DETERMINATION OF BRUCELLOSIS PREVALENCE AND RISK FACTORS ASSOCIATED WITH BRUCELLOSIS IN INDIVIDUALS LIVING IN KARACABEY DISTRICT

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ABSTRACT

Aim: The aim of this study was to determine the prevalence of brucellosis and to examine the risk factors associated with brucellosis.

Methods: In the study, patients registered in the Karacabey population were screened, and it was determined that 62 people were diagnosed with brucellosis in 2023. Of the patients diagnosed with brucellosis, 50 volunteered to participate in the study. In order to compare the characteristics of patients diagnosed with brucellosis, 50 healthy participants with similar characteristics were evaluated as a control group. The demographic characteristics of all participants and their consumption of animal products that pose a risk for brucellosis were evaluated using the Case Report Form. The health literacy levels of the participants were evaluated using the Newest Vital Signs (NVS) Scale.

Results: The one-year brucellosis prevalence for 2023 was found to be 72.3/100,000 among the cases registered in the Karacabey population. It was found that 32 (64%) of the brucellosis cases were male, and 15 (30%) of them migrated to Karacabey from other provinces. It was found that NVS scale scores were not statistically significantly different between cases with and without brucellosis (p>0.05). When the NVS score distribution rates were compared, it was found that there was a statistically significant difference between the two groups; 11 (22%) cases with brucellosis did not score on the NVS scale. In addition, this rate was only 4% (n=2) in the healthy control group. It was found that cases with brucellosis had statistically significantly higher rates of keeping dairy animals (p=0.026) and being engaged in the food business (p=0.003) than cases without brucellosis. According to the Multivariate Binary Logistic Regression Analysis, migration increased the risk of brucellosis diagnosis by 4.061 times (CI; 1.239-13.311) at a statistically significant level. In addition, in this regression model, the NVS scale and other demographic characteristics were not found to be significantly effective variables in increasing the risk of brucellosis (p>0.05).

Conclusion: The level of health literacy is insufficient in cases with brucellosis. However, health literacy does not increase the risk of brucellosis. The rate of keeping a lactating animal and being engaged in the food business is high in cases with brucellosis, and these people are frequently migrants from outside Bursa province. Therefore, it may be useful for physicians to pay attention to the risk of brucellosis in migrants. In addition, it may be useful to develop health education programs to prevent brucellosis outbreaks in the migrant population.

Keywords: Brucella, brucellosis, health literacy, migration, dairy

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INTRODUCTION

Brucellosis has been defined as one of the most important zoonotic diseases causing severe economic losses and public health problems worldwide [1]. Brucella is an intracellular pathogen that causes a serious infectious disease called brucellosis in both animals and humans and can be transmitted from animal reservoirs of the disease to humans by direct contact with infected materials, inhalation of infectious aerosols and ingestion of contaminated food or water [2].

Brucellosis is responsible for human morbidity in endemic regions, its spread is under control in most developed countries, and it is a rare disease in industrialized countries due to routine screening of domestic animals and animal vaccination programs [3]. It has been reported that demographic, occupational and socioeconomic factors play a role in its prevalence; health systems are weak in many countries where it is endemic, and official data probably underestimate the actual burden of the disease; and high-quality research is needed, especially from Eastern Europe, Asia-Pacific, Central and South America and Africa [4].

In a study conducted in the Eastern Anatolia region of Turkey, it was found that the seropositivity rate among people was 4.8% [5]. It was evaluated that the prevalence of Brucella in raw milk collected from a provincial center and central villages in the Central Anatolia region may be as high as 17.32% [6]. In a review in which animals were examined, it was reported that the

disease was primarily seen in cattle in the winter months. The highest prevalence was in the Eastern Anatolia Region, and brucellosis in ovine animals was primarily seen in the Central Anatolia region in winter months [7].

