

IMPORTANCE OF BRUCELLOSIS CONCERNING ANIMAL AND HUMAN HEALTH, PRESENT CONDITION, PROBLEMS, AND SOLUTION PROPOSALS IN TURKEY

ALI BILGILI¹, BASAK HANEDAN²

¹ University of Ankara, Faculty of Veterinary, Department of Pharmacology and Toxicology, Ankara, Turkey.

² University of Ataturk, Faculty of Veterinary, Department of Internal Medicine, Erzurum, Turkey.

Abstract

Considering the fact that a major part of diseases occurring in humans is caused by animals and thinking of the fact that animal health directly affects human health and animal products are unquestionably required for human nutrition, it is concluded that human health depends on animal health. In this context, brucellosis is an important zoonotic disease that causes economic losses for our producers, adversely affects sustainable livestock raising and threatens public health. Human brucellosis occurs by the result that humans directly or indirectly contact infected animals. Therefore, prevention of infection in humans and its control depends on breaking of this contact chain and control of infection in animal reservoirs and its elimination. For these reasons, in this report content, concise information was given about present condition, problems, actions to be taken and solution proposals concerning brucellosis in Turkey.

Key words: Brucellosis, Animal and human health, Problems, Solution proposals.

1. Present Condition

The disease is established by Gram-negative, non-motile, non-spore-forming, non-capsule-forming, and coccobacilli. The causative agent has different biotypes belonging to different species according to the ratio of specific M and A antigens [1]. The disease is characterized by high fever, late term abortion [2], reduction of milk production [3], swelling of joint, and infertility. The animals with brucellosis may be pregnant again in the later years and they give birth without disease signs and continue to spread the disease. The causative agent in cattle is *Brucella abortus*. *B. abortus*, which has different 9 biotypes, is a reason of enzootic abortions in cows, and produces an infection in sheep, goats, horse, dog, and humans [1]. In recent years, it has been determined that the *Brucella* spp. isolated from marine mammals such as whale, dolphin, and otter are different than *Brucella* spp. isolated from land mammals and it is termed as *Brucella maris*. *Brucella* infections are transmitted to humans via contact with infected animals and zoonotic infections characterized by undulant fever in humans [4]. Thus, the prevention and control of infection in humans is based on breaking the contact chain and the prevention and control of infection in animal reservoirs. Scientific Consultation Committee for Brucellosis in Ministry of Health is established to combat the brucellosis.

B. melitensis, *B. suis*, *B. abortus* and *B. canis* can infect humans [4]. *Brucella* organism mainly infects domestic animals and is a worldwide zoonotic disease. Wild mammals and rodents such as brown rats and voles have a reservoir role [5]. Skin, wool, manure and farm materials are infection resources [6]. *Brucella* organisms remain viable for a long period in dust, excretions of animals, soil, meat, and milk products [7] but die when exposed to sunlight [8].

The important risk factor is infected animals, especially transmission via contact or respiration to *Brucella* organisms from goats [9]. 10 to 100 organisms in air can cause disease [5]. *Brucella* infection can occur via cut and injury on hand or conjunctival contact with infected blood or other fluids [9]. In endemic areas with *Brucella* infection, humans become infected with *Brucella* organisms via contact to infected animals, consumption of the infected milk and milk products, especially cheeses produced by unpasteurized sheep and goat milk, and cheeses produced with rennet obtained from kid and lamb stomach [4] and consumption of undercooked beef.

The occupation groups with risk for brucellosis are veterinary surgeons, farm workers, herdsmen, animal breeders, meat packaging workers, abattoir workers [10,11], microbiologists, and clinical laboratory staffs [12].

Brucella organisms can remain viable for four months in butter, for three weeks in cold milk, for 45 days in cow manure, for 100 days in humid soil, for five days in liquid manure. *Brucella* organisms in aborted fetus and placenta for four months have the ability to produce disease.

Figure 1. Aborted fetus in brucellosis.



Brucellosis, causing important economic loss, negatively affecting stock farming and threatening public health in our country, is an important zoonotic disease [13,14].

