Brucellosis prevention and its risk management among livestock farmers based on the PRECEDE-PROCEED model

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Background: One of the most prevalent zoonotic diseases, brucellosis wreaks havoc on rural communities economies and society at large. In this study, we wanted to identify the risk factors for brucellosis among livestock farmers in rural districts.

Methods: 365 livestock farmers in the villages of Germi were chosen for a cross-sectional analytical study using cluster sampling. Educational needs assessments about brucellosis were assessed using the questionnaire comprising 4 modules; first module included demographic characteristics and other 3 modules assessed the components of PRECEDE-PROCEED model (*i.e.*, predisposing factors, enabling factors and Reinforcement factors).

Results: A high average (M=64.5 ± 6) knowledge about the transmission of brucellosis was observed among livestock farmers. However, the mean of attitude scores (about the regular visit of animals by the veterinarian and the effects of the disease on health status) were low (M=27 ± 3.3). Enabling factors (having protective equipment, access to pasteurized dairy products, keeping livestock outside the village and vaccination of livestock) had the low average (M=35 ± 8.7). Enabling factors and reinforcement factors were strongly correlated (r=0.338, p=0.001).

Conclusions: This study indicated that increasing of enabling factors can lead to livestock farmers empowerment and brucellosis prevention among them.

Keywords: Educational needs; Livestock farmers; PRECEDE-ROCEED model; Brucellosis; Reinforcement

INTRODUCTION

Brucellosis (also known as Malta fever or Mediterranean fever) is one of the zoonotic illnesses (diseases that can spread from animals to humans) that poses a threat to public health, especially in poor nations [1,2]. Direct human contact with livestock, drinking or consuming tainted, unpasteurized milk or cheese and consuming raw meat all increase the risk of contracting brucellosis, which is caused by an intracellular, gram negative cocco-bacilli bacterium [3-5].

Through immunization of animals, the prevalence of brucellosis has decreased in developed nations [6]. The risk of infection is still very high in developing nations. Due to its physical consequences, brucellosis has relatively long lasting socioeconomic effects on the livestock business [7].

The World Health Organization (WHO) estimates that every year there are about 500,000 new cases of brucellosis detected worldwide [8]. Iran is a developing nation where 20 out of every 100,000 persons are diagnosed with brucellosis each year [9]. Livestock farming is particularly prevalent in the villages of Ardabil province and Garmi County [10]. For instance, research indicates that in the province of Ardabil, brucellosis affects approximately 2-33 out of every 100000 people [11,12].

Fever, nocturnal sweats, migrating arthralgia and myalgia, appetite loss, decreased white and red blood cell counts, and elevated liver enzymes are some of the typical symptoms of brucellosis [13,14]. One indication of this illness is the concentration of brucellosis bacteria, which typically live in bones and joints and cause spondylitis and osteomyelitis of the lumbar spine [15]. If the examining physician is unfamiliar with the geographical area of the patient and how the illnesses characteristics differ in that region, lumbar lesions on radiological assessment can result in a physician making a mistaken diagnosis. In the course of clinical imaging, this could be misconstrued for lumbar disc lesions. Therefore, early detection and prompt treatment are essential for brucellosis endemic characteristics and how it impacts the unique residential location. These actions can ultimately save lives [16,17].

A health system's most crucial step in disease prevention is to undertake a needs analysis based on the requirements of the general populace [18]. Health needs analyses have been largely responsible for the health system's recent success in preventing brucellosis in developed nations [19]. Health education's major goal is to change people's behaviors as individuals, groups, and communities.

Using health education models can play an important role in both identifying basic health needs and successful planning for behavior change. The PROCEED model can be effective in identifying and meeting educational needs [20]. The PRECEDE-PROCEED model is an extensive structure for assessing health needs for designing, implementing, and evaluating health promotion and other public health programs to encounter those needs. The social diagnosis, epidemiological, behavioral and environmental diagnosis, educational and ecological diagnosis, administrative and policy diagnosis, implementation of the program, process evaluation, impact evaluation, and outcome evaluation are the eight phases of this model. Before creating and carrying out the intervention plan, an educational diagnosis of the issue is absolutely necessary. Hence, the third phase of model, which is the educational stage, is discussed. Three basic constructs of educational needs assessment phase including predisposing factors (*i.e.*, knowledge, attitude and self-efficacy) and enabling factors (*i.e.*, livestock maintenance conditions and facilities and skills) and reinforcement factors (*i.e.*, helping relationship, regular veterinary visit) [21]. Predisposing factors prepare individuals for healthy behavior, enabling factors includes the facilities and conditions that create the ground for behavior change, and the reinforcement factors includes the helping relationships that help the person to do the behavior [22,23].