It is estimated that brucellosis develops in approximately 500,000 people worldwide yearly. The disease causes an estimated economic loss of 344 billion US dollars in the livestock sector, and it is known that low education level, poor economic conditions, unconscious and unvaccinated animal husbandry, and wrong food consumption methods are responsible for the spread of the disease [4, 8]. In addition, it has been discussed that low health literacy may play a role in epidemics and infections that can be transmitted to humans from animals and animal products [9].

It has been stated that although essential disease awareness is high in cases with brucellosis, the willingness to cooperate in epidemiologic surveillance is limited. Patient education may increase compliance with treatment and willingness to enter surveillance, but it may also lead to many false relapse referrals; therefore, it is beneficial to provide ease of treatment in this area [10]. In a study conducted on farmers, it was evaluated that people showed signs of inadequate health literacy on zoonoses [11]. In a study examining the effect of a health education intervention on knowledge, beliefs and encouragement of preventive behaviors related to brucellosis, it was reported that there was a significant decrease in risky behaviors such as consumption of raw milk, assisted animal birth

without an apron, and disposal of animal birth products in the waste bin [12].

Health literacy is a concept that defines understanding and evaluating health information and using this information when necessary [13]. In addition, although Brucella rarely causes human-to-human infection [2], it is an epidemic associated with healthy interaction of the person with the environment, especially with animals and animal foods. However, when the literature is reviewed, it is seen that there is limited research on the factors that increase the risk and health literacy in people infected with Brucella. Therefore, the aim of this study was to determine the prevalence of brucellosis and to examine the risk factors associated with brucellosis.

METHODS

Karacabey is a district located in Bursa province, and according to 2023 data, 85,765 people are registered in its population. Karacabey is one of the districts where agriculture and animal husbandry activities are intensive and similar to those in Bursa province. It is one of the settlements receiving migration from the eastern regions of Turkey. In order to reach the brucellosis cases detected in the Karacabey district in 2023, the records of the Karacabey District Health Directorate and the health institutions working under this organization were examined in this study.

Brucellosis is one of the diseases that must be reported due to the risk of transmission. In addition, the Rose Bengal test is used to detect the disease and health institutions record the information on the detected cases. In this study, it was determined that 62 cases were diagnosed with brucellosis in 2023 by using these records. Considering the population of Karacabey in 2023, the prevalence of brucellosis diagnosis was found to be 72.3/100,000, according to the detected cases. When the patient records were examined, it was evaluated that 2 cases were younger than 18 years, and 4 cases were older than 65 years. Afterwards, the patients were contacted using the contact (phone numbers) of the patients, and the patients were informed about the study. All 56 patients were interviewed, and 50 brucellosis cases volunteered to participate in the study. As a result, the patients invited to Karacabey Family Health Center were again informed about the study. Their signed consent was obtained, and they volunteered to participate in the study.

In order to compare the data of 50 participants diagnosed with brucellosis, 50 participants with similar characteristics in terms of age, gender and education who were followed up in the family medicine outpatient clinic and who were not diagnosed with brucellosis were invited to the study. These cases were selected from the cases with negative Rose Bengal tests. In this way, it was confirmed that the cases in the control group did not have brucellosis. The cases without brucellosis, for whom signed informed consent was obtained that they volunteered to participate in the study, were examined by the researchers with the assessment tools included in the study.

For the research, the ethics committee approval and thesis subject consent form was obtained for the medical specialty thesis titled "Determination of Brucellosis Prevalence and Brucellosis-Related Risk Factors in Individuals Living in Karacabey District" with the protocol code 2011-KAEK-25 2022/09-11 dated 21.09.2022 at the University of Health Sciences Bursa High Specialization Training and Research Hospital.

The NVS Health Literacy Scale is used to evaluate the participants in this study.

The Case Report Form includes questions about age, gender, marital status, comorbidities, migration history, occupation, family history of brucellosis and cheese consumption preferences. This form was created by the researchers.

