BURSA ULUDAĞ ÜNİVERSİTESİ ZİRAAT FAKÜLTESİ DERGİSİ
Journal of Agricultural Faculty of Bursa Uludag University
e-ISSN 2651-4044
https://dergipark.org.tr/tr/pub/bursauludagziraat
http://www.uludag.edu.tr/ziraatdergi
Aralık/2022, 36(2), s. 317-336

ARAŞTIRMA MAKALESİ RESEARCH ARTICLE

Geliş Tarihi (Received): 18.02.2022
Kabul Tarihi (Accepted): 07.04.2022

Evaluation on Biosecurity Practices of Dairy Farms in Bursa Province -I[A]

Şehri YILMAZ[1], Mehmet KOYUNCU[2*]

Abstract: The purpose of biosecurity is to create a barrier against disease-causing agents and other threats by minimizing the transport of biological organisms and external threats to livestock holdings. This research was carried out to reveal the current biosecurity practices of dairy cattle farms in Bursa. In the study, the farms and districts with 20 heads and above in Bursa province, which is registered in the Türkvet and herd book-program database were determined. The farms in five districts (Mustafakemalpaşa, Yenişehir, Karacabey, Nilüfer, Osmangazi) that are suitable for this purpose are grouped according to their animal number. The farms taken into consideration were divided into three layers as those with 20-50, 51-100, and >101 head cattle. The farms were determined and the farms within the population size were chosen and visited randomly by stratified sampling method. In the survey, questions were asked to reveal information about breeders, herd management practices, animal purchase and quarantine, competence in biosecurity, equipment, hygiene and health protection practices. In this context, although there is no difference in terms of districts in terms of quarantine application for buying animals, application of biosecurity rules and disinfection of equipment after use, the difference is significant in terms of farm size ($P<0.05$). In terms of keeping regular health records, the differences between districts and farm size are important ($P<0.05$). According to the $\chi 2$ analysis, there was no difference between the districts in terms of the reasons for not using biosecurity practices in the size of the farms. It was determined that some of the breeders understood the meaning of the concept of biosecurity, but they acted reluctantly by putting forward different reasons at the point of application.

Keywords: Bursa province, biosecurity practices, dairy farms, survey.

[A] Ethics committee approval was obtained with the decision letter of Bursa Uludağ University Research and Publication Ethics Committee dated 31.01.2022 and numbered 6 of the 2022-01 session. Research and Publication Ethics were followed in this study.

[1] Şehri YILMAZ, Tarım ve Orman Bakanlığı, Bursa Tarım İl Müdürlüğü, Bursa, Turkey. e-mail: safran495@hotmail.com OrcID 0000-0003-0038-9303

[*] **Sorumlu yazar/Corresponding Author:** [2] Mehmet KOYUNCU, Bursa Uludağ Üniversitesi Ziraat Fakültesi, Zootekni Bölümü, Bursa, Turkey. e-mail: koyuncu@uludag.edu.tr, OrcID 0000-0003-0379-7492

Atıf/Citation: Yılmaz, Ş. and Koyuncu, M. Year of the publication. Title of the Artıcle. *Bursa Uludag Üniv. Ziraat Fak. Derg.*, 36(2), 317-336. https://doi.org/10.20479/bursauludagziraat.1073094

Bursa İli Süt Sığırcılığı İşletmelerinin Biyogüvenlik Uygulamaları Açısından Değerlendirilmesi -I

