



# Is the Level of Knowledge on Brucellosis Sufficient in the Highly Endemic Region?

Yüksek Endemik Olduğu Bölgede Bruselloz Hakkında Bilgi Seviyesi Yeterli Düzeyde mi?

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## Abstract

**Objective:** Brucellosis is the most common zoonotic disease in the world. In this study, we aimed to investigate the awareness of brucellosis in Van province, the city where brucellosis is highly endemic.

**Material and Methods:** This survey was conducted in the city center of Van from July 2014 to March 2015.

**Results:** In our study, 987 people were included; 555 (56.2%) were females and 432 (44.8%) were males. Mean age of the participants was 26.8 ± 8.3 years. 830 (84.1%) of the participants had previously heard of brucellosis. The rates of correct answers to the questions about brucellosis transmission were compared between the groups that were distinguished by educational level. Correct response rates were found higher in the group with a high school degree or higher to all questions about food-related brucellosis transmission except the question of brucellosis transmission by cheese produced from raw milk. The rate of being informed about the fact that brucellosis can be transmitted by raw milk cheese was 78.7%, but the level of knowledge on other transmission routes was low among all participants. 296 (30%) of the participants had been engaged in animal husbandry in the past and 155 (15.7%) were still involved. The level of knowledge on brucellosis transmission during animal husbandry processes, brucellosis signs in animals and the procedures to be performed for protection against brucellosis was very low.

**Conclusion:** The results of our study showed that the level of knowledge on brucellosis is low in Van province. In order to protect public health and also prevent loss of income in the livestock sector, it is necessary to raise societal awareness about brucellosis.

**Keywords:** Brucellosis, education, animal, community health

## Öz

**Giriş:** Bruselloz tüm dünyada en sık görülen zoonotik hastalıktır. Bu çalışmada brusellozun yüksek endemikite gösterdiği Van ilinde bruselloz farkındalığını araştırmak amaçlanmıştır.

**Gereç ve Yöntemler:** Bu anket çalışması Temmuz 2014-Mart 2015 tarihleri arasında Van ili şehir merkezinde yapıldı.

**Bulgular:** Çalışmamıza 987 kişi dahil edildi; 555 (%56.2)'i kadın, 432 (%44.8)'si erkekti. Katılımcıların yaş ortalaması 26.8 ± 8.3 yaş idi. Katılımcıların 830 (%84.1)'u daha önce bruselloz hastalığını duyduğunu ifade etti. Katılımcıların öğrenim düzeyleri ile bruselloz bulaşı hakkındaki sorulara verdikleri doğru cevap oranları incelendiğinde, brusellozun çiğ süttan yapılmış peynir yemekle bulaştığını bilme oranı ortaokul ve daha az öğrenim almış olanlarda daha yüksekken, diğer tüm sorulara doğru cevap verme oranları lise ve daha üstü öğrenim almış olanlarda daha yüksek bulundu. Katılımcıların çiğ süttan yapılmış peynir ile bruselloz bulaşını bilme oranı %78.7 idi, ancak diğer bulaş yolları hakkında bilgi düzeyi düşük bulundu. Katılımcıların 296 (%30)'sı geçmişte hayvancılıkla uğraşmıştı, 155 (%15.7)'i halen uğraşmaktaydı. Hayvancılık işlemleri sırasında bulaş için riskli durumlar, brusellozun hayvanlardaki belirtileri ve korunma için yapılacak işlemler konusunda bilgi düzeyi çok düşük bulundu.

**Sonuç:** Çalışmamızın sonuçları Van ilinde bruselloz hakkında bilgi seviyesinin düşük olduğunu; hem toplum sağlığını korumak hem de hayvancılık sektöründe gelir kayıplarının önüne geçmek için bruselloz hakkında toplumun bilgi seviyesini artırmaya yönelik girişimlere ihtiyaç olduğunu ortaya koymuştur.