One of the short and practical measurement tools to assess health literacy is the Newest Vital Sign (NVS) scale. The scale is an assessment tool that includes 6 questions, provides results in less than five minutes and measures reading and understanding of health information [14]. In the measurement tool, a food label is given to the person, and the person's capacity to read and understand health information is examined by responding to this stimulus. The scores obtained in the NVS range from 0 to 6, and a high score from the measurement tool indicates an increase in health literacy in individuals. The adaptation of the NVS into Turkish was conducted by Ciftci et al. (2021) [15]. In this study, it was evaluated that the scale was a valid and reliable measurement tool, and the Cronbach α value was 0.70.

Rose Bengal Test antigen is an antigen prepared from Brucella Abortus S99 strain, standardized with standard Brucella antiserum and stained with Rose-Bengal.

Administration of the test:

1. 0.03 ml of patient serum was dripped onto a clean tile.

2. 0.03 ml RoseBengal Test Antigen was added to this.

3. Antigen and serum were mixed with a pipette tip and spread over a 1.5 cm diameter area.

4. Tiles were turned circularly for 3-4 minutes

5. As a result, coarse granular aggregation formation was considered positive agglutination, and homogeneous appearance was considered negative agglutination.

Statistical Analysis

Demographic and clinical characteristics of the cases evaluated in the study were analyzed by descriptive statistical analysis. The Chi-Square Test was used to compare the rates of clinical and demographic characteristics between cases with and without brucellosis. Comparisons of age mean and NVS scores between cases were performed using the Mann-Whitney U (Exact Test) test, Independent Groups t-test and Kruskal Wallis H test between groups of more than two. Factors that effectively increase the risk of brucellosis were analyzed using Univariate and Multivariate Binary Logistic Regression Analysis. The significance level was set as $p < 0.05$ for all analyses. The conformity of the data to normal distribution was checked with kurtosis and skewness values (± 1.5).

IBM SPSS 26.0 program was used in the application of the analyses.

RESULTS

Comparison of demographic characteristics between cases with and without brucellosis is given

in Table 1. According to the Chi-Square test, it was found that the rates of occupation (X^2=20.44, p=0.015) and hometown (X^2=6.25, p=0.012) were statistically significantly different between the cases with and without brucellosis.

Table 1. Comparison of demographic characteristics between cases with and without brucellosis

		Brucellosis Cases		Control Cases			
		n/Middle.	%/SS.	n/Middle.	%/SS.	Analysis	p-value
Age		44.26	14.04	44.48	13.36	t=-0.08	0.936
Gender	Male	32	64.0	33	66.0	X^2=0.04	0.834
	Woman	18	36.0	17	34.0		
Marital Status	Single	11	22.0	8	16.0	X^2=1.52	0.467
	Widow	0	0.0	1	2.0		
	Married	39	78.0	41	82.0		
Education status	Illiterate	1	2.0	0	0.0	X^2=2.13	0.545
	Literate/Primary school	19	38.0	17	34.0		
	Middle School/High School	24	48.0	23	46.0		
	University	6	12.0	10	20.0		
Income status	Bad	7	14.0	11	22.0	X^2=4.31	0.230
	Middle	34	68.0	31	62.0		
	Good	6	12.0	8	16.0		
	Very good	3	6.0	0	0.0		
Profession	Farming	7	14.0	11	22.0	**X^2=20.44**	**0.015**
	Retired	3	6.0	7	14.0		
	Housewife	13	26.0	14	28.0		
	Livestock farming	7	14.0	0	0.0		
	Officer	1	2.0	2	4.0		
	Student	1	2.0	1	2.0		
	Private sector	6	12,0	13	26.0		
	Health worker	2	4.0	0	0.0		
	Freelancer/craftsman	6	12.0	2	4.0		
	Veterinarian/technician	4	8.0	0	0.0		
Hometown (in province)	Bursa	35	70.0	45	90.0	**X^2=6.25**	**0.012**
	Other	15	30.0	5	10.0		

Mean=Mean, SD=Standard Deviation, t=Independent Groups t test, X^2=Square test.