In our country, the studies of the control and eradication programme for *Brucella abortus* have been started in 1930. The laboratory for *Brucella melitensis* was established in 1965 and the production of Rev.1 vaccine for *Brucella melitensis* has been started in 1969.

National Brucellosis Control and Eradication Project has been implemented in 1984 for combating this hazardous disease not only decreasing animal productivity and threatening animal health but also having serious risks on human health [13].

As required by the project, 4 to 8-month-old calves and 3 to 8-month-old lambs and kids have been targeted to be vaccinated by separating Turkey into five regions. This project, gradually started according to the regions, is a comprehensive eradication project continued for 26 years up to 2010. In addition, for the purpose of contributing the eradication and control of disease in conjunction with the project, other studies were also continued to determine how the disease becomes prevalent. Accordingly, *Brucella* prevalence was determined as 6.9% in cows (as individual prevalence of 2.6%), and 30% in sheep (as individual prevalence of 4.7%), indicating that it was not enough progress in defense for 26 years in our country [15].

The project regarding “Determination of Control Strategy of Brucellosis and Tuberculosis in Turkey” prepared in partnership with Ministry of Food, Agriculture and Livestock and Holland Government was started in 2011 and completed in 2012 including 81 provinces. Accordingly, in our country in cows and in sheep and goats the prevalence data of *Brucella* have been demonstrated below maps [15].

Figure 2. Herd prevalence with regard to brucellosis with 6.9% and individual prevalence with 2.6% in cows.

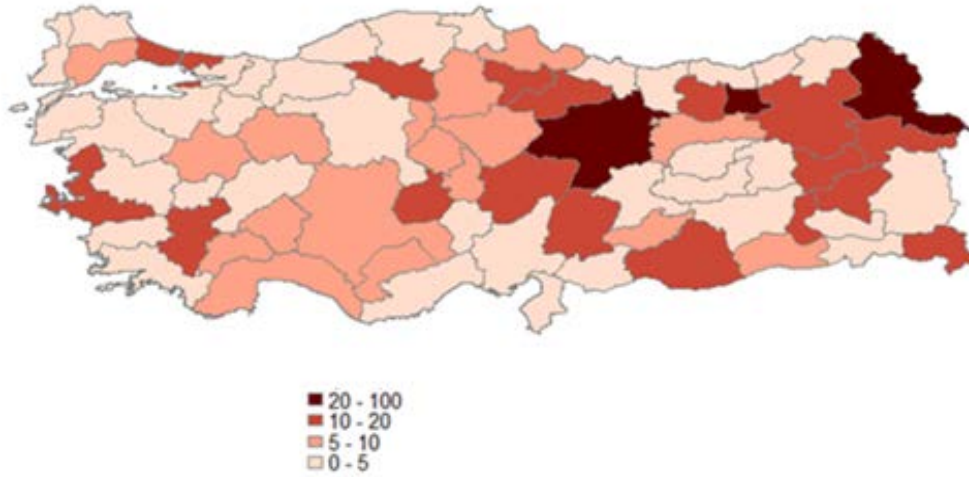
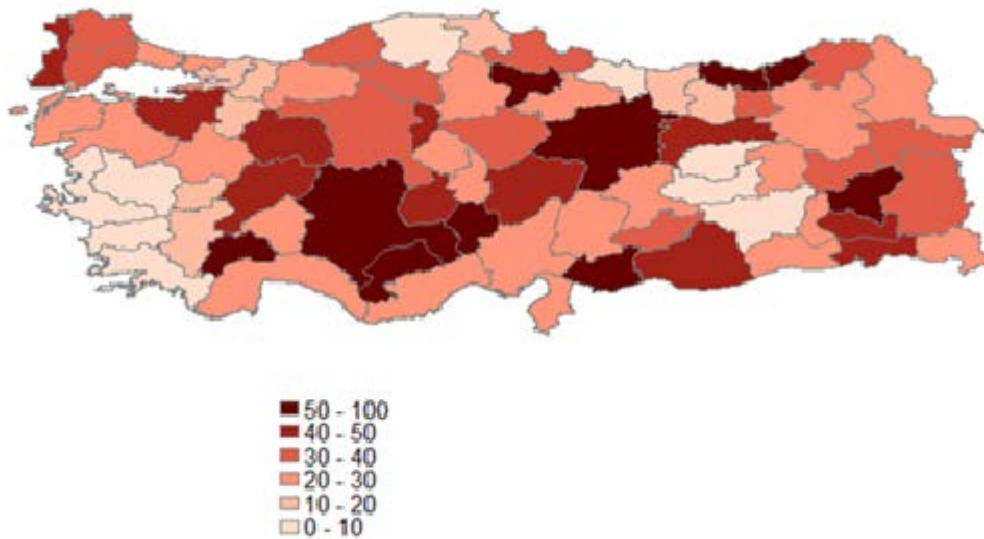