Öz: Biyogüvenliğin amacı, biyolojik organizmaların ve dış tehditlerin hayvancılık işletmelerine taşınmasını en aza indirerek hastalığa neden olan etkenlere ve diğer tehditlere karşı bir engel oluşturmaktır. Süt sığırcılığı işletmelerindeki temel hedef biyogüvenlik kriterleri çerçevesinde insana, hayvana, toprağa ve çevreye önem verirken, üretimde kaliteye erişim noktasında işletmelerin doğru yönlendirilmeleri ve yönetilmeleridir. Bu araştırma Bursa ilindeki süt sığırcılığı işletmelerinin mevcut biyogüvenlik uygulamalarının durumunu ortaya koymak amacıyla yürütülmüştür. Araştırmada Türk- vet ve e- ıslah sistemi veri tabanına kayıtlı Bursa ilindeki 20 baş ve üzeri sığır varlığına sahip olan işletmeler belirlenmiştir. Bu amaca uygun olan beş ilçedeki (Mustafakemalpaşa, Yenişehir, Karacabey, Nilüfer, Osmangazi) işletmeler hayvan varlıklarına göre gruplandırılmıştır. Değerlendirmeye alınan işletmeler 20-50 baş, 51-100 baş ve 101 baş üzeri sığır varlığına sahip olanlar şeklinde üç sınıfa ayrılmıştır. Tabakalı örnekleme yöntemine göre örnek büyüklüğü belirlenmiş ve tabaka içerisindeki işletmeler tesadüfi olarak seçilip ziyaret edilmiştir. Ankette temel olarak yetiştiricilere ait bilgiler, sürü yönetim uygulamaları, hayvan satın alma ve karantina, biyogüvenlik konusundaki yeterlilik, ekipman hijyeni ve sağlık koruma uygulamalarını ortaya koyacak sorular yöneltilmiştir. Bu bağlamda hayvan alımı için karantina uygulaması, biyogüvenlik kurallarının uygulanması ve kullanım sonrası ekipmanların dezenfeksiyonu açısından ilçeler açısından farklılık bulunmamakla birlikte, işletme büyüklüğü açısından farklılık anlamlıdır ($P<0.05$). Düzenli sağlık kayıtlarının tutulması açısından ilçeler ve işletme büyüklükleri arasındaki farklılıklar önemlidir ($P<0.05$). $\chi 2$ analizine göre işletmelerde biyogüvenlik uygulamalarının kullanılmama nedenleri ve çiftliklerin büyüklükleri açısından ilçeler arasında fark bulunmamıştır. Yetiştiricilerin bir kısmının biyogüvenlik kavramın anlamını kavradıkları ancak uygulama noktasında farklı gerekçeler ortaya koyarak gönülsüz davrandıkları belirlenmiştir.

Anahtar Kelimeler: Bursa ili, biyogüvenlik uygulamaları, süt sığırcığı işletmeleri, anket.

Introduction

Biosecurity refers to protecting people and animals from infectious diseases, pests, and the other biological threats. In farms with an important place in a healthy, and balanced diet, sustainable breeding with healthy animals, food safety, and consumer health and satisfaction are directly related to biosecurity (Köseman, 2008).

Although animal breeding is done for different purposes, breeding is healthy animals and profitable animal production. Especially in recent years, the concern of contamination of unidentified disease agents in livestock farms in developing countries has led to an awareness of biosecurity practices. Biosecurity and biological risk management are as important as other herd management practices as they contain many potential threats. With

the emerging attention, the movement of biological organisms is minimized, and it becomes possible to create a barrier that can struggle internal and external threats in livestock farms (Hersom, 2015).

Dairy farms are aiming at growth and development must implement correct and applicable biosecurity measures to maintain maximum production with disease-free herds. Otherwise, infectious diseases may enter the herd even with a single animal purchased and affect other animals, including humans. For this reason, some high-risk diseases should be identified, and prevention and control practices should be put in place against those that may pose potential problems (Wallace 2003). Training and informing the farmer and personnel about the issue's importance is important to prevent possible losses. In this context, it should be taken into account that disease risks may arise from newly purchased animals, deficient health-protection practices, or risky environmental conditions. If these risks are known, it is easier to deal with or overcome problems at the enter farms level. Visitor management, training of employees, management of newly commissioned animals, technical services, storage and transportation of feed, farms practices, and manure management are the main subjects of biosecurity training (Hersom et al., 2017).