Mann-Whitney U test showed that the median values of number of hospital admissions (Z=-5.18, p<0.001) and number of emergency room visits (Z=-3.65, p<0.001) were statistically

significantly higher in cases with brucellosis compared to cases without brucellosis.

The Chi-Square test showed that cases with brucellosis had significantly higher rates of

keeping dairy animals (X^2=4.96, p=0.026) and being engaged in the food business (X^2=9.01, p=0.003) than cases without brucellosis.

The Chi-Square test showed that the proportion of herbed cheese (X^2=4.17, p=0.041)

was statistically significantly higher in cases without brucellosis than in cases with brucellosis (Table 2).

Table 2. Comparison of animal cheese consumption status between cases with and without brucellosis

		Brucellosis Cases		Control Cases		X^2	p
		n	%	n	%		
Making cheese at home	Yes	11	22.0	8	16.0	0.59	0.444
	No	39	78.0	42	84.0		
Buying packaged (branded) cheese only from the market	Yes	27	54.0	26	52.0	0.04	0.841
	No	23	46.0	24	48.0		
Buying fresh cheese from the market	Yes	34	68.0	32	64.0	0.18	0.673
	No	16	32.0	18	36.0		
Mihalliç	Yes	35	70.0	38	76.0	0.46	0.499
	No	15	30.0	12	24.0		
Kashkaval	Yes	10	20.0	14	28.0	0.88	0.349
	No	40	80.0	36	72.0		
Ezine	Yes	16	32.0	19	38.0	0.40	0.529
	No	34	68.0	31	62.0		
Fresh village cheese	Yes	9	18.0	7	14.0	0.30	0.585
	No	41	82.0	43	86.0		
Herbed cheese	Yes	0	0.0	4	8.0	**4.17**	**0.041**
	No	50	100.0	46	92.0		
Other	Yes	6	12.0	3	6.0	1.10	0.295
	No	44	88.0	47	94.0		

X^2 = Chi-Square test.

Among the cases with brucellosis, 7 (14%) had fever, 6 (12%) had sweating, 10 (20%) had malaise, malaise, 7 (14%) had loss of appetite, 7 (14%) had headache, 9 (18%) had back, joint and muscle pain, and 12 (24%) had fatigue.

According to the Chi-Square test, it was found that there was a statistically significant difference (X^2=26.83, p<0.001) in the NVS rates between brucellosis and non-brucellosis cases. Participants with 0-2 points were found to be 60% in the brucellosis group and 38% in the non-brucellosis group.

In the Mann-Whitney U test among the cases with brucellosis, it was found that the median values of

NVS (Z=-2.64, p=0.008) of male cases were statistically significantly higher than those of female cases, and the median values of NVS (Z=-3.55, p<0.001) of single cases were statistically significantly higher than married cases. In addition, it was found that the median values of NVS (Z=-3,88, p<0,001) were statistically significantly higher in cases with an educational level of secondary school and above than in cases with an educational level of primary school and below. In the Kruskal Wallis H test, it was found that the NVS median values of the cases with brucellosis differed statistically significantly (X^2=14.97, p<0.001) according to income status (Table 3).

Table 3. Comparison of NVS scores according to demographic characteristics of cases with brucellosis

		Newest Vital Sign					
		n	Med.	Q1	Q3	Analysis	p
Gender	Male	32	2.50	2.00	5.00	**Z=-2.64**	**0.008**
	Woman	18	1.00	.00	2.00		
Marital status	Single	11	5.00	4.00	6.00	**Z=-3.55**	**<0.001**
	Married	39	2.00	.00	3.00		
Profession	Other	36	2.00	1.00	5.00	Z=-0.85	0.394
	Agriculture/livestock	14	2.00	2.00	2.00		
Hometown	Bursa	35	2.00	2.00	4.00	Z=-0.71	0.475
	Other	15	2.00	2.00	6.00		
Education	Primary school and below	20	2.00	.00	2.00	**Z=-3.88**	**<0.001**
	Secondary school and above	30	3.50	2.00	6.00		
Income	Low	7	0.00	.00	2.00	**X^2=14.97**	**<0.001**
	Middle	34	2.00	2.00	3.00		
	High	9	6.00	5.00	6.00		
Brucellosis in the family (including close relatives)	There is	10	2.00	2.00	4.00	Z=-0.04	0.971
	No	40	2.00	1.00	5.00		