Figure 3. Herd prevalence with regard to brucellosis with 30% and individual prevalence with 4.7% in sheep.



However, in countries that *Brucella* eradication is accomplished, the disease prevalence has been decreased below 1% via *Brucella* vaccination, and then the disease has been eradicated by slaughtering the animals positively determined by *Brucella* test. In our country, in struggling with *Brucella*, it is approved that mass vaccination instead of local vaccination would be effective, and conjunctival vaccination would be administered in all age animals [16].

For this purpose, Control and Eradication Project of Brucellosis has been started from 01/01/2012 via conjunctival vaccination to be continued for 10 years in cows, and for 6 years in sheep and goats. This project is being implemented according to the principles in the regulation on the combating brucellosis published in the Official Gazette with numbered 27189 and on 03/04/2009. As compatible with European Union Council Directive of 26 June 1964 and

numbered 64/432/EEC on animal health problems affecting intra-community trade in bovine animals and swine [17], European Union Council Directive of 13 December 1977 and numbered 78/52/EEC establishing the community criteria for national plans for the accelerated eradication of brucellosis, tuberculosis and enzootic leucosis in cows [18], and European Union Council Directive of 28 January 1991 on animal health conditions governing intra-community trade in ovine and caprine animals [19], the regulation of Control and Eradication Project of Brucellosis was prepared.

Struggling with brucellosis is implemented according to the regulation on the combating brucellosis on 03.04.2009 and numbered 27189 published in Official Gazette [20] and Control and Eradication Project of Brucellosis via conjunctival vaccination with number of 2012/03 [16].

Figure 4. In Turkey, focuses of brucellosis in cows (Data of World Organization for Animal Health, in 2008-2016) [21].

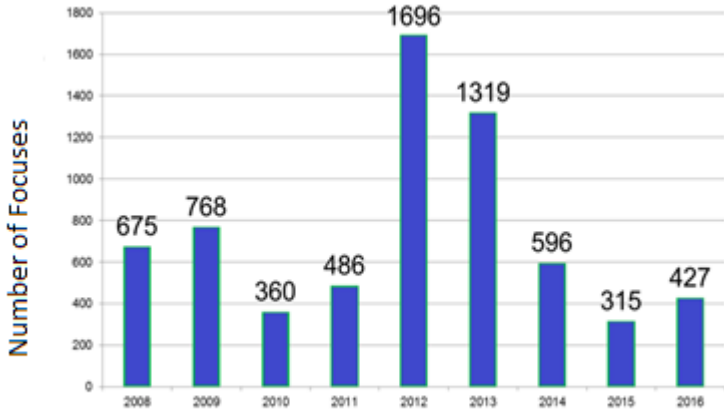


Figure 5. In Turkey, focuses of brucellosis in sheep and goats (Data of World Organization for Animal Health in 2008-2016) (Anon 2017a).