Although the risks in biosecurity practices are valid for every farms, it has been determined that large-scale herds follow more biosecurity practices than small-scale herds. The frequency of diagnostic testing and the tendency to practices such as the inspection of purchased cattle increase with herd size. On the other hand, breeders generally try to minimize the negative effects of the risks they know. It has been determined that those working in farms with more presencethat is animal have more information about the risks associated with zoonotic pathogens. Overall, it has been concluded that many management practices are associated with herd size (Hoe and Ruegg, 2006). The measure of how difficult or unsuccessful an animal is coping with its conditions gives information about the degree of poor welfare of the animal. If the animal welfare is good level in the conditions in which it will give the most accurate information about what an animal's preferences (Koyuncu and Altınçekiç, 2007).

In general, there are almost no data on the level of biosecurity practice in livestock farms in Turkey. From this point of view, it has been determined that there is no previous study to determine the biosecurity level of dairy farms in Bursa. In particular, the studies to be carried out based on the farms by way of sampling in the field are important in defining the problems in production and revealing their solutions. Considering the importance of dairy cattle farming activities from the past, the presence of animals, and their place in the country's plan and production capacities, it has been concluded that this type of study is necessary and important. This study, it is aimed to reveal an awareness of the importance of biosecurity in dairy farms, to what extent biosecurity is known or applied, especially considering the districts that stand out in terms of dairy cattle presence in the province.

Material and Method

As research material, farms with twenty or more cattle registered in Turkvet and e-Islah databases (2016) in three districts (Mustafakemalpaşa, Yenişehir, Karacabey) and two central districts (Nilüfer, Osmangazi) in Bursa province where dairy cattle breeding is intense were taken. The counties of Mustafakemapaşa, Yenişehir and Karacabey, which were taken into consideration, have approximately 60% of the total number of cattle. Data obtained from face-to-face surveys conducted on a voluntary basis with farm owners regarding biosecurity in selected farms were used. Ethics committee approval was obtained with the decision letter of Bursa Uludağ University Research and Publication Ethics Committee dated 31.01.2022 and numbered 6 of the 2022-01 session.

In this study, the population was divided into homogeneous subgroups in terms of one or more characteristics, and a "stratified sampling method" was used. The farms were first divided into five subgroups according to the districts in which they were located, and secondly, into three layers according to the size of the farms. In the stratification process, paing attention to the fact that each enter farms prise belongs to the group (layer) to which it belongs. It has been determined that there are 1603 dairy farms that meet these criteria. In the second stage, the districts where such farms are concentrated were determined, and the stage of determining the farms in five districts (Mustafakemalpaşa, Yenişehir, Karacabey, Nilüfer, Osmangazi) by the criteria discussed in terms of transportation and healthy conduct of the work was started. The fact that these districts are included in the evaluation is due to the intensive dairy cattle breeding. In the third stage, the selected farms were grouped according to the existing animal existence. In this context, farms are divided into three layers as holdings with 20-50 head, 51-100 head and >101 head cattle. The sample population sizes to represent the farms in these three layer and in five districts were determined by calculating according to the "stratified sampling" method (Sümbüloğlu and Sümbüloğlu, 2002).

A minimum of 150 participants' information was evaluated to ensure that made sufficient observations to meet the estimation of the coefficients for each response in the five districts considered (Table 1). In terms of districts, there were cases where no answer could be given to all the questions asked in the farms visited, and this was reflected in the total number of answers. On the other hand, the participants could choose more than one criterion in the answers given to some of the survey questions.

Table 1. Number of surveys conducted by districts and farms capacity

	Farms capacity (head)			
Districts	20-50	51-100	>101	Total
Yenişehir	20	12	5	37
Osmangazi	4	2	2	8
Nilüfer	16	6	1	23
M.Kemalpaşa	30	10	7	47
Karacabey	19	5	11	35
Total	89	35	26	150

The questionnaire forms obtained at the end of the research were transferred to the computer using the Google forms program. Some answers were numerically coded and exported to Microsoft Excel to aid analysis. Then, numerical (frequency) and proportional values were calculated for the answers given to each survey question. Finally, tested the effect (relationship) of district and farm sizes on the answers with Chi-square analysis (Minitab, 2014).