Med.=Median, Z=Mann Whitney U test, X^2=Kruskal Wallis H test.

According to the Mann-Whitney U test and Exact Test, it was found that the median values and ratios of NVS according to animal food consumption characteristics did not differ statistically significantly among the cases with brucellosis (Table 4).

Table 4. Comparison of NVS scores of brucellosis cases according to animal food consumption characteristics

		Newest Vital Sign					
		n	Med.	Q1	Q3	Z	p
Do you eat rare meat?	Yes	5	2.00	.00	3.00	-0.87	0.412*
	No	45	2.00	2.00	5.00		
Do you consume game (land)?	Yes	5	2.00	.00	2.00	-1.38	0.191*
	No	45	2.00	2.00	5.00		
Do you buy raw milk from the milkman?	Yes	27	2.00	.00	5.00	-0.58	0.565
	No	23	2.00	2.00	3.00		
Do you make cheese yourself at home?	Yes	11	2.00	.00	4.00	-0.75	0.451
	No	39	2.00	2.00	5.00		
Do you keep lactating animals?	Yes	19	2.00	.00	4.00	-1.70	0.089
	No	31	2.00	2.00	5.00		
Are you in the food business?	Yes	23	2.00	.00	4.00	-1.85	0.064
	No	27	3.00	2.00	6.00		
Do you only buy packaged (branded) cheese from the market?	Yes	27	2.00	2.00	6.00	-1.69	0.092
	No	23	2.00	.00	4.00		
Do you buy fresh cheese from the market?	Yes	34	2.00	2.00	5.00	-0.41	0.482
	No	16	2.00	.00	4.00		
Mihalliç	Yes	35	2.00	2.00	4.00	-0.13	0.895
	No	15	3.00	.00	6.00		
Kashkaval	Yes	10	3.50	2.00	6.00	-1.35	0.215*
	No	40	2.00	1.00	4.00		
Ezine	Yes	16	2.50	2.00	5.50	-1.33	0.184
	No	34	2.00	.00	4.00		
Fresh village cheese	Yes	9	3.00	.00	5.00	-0.25	0.823*
	No	41	2.00	2.00	4.00		
Other	Yes	6	3.00	.00	6.00	-0.09	0.942*
	No	44	2.00	2.00	4.00		

Med.=Median, Z=Mann Whitney U test, *Exact Test.

According to Pearson Correlation Analysis, there was a statistically significant negative correlation between NVS scores and age (r=-0.578, p<0.001), BMI (r=-0.449, p=0.001), blood pressure (first) (r=-0.718, p<0.001) scores.

According to Spearman Correlation Analysis, there was a statistically significant negative correlation between the NVS scores and blood pressure (two) (r=-0.536, p<0.001) and number of hospital admissions in the last 1 year (r=-0.281, p=0.048).

According to Univariate Binary Logistic Regression Analysis, it was found that immigration increased the risk of Brucella diagnosis by 3.857 times (CI; 1.278-11.638) at a statistically significant level (Table 5). According to the Multivariate Binary Logistic Regression Analysis, it was found that immigration increased the risk of Brucella diagnosis

by 4.061 times (CI;1.239-13.311) at a statistically significant level (Table 5).