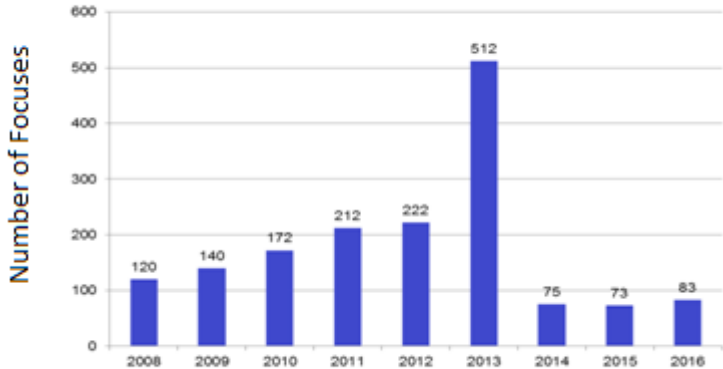


Table 1. The results of vaccination for *Brucella* S-19 strain in cows according to the data of Türkvet in 2012-2016 [22].

2012	2013	2014	2015	2016
2.877.190	4.074.748	2.300.330	1.599.408	1.853.502

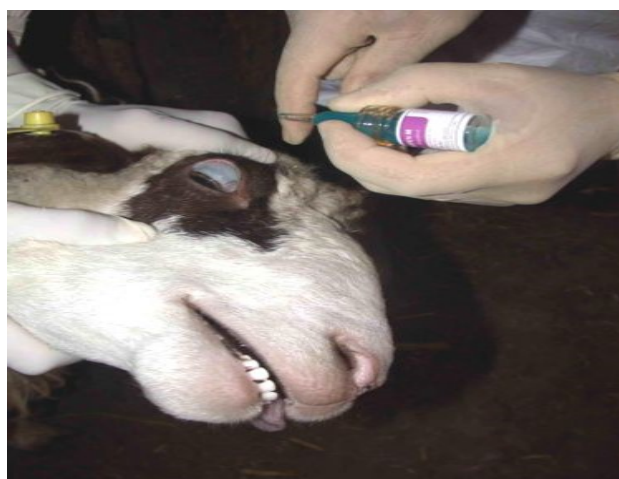
Table 2. The results of vaccination for *Brucella* Rev-1 strain in sheep and goats according to the data of Türkvet in 2008-2016 [22].

2012	2013	2014	2015	2016
7.320.487	11.161.120	5.131.188	3.525.842	4.026.249

Figure 6. Vaccination for *Brucella*.



Figure 7. Vaccination for *Brucella*.



According to the project, *B abortus* S-19 conjunctival vaccine was administered to cows in 2012 except those vaccinated with S-19 vaccine via subcutaneous route, as mass vaccination strategy. In 2013, first vaccination of adult cows not vaccinated in 2012, second vaccinations to cows, and first vaccinations to 3 to 6-month-old calves were made. From 2014, 3 to 6-month-old calves were vaccinated [15,16].

B. melitensis Rev-1 conjunctival vaccine was administered to female sheep and goats and male breeding sheep and goats from 2012 except those vaccinated with Rev-1 vaccine via subcutaneous route, as mass vaccination strategy in sheep and goats [23].

Enough immunity is anticipated to develop for life of each animal with one dose. In second year only 3 to 6-month-old female lambs and kids and unvaccinated adult female and breeding male sheep and goats remaining previous year would be vaccinated. These vaccinations would be performed with a 6-year programme [23].

The number of focuses in our country was 1696 in cows in 2012 and 596 in 2014. The number of focuses in our country was 222 in sheep and goats in 2012 and 75 in 2014 [15].

According to the regulation on the combating brucellosis, it is targeted that the prevalence of brucellosis is below 1%, consistent with EU regulation, via mass vaccinations and after the brucellosis is eradicated by testing and slaughtering. For this purpose, it is planned that animal industries are followed and animals with brucellosis are slaughtered until the brucellosis prevalence below 1% is achieved.

The appraisal of animals to be slaughtered is based on the rules depicted by law with number of 5996 [24] and official veterinarian must supervise during killing the animal. The project period would be able to prolong according to the result of survey study in the end of 10 years in cows and in the end of 6 years in sheep and goats.

As part of combating animal diseases, payments to practitioners for the programmed vaccinations determined by Ministry of Food, Agriculture and Livestock are made, and the veterinarians who administer vaccine are benefit from payments regarding the programmed vaccinations.

The method of conjunctival vaccination for *Brucella* infection instead of subcutaneous vaccination has decreased the transmission risk of disease regarding occupational.