Results and Discussion

Age is one of the important criteria for orientation to research studies and biosecurity training programs at the point of the future of farms. (Ellis-Iversen et al., 2010) reports that those who intend to implement zoonotic control programs are generally young and middle-aged breeders. On the other hand, studies on both humans and animals show that young people have lower compliance with recommended practices, and aged people adopt approaches that protect themselves and their animals more (Barr 2008; Bish and Michie 2010; Schemann et al., 2011). In the study, 20-40 years old were classified as young, 41-60 years old as middle-aged, and over 60 years old as old. While more than half of the breeders are in the middle-aged group (54.2%), the ratios of young and old are 35.4 and 10.4 ($P<0.05$). On the contrary, in Mustafakemalpaşa, the majority of breeders are in the young group (53.33%), while in other districts, the majority are in the middle-aged group. According to their operating capacities, the majority of breeders are in the young and middle-aged groups. It was observed that those in the group considered young have awareness in following current issues and understanding the importance of the issue. Another age-related finding of this study is that the preference of young breeders to obtain information from experts on the subject is lower than the aged group. It has been observed that they prefer accessing and applying information on the topic. It has been evaluated that the educational status of cattle farm owners can be an important factor in the continuation of production activities. It has been determined that the education level of the breeders' increases in parallel with the farm capacity.

When the education level of the breeders in the visited farm is evaluated by districts, the ratio of primary and high school graduates and secondary school and university graduates is close to each other in Mustafakemalpaşa district, high school graduates are prominent in Yenişehir district, primary and high school graduates are close to each other in Karacabey district and those in Nilüfer district are predominantly primary school graduates. All of the breeders evaluated in the Osmangazi district are primary or high school graduates. When evaluated in terms of the size of the farm, it was determined that the education level of the breeders increased in parallel with the increase in the capacity. As the size of the farm increases, the ratio of primary, secondary and high school graduate's decreases. Such that there are no primary or secondary school graduates in the >101 head group, and 83.2% are university and high school graduates. In the $\chi 2$ analysis in terms of education level, no difference was found in terms of districts and farms sizes.

There are barns built using different resources depending on the development of dairy cattle in the districts discussed in the research. It is seen that the open shed barn system, which is the type of structure that takes into

account the climatic conditions of the region, the environmental demands, and the welfare of the animals, is predominantly preferred. In particular, the closed barn system is used in farms with an older establishment date and low animal populations, which can be seen in the grouping according to the size of the farms in the second part of Table 2. Yener et al (2013), 17.5% of the barns examined are closed, and 82.5% of them are open shed barns, 40.9% had an administration building. In terms of the breeding model, no difference was found districts and farm sizes in the $\chi 2$ analysis.

Table 2. The breeding model applied in dairy farms (%)

Criteria		Closed barn	Open yard	Open shed barn
Districts	M.Kemalpaşa	17.0	6.4	76.6
	Yenişehir	18.9	0.0	81.1
	Karacabey	12.1	3.0	84.9
	Nilüfer	17.4	17.4	65.2
	Osmangazi	12.5	0.0	87.5
Farms capacity (head)	20-50	23.0	8.0	69.0
	51-100	5.7	2.9	91.4
	>101	7.7	0.0	92.3

It is seen that the breeders that emerged here can make inquiries about only one of the five criteria specified when buying animals, and there are those who choose the way of buying animals by considering more than one criterion (Table 3). It has been determined that a significant part of the breeders did not research the disease history of the farms capacity (head) selling their animals before buying the animal. On the other hand, the breeders did not know what to do within the scope of obtaining and using this information. Based on the appearance of an animal that is seen to be at risk in terms of health, it emphasizes the necessity of researching it to shed light on future studies (Sibley, 2010). While the buyer's response to animal inspection was found to be significant based on districts, the difference between the answers given in terms of farm sizes was generally significant ($P<0.05$).