Germi is one of the cities of Ardabil province that has many villages in its four regions including Moran, Ongut, Zahra and central region. The main occupation of many residents of these villages is agriculture and livestock farming, Livestock production and consumption is a significant source of income in many areas. Together, this model's application can help the healthcare system eliminate brucellosis in the future by helping to better understand the needs assessment of brucellosis disease among local laborers (such as livestock farmers). Hence, in this study using the only PRECEDE

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model, we looked at the risk factors for brucellosis prevention among livestock farmers in Germi county's rural areas. We hypothesized that predisposing elements like knowledge, attitude and self-efficacy could help livestock farmers be more effective at preventing the occurrence and spread of brucellosis.

MATERIALS AND METHODS

365 livestock farmers in Germi County's rural areas were included in a cross sectional analytical study by cluster sampling. In this study, we selected the Germi County due to the annual incidence of 60 to 70 cases of brucellosis. The statistical population in these studies was 7177 person consisting of 7140 traditional Livestock farmers, 22 industrial livestock workers, and 12 people from cheese factories, 3 slaughterhouse workers, who were directly related to livestock or their products. Based on the Cochran's formula and considering the default values for P and Q (P=0.5, Q=0.5) and d=0.05, the sample size for the present study was estimated to be 365. Germi county was divided into four clusters including Moran, Ongut, Zahra and central cluster from each of the four clusters, 90 traditional livestock farmers and 3 to 5 industrial livestock workers or workers related to livestock products were selected. Inclusion criteria included 1-having livestock 2-living in the village and 3-completing informed satisfaction. In the absence of any of these conditions, the samples would be excluded from the study.

The standard questionnaire of PRECEDE-PROCEED model was used which consisted of four parts, i) Demographic section with 10 questions, ii) Predisposing factors with 42 questions including awareness (27 questions), attitude (15 questions) with triple Likert option (right, wrong, do not know) and iii) Enabling factors with 16 questions including 5 items of conditions and facilities with triple Likert (agree, disagree, have no opinion) and 11 skill items with five likers (always, often, sometimes, rarely, never (and) reinforcement factors with 9 questions with triple Likert (agree, disagree, have no opinion). Content Validity Index (CVI) of the questionnaire was confirmed by a panel of experts consisting of 2 epidemiologists, 2 infectious disease specialist and 6 health education specialists. (CVI=up to 0.92) The reliability of the questionnaire was confirmed by test retest on 40 Livestock farmers (who were not included in the main analysis) as a pilot study with Cronbach's alpha coefficient of 0.82.

First, descriptive statistics were used to examine the mean scores of the predisposing, enabling, and reinforcing components. Then the relationship between these structures was investigated through Pearson correlation and ultimately using of ANOVA and regression, effects of enabling factors on reinforcement factors had been analysed. Data were analyzed using SPSS v. 20 and $p<0.05$ was considered statistically significant.

RESULTS

In this study, partcipants had a mean (SD) age of 42.5 ± 12.5, 49.3% (n=180) were men, 34.2% of participants were illiterate, 57.3% with less than diploma and 8.5% had diploma. Major occupations in women was housewife (49.3%) and in men were farmer (32.9).

Our findings showed that predisposing factors had the highest mean (M=102.5 ± 7.7) in assessing the needs of Livestock farmers in the prevention of brucellosis. Enabling factors (M=45.1 ± 8.7) and reinforcement factors (M=17 ± 5.7) were in the next stages, respectively (Table 1).

TABLE 1
Descriptive analysis of PRECEDE model constructs in the prevention of brucellosis among livestock farmers

	N	M	SD
Reinforcement factor (Helping relationship and healthy behavior doing)	365	17.53	5.49
Enabling factor (eg skills and facilities)	365	45.11	8.7
Predisposing factor (eg knowledge, attitude)	365	102.55	7.7
Knowledge		64.5	6
Attitude		27	3.3

The results of Pearson correlation demonstrated a high association between enabling factors, which include the ability to keep animals outside of the community, availability to livestock immunizations and proper usage of pasteurized dairy products and healthy meats, has strong relationship with reinforcement factors (helping relationships that help the Livestock farmers to engage in healthy behavior). While predisposing factors did not correlated significantly with enabling factors and reinforcement factors (Table 2).

Table 2
Correlation of PRECEDE constructs in the prevention of brucellosis

		Reinforcement	Predisposing	Enabling
Reinforcement	Pearson correlation	1	0.101	0.338**
	Sig. (2-tailed)	-	0.054	0.001
	N	365	365	365
Predisposing	Pearson correlation	0.101	1	0.065
	Sig. (2-tailed)	0.054	-	0.218
	N	365	365	365
Enabling	Pearson correlation	0.338**	0.065	1
	Sig. (2-tailed)	0.001	0.218	-
	N	365	365	365

**. Correlation is significant at the 0.01 level (2-tailed).

We found that enabling factors among livestock farmers had a great impact on reinforcement factors to protect them against brucellosis (Figure 1). While predisposing factors alone had not such an effect.