In the effective control of disease killing, conditional slaughtering, and properly elimination of the diseased organ and materials are highly important. In our country areas conditional slaughtering and transport issues are an important risk factor for the spread of disease.

In addition, Ministry of Food, Agriculture and Livestock has not a specific budget on the combating brucellosis, thus causing concerns and unjust suffering in animal breeders. The animal breeder should deliver the abortion materials on day of abortion to Directorate of Provincial Food, Agriculture and Livestock.

Table 2. The reports of brucellosis in Turkey.

Place and Year of Report	References
<i>Brucella</i> seropositivity was determined in 147 out of 400 sera obtained from 16 different sheep flocks with abortion events unvaccinated against <i>Brucella</i> by serum agglutination test in Kars and its district.	Celebi and Atabay, 2009 [25]
286 brucellosis cases in Southeastern Anatolia Region on June 2007 to July 2009	Tekin et al., 2012 [26]
Brucellosis related to laboratory was determined in 38 out of 667 laboratory staffs in 37 hospitals of 17 provinces in Turkey in 2012.	Sayin-Kutlu et al., 2012 [27]
<i>Brucella</i> seropositivity was determined in 525 out of 2913 patients in Iğdır province in Northeastern Anatolia Region of Turkey.	Arvas et al., 2013 [28]
<i>Brucella</i> positivity was determined in 317 out of 334 milk samples obtained from cattle with history of abortions in Erzurum province in 2013.	Arasoğlu et al., 2013 [29]
Occupational brucellosis in 712 veterinarian and 84 veterinary technicians was determined in 2014 in Turkey.	Kutlu et al., 2014 [30]
The positivity rate for brucellosis by micro-agglutination test was 3.03% in cattle with abortions on April 2008 to September 2008 in Adana province.	Yücel et al., 2014 [31]
423 brucellosis cases according to the result of study in Marmara Region in 2000-2013.	Öztürk - Engin et al., 2014 [32]
Brucellosis positivity in 496 children in Van province on July 2009 to December 2013.	Parlak et al., 2015 [33]
8% positivity rate for brucellosis in 114 cases in hyperendemic Gürün, Altınyayla and Kangal counties of Sivas on April to October 2011.	Alim et al., 2015 [34]
The brucellosis positivity was determined in 88 children, 5 to 14 years old, with history of joint pain in Adıyaman Besni hospital in 2011 to 2013.	Yılmaz et al., 2016 [35]
The rate of positivity for brucellosis was determined to be 8.37% in 227 bulls in Northeastern Anatolia Region (provinces of Kars, Ardahan, and Iğdır).	Çelebi et al., 2016 [36]

Table 3. Brucellosis case and death numbers, rates of morbidity and mortality in humans in 2011-2015 in Turkey (Ministry of Health, TSİM, 2016) [37].

Year	Population	Case Number	Rate of Morbidity	Mortality Number	Rate of Mortality
2011	74.724.269	7.177	9,60	0	0,00
2012	75.627.384	6.759	8,94	0	0,00

2013	76.667.864	7.225	9,42	0	0,00
2014	77.695.904	4.475	5,76	0	0,00
2015	78.741.053	4.173	5,30	0	0,00