When the subject is evaluated on the basis of districts, it is seen that the point of getting information from the seller and examining the animals by the buyers comes to the fore. When the evaluation is made according to the capacity of the farms, while the above-mentioned two criteria remain important in small-scale farm, it has been determined that the points of requesting the test results of the animals to be purchased and getting information from the veterinarian of the farms are more frequently questioned in farms with 101 head or more animal assets.

Table 3. The path followed when buying animals from outside the farms (%)

Answers	Districts					P
	Karacabey	M.Kemalpaşa	Nilüfer	Osmangazi	Yenişehir	
I would like information from the seller	60.0	53.2	47.8	50.0	70.3	
I evaluate the animal	31.4[b]	55.3[a]	47.8[a]	87.5[a]	70.3[a]	*
I want test results	22.9	10.6	4.3	12.5	2.7	
I get information from the seller's vet	11.4	12.8	4.3	0.0	24.3	
I request the cattle health certificate	11.4	4.3	8.7	0.0	2.7	
	Farm capacity (head)					P
	20-50	51-100	>101			
I would like information from the seller	59.6	62.9	46.2			
I evaluate the animal	51.7[b]	77.1[a]	30.8[b]			*
I want test results	3.4[b]	2.9[b]	46.2[a]			*
I get information from the seller's vet	3.4[c]	22.9[b]	34.6[a]			*
I request the cattle health certificate	1.1[b]	5.7[b]	23.1[a]			*

* Values with different superscripts in the same row differ at ($p<0.05$).

While it was determined that about 77.7% of all farms examined did not have any tests on the animals they bought, the rate of those who had the test was 12.8% (Table 4). When the farms based on districts are evaluated for any testing following the purchase of animals, it is seen that a significant part of them do not prefer this. It has been determined that this approach reaches 42.3%, especially in farms with a capacity of 101 heads or more. Approaches to animal identification are important to minimize the risks that a contagious disease may pose to the farms being purchased. As a result of the $\chi 2$ analysis, testing on animals following the buying did not differ in terms of districts. However, the differences in the size of the farm are significant ($P<0.05$) in animal testing following the buying.

Table 4. Animal testing following buying (%)

Criteria		Yes	No	Sometimes	P
Districts	M.Kemalpaşa	8.5	78.7	12.8	
	Yenişehir	13.5	70.3	16.2	
	Karacabey	17.1	77.2	5.7	
	Nilüfer	19.0	81.0	0.0	
	Osmangazi	0.0	100.0	0.0	
Farms capacity (head)	20-50[b]	6.9	85.1	8.0	
	51-100[b]	5.7	85.7	8.6	*
	>101[a]	42.3	42.3	15.4	

* Values with different superscripts in the same column differ at ($p<0.05$).

The application of quarantine has increased due to the increase in capacity in farms (Table 5). Talapha et al (2008) state that quarantine can reduce disease transmission between herds of newly brought animals to a farm. Despite the recommendations of Defra (2002), it is a cause for concern that more than 50% of farmers in the current study do not isolate incoming animals. Newly brought animals to the farm may in some cases, be kept in an easily separated pasture or a quarantine location away from the rest of the herd. These farms also show that