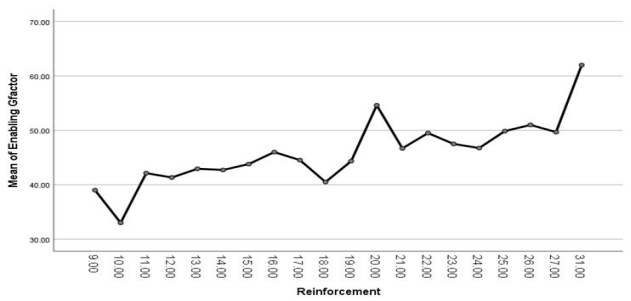

Figure 1: Effects of enabling factors on reinforcement factors to protect against brucellosis.

When we assessed the mediating effects of enabling factors on the relationship of predisposing factors and reinforcement factors through linear regression, this relationship also became significant (Table 3).

TABLE 3

Mediating effects of enabling factors on relationship of predisposing factors and reinforcement factors

PRECEDE constructs prediction	R	R^2	A.R^2	Sig
Enabling factor, predisposing	0.347	0.12	0.115	0.001
Only Enabling factors	0.338	0.114	0.112	0.001
Only predisposing factors	0.101	0.01	0.007	0.054

Dependant variable: Reinforcement factors

DISCUSSION

Brucellosis is one of the most common infectious diseases transmitted from livestock which has negative socio economic effects on the life of the rural population. Given that most of the villagers are engaged in livestock occupation, the occurrence of the brucellosis should be prevented to reduce the burden of disease. This study showed that predisposing factors had the highest mean in assessing the needs of livestock farmers in the prevention of brucellosis, followed by enabling factors and reinforcement factors.

We found that predisposing factors such as knowledge, attitude had a higher mean than other constructs such as enabling factors and reinforcement factors. Although predisposing factors had a high average because of knowledge scores, but attitude items had a low average. The second item of knowledge, which was "brucellosis is a zoonotic disease transmitted from livestock to humans," had a higher mean. Indeed the item 35 of attitudes construct includes "I think livestock needs to be examined by veterinarians" had a low score and item 39 "I don't think yogurt can transmit the disease" and item 40 attitudes "keep livestock away from family members" had the lowest average. Therefore, in the needs assessment conducted people do not need to increase knowledge but needs to alter their attitudes in the field of brucellosis prevention. These results were in consistent with the study of Hajari, et al. In Isfahan Hajari A, et al.

Despite having the high mean, predisposing factors did not show a correlation with enabling factors and reinforcement factors. Thus merely having knowledge about brucellosis cannot empower the study population to prevent the brucellosis. The subjects had more information about the transmission of brucellosis through contaminated milk and did not know other ways of transmitting the disease, including consumption of dairy and meat products. They were also unaware of the respiratory transmission of brucellosis. Farmers' attitudes about regular veterinary visits and keeping livestock in a suitable place away from where family members live, should also be corrected. Although similar results were obtained in the study of Li, et al., there was still a need to increase information about the transmission of disease through animal waste [24,25].

Enabling factors such as providing facilities and conditions were strongly correlated with reinforcement factors. Items 53 to 58 had the highest correlation with reinforcement factor which were: "If I have livestock, I vaccinate them on time", "I will inform the veterinarian if a livestock abortion occurs", "I use gloves when milking livestock", "I use gloves to chop the livestock meat", "I put the meat in the refrigerator for 24 hours before chopping", "I do not use traditional ice cream" respectively. Therefore, when the mediating effects of enabling factors on the relationship between predisposing factors and reinforcement factors were investigated, it was observed that predisposing factors had a significant relationship with reinforcement factors. This results are consistent with previous reports. This study has some limitations. First, we were unable to assess the cause effects due to the cross-sectional nature of our study. Second, this study was done in a single region and might not be generalizable to other parts of Iran despite the fact that the prevalence of brucellosis in Germy is higher than national average.

CONCLUSION

Our study showed that predisposing factors are not merely effective in performing brucellosis prevention behaviors among livestock farmers in Germi County. Therefore, to perform healthy behavior for brucellosis prevention, along with predisposing factors, enabling factors including facilities (*i.e.,* development of livestock vaccination services and increase the access of livestock farmers to these services) and conditions (*i.e.,* creating suitable conditions for the keeping livestock outside the village and also creating purchasing facilities, collecting and transferring milk produced to pasteurized milk factories and finally increasing the performance of people in the use of gloves and masks when they are in contact with livestock and livestock products) must be available.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Informed consent was obtained from all participants. Ethic approval was obtained from ethic committee of Ardabil university of medical sciences (IR.ARUMS.REC.1399.202). All study participants consented to participate in the study.

CONSENT FOR PUBLICATION

All authors consented to the publication of this article.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

COMPETING INTEREST

The authors declare that they have no competing interests.

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AUTHORS' CONTRIBUTIONS

Maleki Ali and Shaker Hamidreza and Ahmadi Fatemeh are nursing students that performed Data gathering. Spss Analysing And Manuscript Writing: Narimani Sajjad.

STUDY DESIGN

Dr Elham Zarehoseinzade. Dr Mehdi khezeli and Dr shandiz Moslehi: revised the manuscript.

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