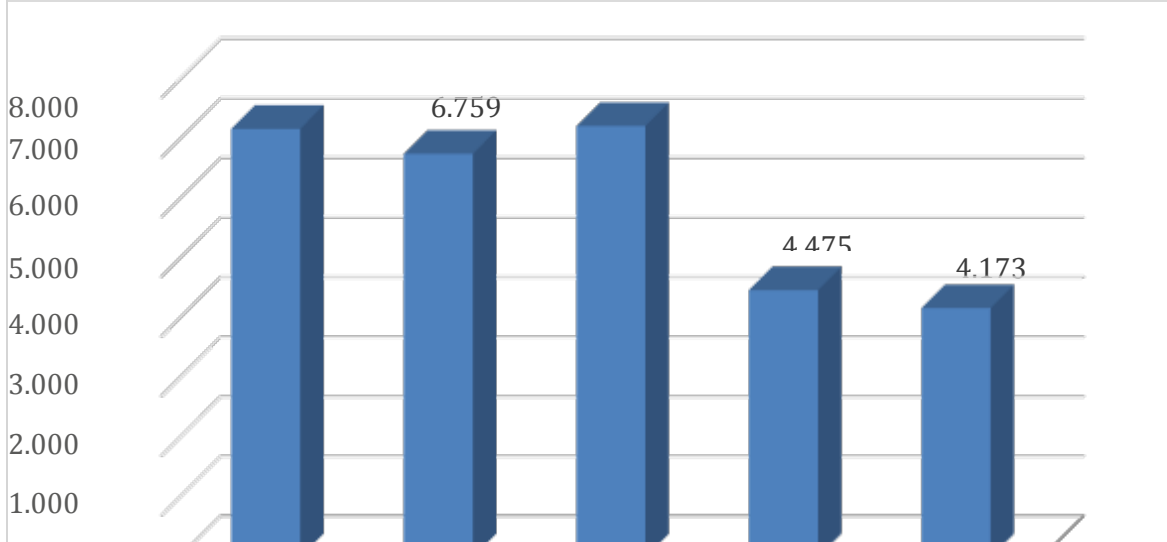
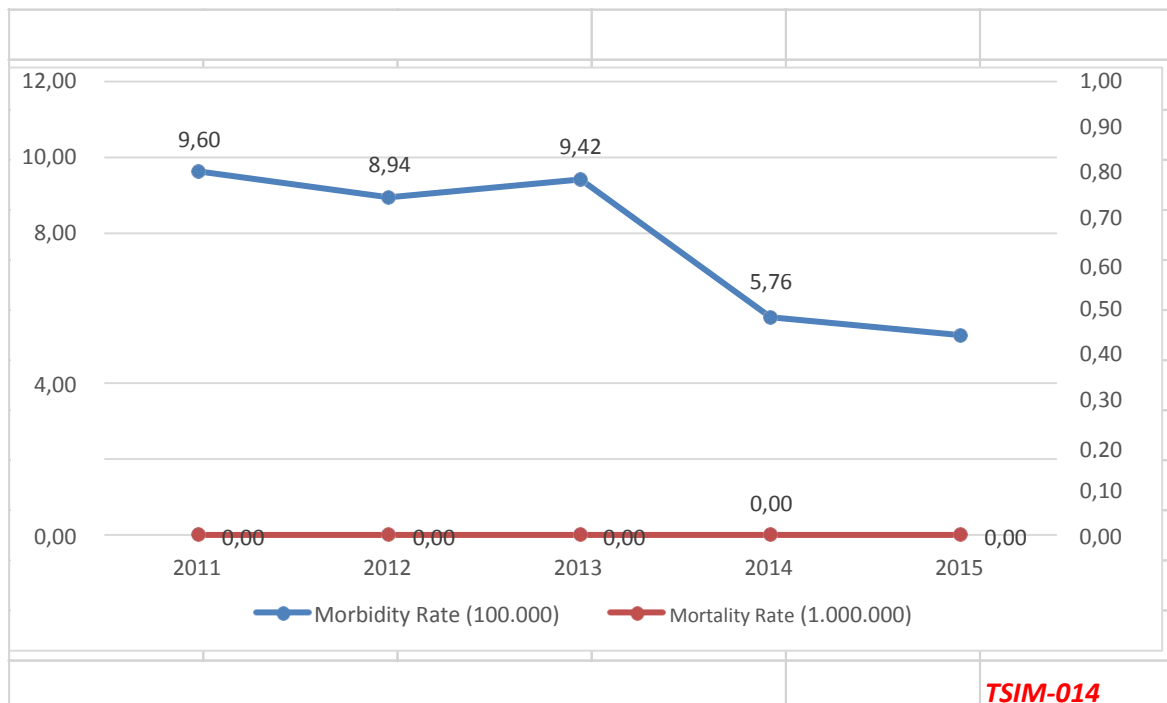


Table 4. Brucellosis morbidity and mortality rate in humans in 2011 - 2015 in Turkey (Ministry of Health, TSIM, 2016) [37].