**Anahtar Kelimeler:** Bruselloz, eğitim, hayvan, halk sağlığı

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## Introduction

As the most commonly seen zoonotic disease, brucellosis is endemic in the Mediterranean shores of Europe, North and East Africa, Middle East, South and Central Asia, and Central and South America (1). Brucellosis is still endemic in our country, especially in Central Anatolia, East and Southeastern Anatolia (2). The seroprevalence of brucellosis in the countryside in Van province has been reported as 27.2%, and it is one of the provinces with the highest seroprevalence rate in our country (3,4). Being a multisystemic disease, it can lead to various clinical pictures and progress with severe hematologic, cardiac and neurologic complications (5-7). Protection from brucellosis is an important matter in terms of public health since it is still endemic in our country, can cause serious complications and even be fatal. The most ideal way to reduce human brucellosis is to decrease brucellosis in animals. In other respects, when it is considered that brucellosis is transmitted to humans by the consumption of raw milk and dairy products, raising awareness about brucellosis has great importance in the protection against brucellosis (8-10). This study aimed at investigating brucellosis awareness in Van province where brucellosis shows the highest endemicity.

## Materials and Methods

This survey study was conducted on 987 participants in the city center of Van province between July 2014 and March 2015. The survey included three parts. The first and second parts of the survey were conducted on all participants; however, the third part was only conducted on participants who had been or were still engaged in animal husbandry.

The first part questioned demographics (age, gender, education), the participants' state of being involved in animal husbandry, whether or not they had previously heard of brucellosis, and whether or not the participant or anyone in his/her close circle or family had been diagnosed with brucellosis.

Mode of transmission was questioned in the second part. The participants were divided into two groups as secondary school and lower and high school and higher regarding their educational background, and correct response rates to the questions in the second part were compared between the groups.

The third part included questions on the mode of transmission of brucellosis from animals to humans, the symptoms of brucellosis in animals, and the procedures to be done to control brucellosis in animal husbandry.

Statistical analysis was performed on SPSS (Statistical Package for Social Sciences, version 21.0, SPSS Inc., Chicago, IL, USA) program. Chi-square and Fisher's exact tests were used to compare nominal data. Approval of the Ethics Committee of Yüzüncü Yıl University was received for the study.

## Results

Our study included 987 individuals of whom 555 (56.2%) were females and 432 (44.8%) were males. The mean age of the participants was  $26.8 \pm 8.3$  years (minimum 14, maximum 70), and their distribution according to the educational background is shown in Figure 1. While 830 participants (84.1%) expressed that they had heard of brucellosis, the rest stated that they had not. Eighty-four (8.5%) participants had previously been diagnosed with brucellosis, and there were people in the family and/or close circle of 501 participants (50.8%).

Rates of correct responses to questions about food and brucellosis transmission according to the educational background of the participants are demonstrated in Table 1. While the knowledge that brucellosis is transmitted by consuming cheese made of raw milk was higher in the secondary school and lower education group, rates of correct responses to all other questions were found higher in the high school and higher education group. 178 (28.1%) participants having a high school degree or higher and 88 (24.8%) participants having a secondary school degree or lower were found to have no knowledge on transmission of brucellosis through foods ( $p=0.245$ ).

While 536 (54.3%) participants had never been engaged in animal husbandry before, 296 (30%) had been involved in animal husbandry in the past and 155 (15.7%) were still involved. 366 (81.2%) participants engaged in animal husbandry had heard of brucellosis before. The responses of 451 participants who had been or were still engaged in animal husbandry to the question "How is brucellosis transmitted to humans during animal husbandry procedures?" are shown in Table 2.

