste. The fact that milk is not pasteurized when making herbed cheese may be an important source of contamination.

To disinfect the barn, contaminated materials such as excrement, newborns, and trash must be buried or disposed of in remote regions away from the herd, ideally using burial or incineration procedures. Burying waste material is seen as a tough process, especially during the winter months, due to the challenging climate conditions. As a result, animal cemeteries should be established in villages, away from residential areas, schools, roadways, and water supplies, to dispose of both animals who have died from epidemic diseases and infected materials. Another way is to install portable incinerators at Agricultural Directorates for the disposal of animal waste materials, which can help prevent multiple outbreaks (Özcan and Şahin, 2012). The introduction of an animal infected with *Brucella spp.* into the herd may cause the infection to spread to the entire herd (Wareth et al., 2014). In order to prevent this, it is necessary to ensure that the animal to be added to the herd comes from a pure herd, necessary serologic tests are performed before joining the herd, animals with

suspected brucellosis are isolated until diagnosis is made, and close cooperation with public health authorities is required (Corbel et al., 2006). In the study by Özcan et al. (Özcan and Şahin, 2012), it was found that 91.7% of the animal breeders added a new animal to the herd immediately without isolating it. Similarly, in our study, 96.2% of the participants stated that they immediately included the new animal in the herd. The fact that only 7.8% of the participants thought that the disease could be transmitted by touching abortion material with bare hands, 3.9% thought that the disease could be transmitted by touching sick animals with bare hands, and none of the participants wore gloves during farrowing and normal calving indicates that contact-related occupational exposure is ignored and basic prevention measures are not known. Another finding was that 90.5% of the milkers were milked with bare hands. Although all of the milkers stated that they washed their hands after the procedure, it is possible to transmit microbes through abrasions or cracks.

In previous research (Yentur Doni et al., 2017), female farmers in the southeast of Turkey were examined to determine the incidence of brucellosis and associated risk factors. Our representative community-based cross-sectional study was carried out over the course of four months in 2013 in nine provinces, and blood samples from 707 farmworker women of reproductive age were evaluated using the Rose Bengal and conventional agglutination tests. The only real risk variables were being employed as seasonal agricultural work and having had five or more pregnancies. We contrasted the knowledge levels of men and women in our study. Males had a higher level of right responses about transmission through yogurt, despite there being no appreciable differences between the groups in terms of correct responses and practices.

Limitations

The results of the study reflect the responses of participants from a single center from a single region. Therefore, it is a limitation of our study.

Conclusion

As the human-animal transmission cycle is difficult to break for a variety of reasons and thwarts eradication efforts, brucellosis remains a serious public health concern in Turkey. Our study found that every participant was aware of brucellosis and how it spreads from animals to people. The negative notion that boiling milk alone is sufficient has raised some serious concerns, as it ignores the necessity of a specified waiting interval and the addition of salt. The participants' lack of knowledge of zoonotic illnesses was another significant issue that was brought up. Surprisingly, half of the previously diagnosed brucellosis patients kept consuming raw milk and dairy products, highlighting how challenging it is to change a habit. Periodic training exercises should be held by the appropriate authorities, with a focus on the disease's clinical importance, in order to break the cycle of transmission.

Acknowledgements

Not applicable.

Conflicts of Interest

The authors have no conflicts of interest to declare.

Ethical approval

Ethics committee approval was obtained from Harran University Non-Interventional Research Ethics Committee with the decision dated 23.01.2023, session number 02 and number 16. All procedures in the study were performed according to the World Medical Association Declaration of Helsinki.

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