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2. Problems

- As with other diseases required to be notified, killing, conditional slaughter, and suitable and immediate elimination of diseased organ and materials are highly important. Problems, such as insufficient of abattoirs in the country-wide for conditional slaughter, negative attitudes of abattoirs for conditional slaughter, and difficulty for transportation to abattoir, cause an important risk in spread of disease by loss of time.
- That Ministry of Food, Agriculture and Livestock spends from general budget for combating brucellosis but has not a specific budget for *Brucella disease* may cause unnecessary apprehension and unjust treatment for animal breeder and loss of time.
- There are important duties of animal breeders in brucellosis combat. Animal breeders should apply to Directorate of Provincial Food, Agriculture and Livestock for identification procedure on day of abortion.
- Insufficient personnel, vehicle, and equipment about implementing of planned mass vaccinations.
- Insufficient of licensed livestock market and uncontrolled animal trade except livestock market.
- High increase in animal movements due to transportation means, thus uncontrolled animal movements.
- Gathering animals from different provinces and counties without putting any test because of the projects of Agricultural Development Cooperative and distribution of those animals.
- Unconscious of animal breeders on dealing.
- That animal breeder thinks to receive indemnity late and sells the diseased animal to any facility without disease.

3. Solution Proposals

- Female cows with 3-6 months old should be vaccinated for brucellosis.
- When a new animal will be added to any herd, laboratory test is required or certificated animal with free of brucellosis or vaccinated animal for brucellosis is chose.
- After milk is boiled or pasteurized (at 70 °C for 10-15 minutes), it is consumed or milk products are produced.
- Bulls should be kept in mind to transmit *Brucella* infection via coitus, thus laboratory test is required for bulls regarding free of brucellosis, or artificial insemination is chose.
- Aborted fetus and placenta should not be contacted with naked hand. If possible, they should be sent to the laboratory, or if not possible, they should be buried in a deep hole or burned.
- The diseased animals should be slaughtered because treatment takes a long time and expensive, and *Brucella* spp. are constantly excreted in milk. The consumption of meat is unobjectionable after cooking.

- Supply of vehicle, staff and equipment requirements is important factor in the accomplishment of mass vaccination.
- The ground vehicle with all equipments including unit of disinfection in Directorate of Provincial Food, Agriculture and Livestock for effective identification and intervention of disease is required.
- For supplying all kinds of hygienic conditions, regular vaccinations to animal diseases should be meticulously continued. The frequency of surveillance should be increased to assure that all kinds of hygienic conditions are supplied in regions.
- Early diagnosis of brucellosis is highly important in the prevention of disease spread. Thus, notifications should be immediately made on that aborted materials are sent to related institution.
- Animal identification and control of its movements should be effectively implemented. Upon non-certificated animal introduced into stock farming unit, it is imposed on administrative fine.
- Livestock markets should be licensed and controlled for getting in and out of animals.
- Bacteriological diagnosis should be rigorously implemented in compatible with Notice of *Brucella* Eradication Project via conjunctival route (2012/03) in 2012.
- Agricultural Development Cooperative gathers animal at country-wide with various criteria and these animals may be a source of brucellosis. Thus, animal health tests should be rigorously implemented.
- Diseased or suspicious animals should not be contacted with stock farming unit up to quarantine end.
- Appraisal should be implemented according to the criteria determined by Ministry of Food, Agriculture and Livestock.
- Precautions regarding risk of disease spread caused by farmers should be taken. Programs creating awareness should be routinely carried out for farmers in context of animal care, nutrition, diseases, transmission of diseases, and vaccination by staffs from Ministry of Food, Agriculture and Livestock and Agricultural Insurance Pool.
- Management and technical staffs, decreasing numbers of outbreak of diseases and allowances, should be rewarded based on provinces.
- Meat and milk foundation should be nominated for conditional slaughter based on province and county taking account of the fact that special abattoirs are not enthusiastic about conditional slaughter.
- In addition, I think that cost effective vaccination can contribute to vaccination campaigns.

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