The state of the participants' having heard of brucellosis vaccination, their state of getting their animals vaccinated, and reasons for not getting the animals vaccinated are shown in Figure 2. Responses to questions "How do you clean the objects and floors contaminated by urine, feces, the miscarried fetus, the fluid and membrane of the fetus of the animals that had a mis-

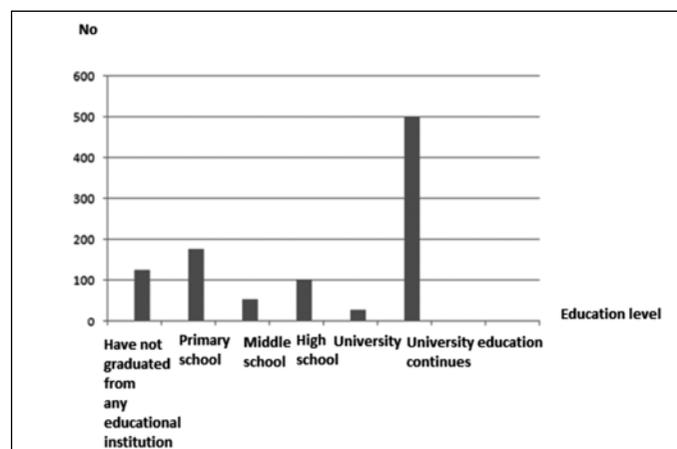


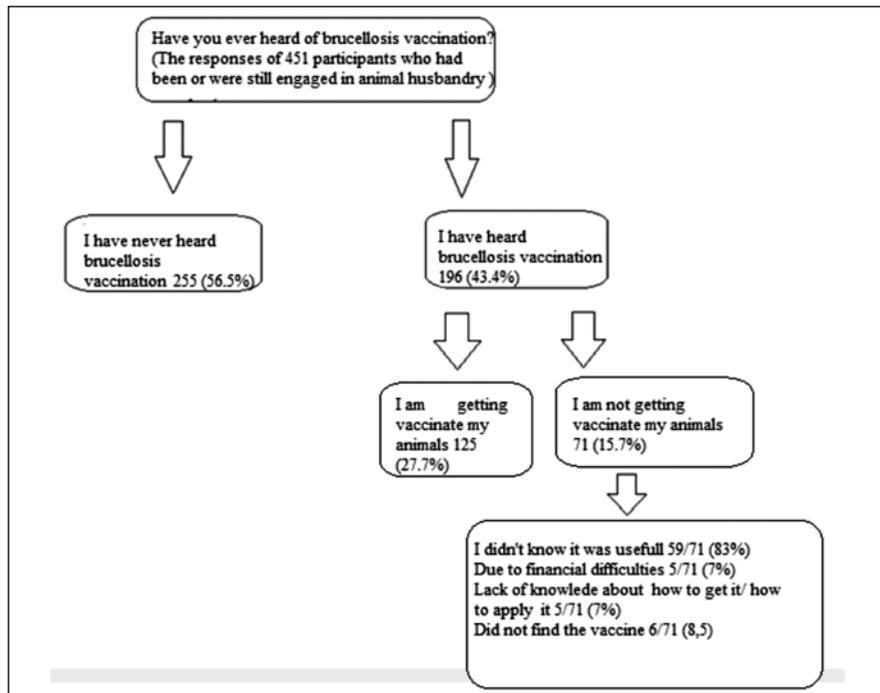
Figure 1. Distribution of the participants according to their level of education.

**Table 1.** Responses of the participants to the questions on foods and brucellosis transmission

	Ones with secondary school education and lower (355 persons) n (%)		Ones with high school education and higher (632 persons) N (%)		p	Total correct responses n (%)
	Yes	No	Yes	No		
Can be transmitted by consuming cheese made of raw milk	317 (89.3)	38 (10.7)	459 (72.6)	173 (27.4)	0.001	776 (78.7)
Can be transmitted by consuming yogurt made of raw milk	120 (33.8)	235 (66.2)	373 (59)	259 (41)	0.001	493 (49.9)
Can be transmitted by consuming butter made of raw milk	101 (28.5)	254 (71.5)	327 (51.8)	305 (48.2)	0.001	428 (43.3)
Can be transmitted by consuming not well-cooked red meat	0 (0)	355 (100)	122 (19.3)	510 (80.7)	0.001	122 (12.3)

**Table 2.** Responses to the question “How is brucellosis transmitted to humans during animal husbandry procedures?”

How is brucellosis transmitted to humans from animals?	n (%)
Contact with sick animals	87 (19.3)
Bare hand contact with the womb secretions and membranes of a pregnant animal with brucellosis disease during delivery	99 (21.9)
Bare hand contact with the miscarried young	53 (11.8)



**Figure 2.** Responses to the question “Have you ever heard of brucellosis vaccination? If you heard brucellosis vaccination, have you got your animals vaccinated? If you have not got your animals vaccinated what are reasons for not getting the animals vaccinated?”