Table 5. Factors that increase the risk of Brucella diagnosis

	B[a]	Odds Ratio	95% CI		B[b]	Odds Ratio	95% CI	
			LL	UL			LL	UL
Age	-.001	.999	.970	1.028	-.008	.992	.942	1.045
Gender (Male)	-.088	.916	.403	2.084	.156	1.169	.454	3.009
Education (Primary school and below)	.258	1.294	.573	2.921	.311	1.365	.405	4.600
Income (Low income)	-.550	.577	.204	1.636	-.695	.499	.136	1.828
Hometown (outside Bursa)	**1.350**	**3.857***	**1.278**	**11.638**	**1.401**	**4.061***	**1.239**	**13.311**
Comorbidity (None)	-.184	.832	.359	1.930	-.079	.924	.267	3.195
Brucellosis in your family	1.056	2.875	.837	9.881	1.291	3.638	.926	14.291
Newest Vital Sign	-.096	.909	.727	1.135	-.151	.860	.635	1.165

a=Univariate Binary Logistic Regression Analysis, b=Multivariate Binary Logistic Regression Analysis (NR2=0.16, X^2=12.92, p=0.115), CI=Confidence Interval, LL=Lower Limit, UL=Upper Limit.

DISCUSSION

In the study, brucellosis prevalence for the year 2023 was 72.3/100,000 among the cases registered in Karacabey, the average age of the cases with brucellosis was 44 years, 64% were male, and 30% migrated to Karacabey district from other provinces. NVS scale scores were not statistically significantly different between the cases with and without brucellosis. When the NVS score distribution rates were compared, there was a statistically significant difference between the two groups; 22% of the cases with brucellosis scored 0 points on the NVS scale. Cases with brucellosis had statistically significantly higher rates of dairy animal feeding and food occupation

than cases without brucellosis. According to the Multivariate Binary Logistic Regression Analysis, migration increased the risk of brucellosis diagnosis by 4.061 times at a statistically significant level. In addition, in this regression model, the NVS scale and other demographic characteristics were not significantly effective variables in increasing the risk of brucellosis.

In a retrospective study in which 140 cases with brucellosis were examined, it was found that only 27 of the cases were female [16]. In a similar study, it was evaluated that the male sex ratio in brucellosis cases was 70% [17]. Similar to the studies in the literature, 64% of the cases with brucellosis were male in our study. In addition,

there are studies in which the gender ratios of cases with brucellosis are similar [18]. According to employment data, it can be said that the labor force participation rate of men is higher than that of women [19]. In addition to this, men are more likely to perform some professions with the risk of Brucella transmission. In addition, it should be kept in mind that women may be more likely to have contact with milk and dairy products than men.

The occupational characteristics of the cases with brucellosis were found to be different from the participants in the control group. When the cases with brucellosis were analyzed, it was evaluated that 14% were farmers, 14% were livestock farmers, 4% were health workers, and 8% were veterinarians/technicians. It has been reported that veterinarians and veterinary technicians, people engaged in animal husbandry, farmers working in multi-herd farms, slaughterhouse workers and meat/dairy processing plant workers have a high risk of Brucella [20]. Karacabey is a region where agriculture and animal husbandry are widely practiced. Therefore, it can be interpreted as a result compatible with the literature as an expected situation that occupational groups with a high probability of providing services and producing work in the Karacabey region are at a higher risk of brucellosis. In addition to this, Karacabey is a region close to seafood as it is adjacent to the sea and lakes [21]. In recent studies, it has been reported that Brucella can infect the environment due to seafood [22]. Therefore, it may be useful to investigate the effects of seafood on brucellosis cases seen in this region.