the implementation of biosecurity measures includes a behavioral change (Ellis-Iversenet et al., 2008). Such preventive strategic approaches are specific to the farms and should be developed with subject experts who know the herd structure and inform the breeder at critical points (Villarroel et al., 2007; Ellis-Iversen et al., 2008; Brennan and Christley, 2013). On the basis of districts, no answer to this question stands out in Mustafakemalpaşa district, while yes answer stands out in Yenişehir, Nilüfer and Osmangazi districts. It has been found that the rate of those who say that they sometimes resort to this type of practice varies between 9.5-17.1% among districts. When this question is considered in terms of farm capacity, it has been determined that the application of quarantine has increased due to the increase in capacity. While this value is 29.9% in small-scale farm (20-50 heads), it rises to 80% in farm with a capacity of 101 heads or more. According to the $\chi 2$ analysis, there was no difference between the districts in terms of quarantine for the purchased animals. However, differences between farm sizes are important for quarantine purchased animals ($P<0.05$). The recommended quarantine period for newly brought animals to the establishment may vary. Preferably, 3-4 weeks is recommended for diseases with a short incubation period (Wells et al., 2002; Barrington et al., 2002; Callan and Garry, 2002; Villarroel et al., 2007). Even if animals have been tested on arrival at the farm, they should be quarantined until the results of the tests, which are not generally done, are complete. In addition, it is known that cattle may be more carriers of disease agents than some tested conditions.

Table 5. Quarantine application for buying animals (%)

Criteria		Sometimes	Yes	No	Never	P
Districts	M.Kemalpaşa	12.8	29.8	57.4	0.0	
	Yenişehir	16.7	47.2	33.3	2.8	
	Karacabey	17.1	40.0	40.0	2.9	
	Nilüfer	9.5	47.6	33.3	9.5	
	Osmangazi	12.5	37.5	25.0	25.0	
Farms capacity (head)	20-50[b]	13.8	29.9	54.0	2.3	
	51-100[a]	17.1	34.3	40.0	8.6	*
	>101[b]	12.0	80.0	4.0	4.0	

* Values with different superscripts in the same column differ at ($p<0.05$).

Questions were asked to the farms about buying animals from outside and the answers received are shown in Tables 6 and 7. In the evaluation made by all farms, it was determined that buying animals from outside was around 58%, and this value decreased to 24.7% in buying as pregnant. In the evaluation made according to the farm capacities, buying animals from outside decreases as the operating capacity increases. A similar situation is seen in the bought of pregnant animals. When the results obtained from the evaluations made to determine what breeders question in order to monitor the health status of the buying animals, those who say that they will buy them in my farm without any testing or isolation reach 50% in Osmangazi, while it is below 20% in other districts. This answer should approach zero. Because the most important source of transmitting diseases to the existing herd is the animals purchased from abroad.

Table 6. Distribution of the path followed in buying of new animals to the districts (%)

Answers	Districts					P
	Karacabey	M.Kemalpaşa	Nilüfer	Osmangazi	Yenişehir	
The animal is bought	51.4	63.8	52.2	62.5	59.5	
Buying a pregnant animal	14.3	27.7	21.7	37.5	29.7	
Animals bought from markets or farms join the herd without testing or isolation	11.4	12.8	17.4	50.0	13.5	
Animals are taken from herds with similar or better health standards	8.6	23.4	17.4	37.5	24.3	
Animals taken from markets or farms are isolated for at least two weeks	0.0	8.5	4.3	12.5	2.7	
Animals are only taken from farms in known health condition and isolated for at least 30 days	8.6	0.0	4.3	0.0	5.4	
Animals are not bought and the herd is kept closed to the outside	20.0^{b}	21.3^{b}	30.4^{a}	12.5^{b}	16.2^{b}	*

* Values with different superscripts in the same row differ at ($p<0.05$).

In the evaluation made according to the operating capacities, buying animals from outside decreases as the capacity of the farm increases, the farm uses its own resources and those with a capacity of more than 101 heads answered yes to the question of whether to buying animals from outside, with 46.7%. A similar situation is seen in the buying of pregnant animals. While those who said that they would add the animals taken from the markets or from the farms that sell them to the herd without any testing, were 7.7% above 101 heads, while it changed between 14-23% in the other groups. The approach to the follow-up of the health status of the purchased animals and isolation is well below what it should be, and the positive development due to the increase in the operating capacity is not fully seen. Keeping animals in the farm closed to the outside is a way to protect them from contagious diseases. In closed herds, no outside cattle are taken into the farms so the cattle in the herd does not contact the cattle in other farms. On the other hand, when it is necessary to animals from outside to minimize the risk of contracting a contagious disease, the existing animals must be protected with a correct vaccination program.