**Table 3.** “Responses to the question “What is your approach when your cattle, sheep or goat has a miscarriage?”

Approach when your cattle, sheep or goat has a miscarriage	Correct n (%)	Incorrect n (%)
Does the cattle, sheep or goat need to be separated from the flock/barn when it has a miscarriage so as not to contaminate other animals? (Correct response: Yes)	54 (12)	397 (88)
Can the cattle, sheep or goat be milked, and its milk be used to make cheese, and etc. if it had a miscarriage? (Correct response: No)	89 (19.7)	362 (81.3)
Can the milk of cattle or small cattle be given to the calf if it had a miscarriage? (Correct response: No)	82 (18.2)	369 (81.8)

**Table 4.** Responses to the question “How do you clean the objects and floors contaminated by urine, feces, the fluid and membrane of the fetus of the animals that had a miscarriage?”

Material used in cleaning	n (%)
Fertilizer	1 (0.2)
Lime	18 (4)
Detergent	10 (2.2)
Water	77 (17.1)
I do not clean	345 (76.5)

**Table 5.** Responses to the question “What are the symptoms of brucellosis in animals?”

Symptoms	n (%)
Having miscarriages	50 (11.1)
Reduced fertility	19 (4.2)
Decreased milk	27 (6)
I do not know	388 (86)

carriage? and “What is your approach when your cattle, sheep or goat has a miscarriage? are shown in Table 3 and Table 4. Responses to the question “What are the symptoms of brucellosis in animals?” are demonstrated in Table 5.

## Discussion

The most frequently reported risk factors for brucellosis is raw milk consumption (48%) and animal husbandry (59%) (11). Apart from milk, brucellosis is also transmitted by raw consumption of dairy products such as cheese and cream and consumption of uncooked, raw meat. Although *Brucella* spp. content is diminished in the making of butter, yoghurt and curd cheese due to a fair amount of acidification, pH must have decreased under 3.5 for the bacteria to be completely destroyed. In pH levels over 3.5, the risk of brucellosis transmission still continues (1). In a large series reported from Van province, 63.6% of the cases

have been determined to consume raw milk and dairy products (12). In series reported from our country, it has been indicated that brucellosis transmission is based on raw milk and dairy products consumption at a rate of 94.6% (10,13). Consumption of raw milk by boiling it also protects from brucellosis. The seroprevalence of brucellosis has been found lower in persons consuming boiled milk compared to those consuming milk without boiling it and in persons consuming cheese made of boiled milk compared to those consuming cheese made of unboiled milk (1,14). In our study, even though awareness about the fact that brucellosis is transmitted by eating cheese made of raw milk was high, approximately one fourth of the participants responded incorrectly. More than half of the participants did not know that brucellosis could be transmitted by other raw dairy products besides cheese. Particularly, the rate of knowing that it could be transmitted by consuming raw, uncooked meat was found low. The prevalence of brucellosis has been found to decrease with the increase in educational background (15). In accordance with the literature, rate of correct responses was found significantly higher in the group with high level of education.

In a seroprevalence study conducted in Van province in our country, brucellosis positivity has been found 22.9%, 21.5% and 21.7% in sheep, goats and beef cattle, respectively (6). Seropositivity in sheep and beef cattle in Kırıkkale province has been reported as 6.4%, in Kayseri province as 10.37%, in Afyon province as 5%, and in Kars province as 34.8% (16-18). We can say that Van is one of the provinces with the highest rate of brucellosis seropositivity in our country. Brucellosis transmission occurs with direct contact with the infected animal during husbandry procedures, contact with the secretion of the animal, pregnancy material, urine and the disintegrated skin or mucosa (11,19). In a study conducted in India, it has been detected that brucellosis seropositivity is highest in shepherds (11.4%) and slaughter house workers (8.6%) among various occupational groups; however, it has also been determined that persons in these occupational groups have never heard of brucellosis before, do not have any knowledge of mode of transmission of brucellosis and symptoms of the disease and that they do not use any kind of protective equipment (8). In our study, it was confirmed that

persons engaged in animal husbandry had heard of brucellosis disease but their level of knowledge on how brucellosis is transmitted to humans during animal husbandry procedures was very low.