In the present study, the rate of migration out of Bursa was higher in cases with brucellosis than in the control group, and the rate of migration in these cases was 30%. Human migration is one factor that increases the risk of spread of brucellosis. It is known that the globalization process and the development of transportation facilities both facilitate human migration and facilitate the trade of meat and dairy products. In a study conducted in Germany, it was evaluated that 75% of the brucellosis cases reported were travel-related and that asylum seekers coming to Germany significantly increased the possibility of brucellosis [23]. In a similar study, it was found that the risk of Brucella was significantly increased in cheeses from Bulgaria, France, Greece and Turkey [24]. In a study conducted in Turkey, it was stated that the risk of brucellosis did not increase due to migration to Istanbul and its surroundings, contrary to expectations and that this may be an effect of the developing agriculture and livestock sector and the increasing awareness of the use of raw milk may be effective in this situation [25]. In contrast to this study, in our study, it was observed that migration may be a risk factor for Brucella outbreak. Therefore, it can be said that evaluations covering wider regions in future studies will benefit the literature.

In this study, the types of cheese consumed and the patterns of cheese consumption did not vary between cases with and without brucellosis; the rate of herbed cheese consumption was higher in cases without brucellosis. In this study, only cheese products were questioned concerning meat and

dairy products. It is seen that people with and without brucellosis consume cheese similarly. In some studies in the literature, it has been stated that consumption of herbed cheese may pose a risk for the diagnosis of brucellosis [26, 27]. In these studies, it was stated that fresh herbed cheese made with raw milk may cause this situation. Considering that the number of cases evaluated in our study was low, whether different types of herbed cheese reduce the risk of brucellosis can be examined in future studies.

In the present study, health literacy levels did not change according to cheese consumption patterns and cheese consumption types in cases with brucellosis. Although Brucella rarely causes human-to-human infection, it is an epidemic mainly associated with healthy interaction with animals and animal foods [2]. Therefore, it is accepted that the spread of Brucella is facilitated, especially in products made with raw milk [6]. In addition, it has been reported that cheeses made with raw milk and produced under unsanitary conditions are risky in terms of Brucella [26, 27]. The results obtained from our study show that health literacy is not an influential variable according to the type and type of cheese consumption. In addition, it should be kept in mind that the number of cases in this study was limited, demographic and clinical characteristics were not equalized according to cheese consumption, and this issue should be re-examined in larger samples in future studies.

According to the Multivariate Binary Logistic Regression Analysis, it was concluded that migration increased the risk of Brucella diagnosis by 4.061 times at a statistically significant level; in addition, in this regression model, the NVS scale and other demographic characteristics were not significantly effective variables in increasing the risk of brucellosis. Therefore, as a result of this study, we concluded that health literacy is ineffective in increasing the risk of brucellosis, while migration history is a significant risk factor. Migration is one of the essential phenomena that cause the transfer of cultural characteristics related to nutrition and health. For this reason, these individuals transfer their health and nutrition cultures to other individuals and maintain physical interaction with their hometowns through visits, guests from their hometowns and food. It is known that there is migration from the eastern regions of Turkey (Eastern Black Sea, Eastern and Southeastern Anatolia) to the western regions and that these regions of Turkey have a higher risk of Brucella outbreaks [5, 7]. Therefore, it would be useful for physicians working in the western areas to pay attention to the risk of Brucella in cases with a history of migration. In addition, it would be useful to state that we do not have clear evidence on where and how these cases contracted brucellosis.

One of the limitations of this study is that diagnosed patients were reached using medical records. In other words, cases affected by brucellosis but not detected by physicians who have not been admitted to health institutions are outside the scope of this study. Another limitation of the study is that the number of cases was limited

and included only cases diagnosed in one year. Another limitation is that the diagnosed patients learned the truth about brucellosis during the disease process. When we interviewed the patient, the patient had already acquired the correct information about brucellosis. Therefore, the patient may have already changed changeable behaviors.

Migration history is a critical variable that increases the risk of brucellosis. Consequently, it would be helpful for family physicians serving in western regions to pay attention to the risk of brucellosis in cases with a migration history. In addition, it should be kept in mind that health literacy does not increase the risk of brucellosis. Still, health literacy is relatively low in a significant portion of cases with brucellosis, and necessary practices and programs should be developed to overcome these knowledge deficiencies.

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