Brucellosis eradication program in sheep and goats in our country was started first in 1952 (4). The best method in controlling brucellosis in animal husbandry is taking the infection under control in its source and having it eradicated. Recommended methods to provide this are vaccination of the animals, surveillance of the animals with laboratory support, separating the infected animal from the healthy ones and killing it. The most economical method in regions with a brucellosis seroprevalence of 1% and lower in animals is the killing of the animals whose laboratory-supported surveillance turns out positive. However, this method is not suitable for our country since seropositivity is much higher in our country and grasslands and water meadow are mutually used and animal migration is not under control. The suitable method for our country is the vaccination of the animals. Various vaccination activities have been carried out against brucellosis since 1960 (4). In scope of the notice referred to as "Combat with Animal Diseases and Animal Movement Control Program" published in 2017 in our country, brucellosis vaccination is given free of charge by the Ministry of Agriculture and Forestry (20). In our study group, more than half of the individuals engaged in animal husbandry expressed that they had not heard of the vaccination. We determined that most of the individuals with knowledge of the vaccination had their animals vaccinated, but majority of the persons having heard of the vaccination did not have their animals vaccinated since they did not know the benefits of the vaccine. The results of our study led us to consider that individuals engaged in animal husbandry had a significant lack of knowledge and education on brucellosis vaccination.

The most important mode of transmission between animals is contact after miscarriage. As a result of the contamination of the barn with organisms after miscarriage, brucellosis is transmitted to other animals by inhalation, inoculation from the conjunctiva and skin contamination. Other modes of transmission include the mutual use of milking machine, which results in the transmission of the disease from the breast of the animal, the feeding of the calves with the milk of the infected animal and sexual contact (1). Therefore, miscarriage management is vital in the prevention of brucellosis. Burning the miscarriage secretions and objects that were in contact with the secretions or burying them away from water resources by whitewashing them, and disinfecting the barn with disinfectants containing hypochloride, iodophor or phenol components are necessary (1). The results of our study revealed that persons engaged in animal husbandry do not separate the animal having a miscarriage from the flock, continue to use its milk and do not do any additional cleaning after the miscarriage.

Brucellosis in animals causes miscarriages, reduction in milk production, decrease in weight gain, premature deaths, and thus increase in veterinary costs besides looking sick. An association has been found in many studies between brucellosis seropositivity and increased frequency in miscarriages (19). In a study carried out in India, it has been shown that brucellosis creates 3.4 billion dollars revenue loss as a result of causing reduction in animal products, decrease in fertility and premature deaths of the animals (21). Another unwanted effect of brucellosis in animals is the transmission of the disease to other animals and the young born from the infected animal (19). The results of our study showed that a majority of the persons engaged in animal husbandry do not know the negative effects of brucellosis in animals. It is our belief that insufficient knowledge of the persons engaged in animal husbandry is a reason for them not to do any research and find out the measures to be taken against brucellosis.

When the low level of knowledge on brucellosis as put forth by our study is evaluated with the fact that Van province is one of the provinces with the highest brucellosis seroprevalence in animals in our country and that the traditional cheese consumed in Van is mostly made of raw milk, it is clear that public health is at risk. Raising societal awareness about brucellosis will preclude an important public health problem and revenue loss in animal husbandry. In order to raise awareness in our public in the matter of easy, practical and applicable measures in the protection against brucellosis, we are of the opinion that various studies aimed at societal enlightenment, such as giving lessons about brucellosis in schools in provinces with a high rate of endemicity should be carried out.

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