Table 7. Distribution of the path followed in buying of new animals to the size of the farm (%)

Answers	Farm capacity (head)			P
	20-50	51-100	>101	
The animal is bought	62.9	54.3	46.1	
Buying a pregnant animal	28.1	14.3	26.9	
Animals bought from markets or farms join the herd without testing or isolation	14.6	22.9	7.7	
Animals are taken from herds with similar or better health standards	16.9	25.7	23.1	
Animals taken from markets or farms are isolated for at least two weeks	3.4	2.9	11.5	
Animals are only taken from farms in known health condition and isolated for at least 30 days.	2.2^{c}	28.6^{a}	15.4^{b}	*
Animals are not bought and the herd is kept closed to the outside	14.6^{b}	0.0^{c}	30.7^{a}	*

* Values with different superscripts in the same row differ at ($p<0.05$).

In addition, care should be taken to bought animals whose health status is known and whose vaccination program is applied in the herd to be bought. Preferring heifers, especially for buying, provides an advantage for the farms. Because heifers are not milked, and quarantine are easier. In addition to the records containing health information about the purchased cattle, documents regarding the somatic cell count, especially for dairy cattle, must also be requested. It is stated that it would be a correct approach to test the milk tank of the farms, where the purchase is made, in terms of contagious mastitis, when possible (Anonymous 2008).

Sarrazin et al (2014), state that the transition from treatment to health protection has an important place in the correct implementation of biosecurity, within the scope of all measures that prevent the entry of pathogens into the herd and the spread of pathogens in the herd at the point of the health of animals. While determined that the rate of keeping regular health records in farms was above 60% in other districts except for Osmangazi (Table 8). The low number of farms visited in Osmangazi also affects this. It has been determined that as the holding capacity increases, keeping records for the health of animals is higher. In a study conducted in Şanlıurfa, 68% of dairy farms kept in-farm records, and this result was evaluated as an indication that breeders tend to make conscious and long-term plans (Yener et al., 2013). Thanks to the records, it is possible to eliminate the farm's deficiencies regarding biosecurity, plan the future, and make periodic applications on time. The rate of keeping records in cattle farms was found to be high (97.7%), while the rate of keeping records of sick animals was found to be very low (34.3%). On the other hand, the rate of controlling and keeping records of rodents and pests was found to be 98.3% (Köseman and Şeker, 2016). In terms of keeping regular health records, the differences between the districts and the size of the farms are significant (P<0.05).

Table 8. Health management records for districts and farm capacity (%)

Criteria		Yes	No	P
Districts	M.Kemalpaşa[a]	61.7	38.3	*
	Yenişehir[a]	77.8	22.2	
	Karacabey[a]	61.8	38.2	
	Nilüfer[a]	63.6	36.4	
	Osmangazi[b]	12.5	87.5	
Farms capacity (head)	20-50[b]	54.7	45.3	*
	51-100[b]	65.7	34.3	
	>101[a]	88.5	11.5	

* Values with different superscripts in the same column differ at (p<0.05).

Table 9. Request for information on biosecurity (%)

Criteria		Regular	Never	Rarely	P
Districts	M.Kemalpaşa	20.0	33.3	46.7	
	Yenişehir	34.3	31.4	34.3	
	Karacabey	35.3	35.3	29.4	
	Nilüfer	31.8	40.9	27.3	
	Osmangazi	28.6	28.6	42.9	
Farms capacity (head)	20-50[b]	20.0	42.4	37.6	*
	51-100[b]	25.7	28.6	45.7	
	>101[a]	69.6	13.0	17.4	

* Values with different superscripts in the same column differ at (p<0.05).

Breeder's demands on biosecurity to get information about are given in Table 9. While the rates of farms that regularly and rarely request information are about 29.4% and 36.4%, respectively, the rate of those who never request information is 34.2%. On the other hand, when the approaches of the farms to the subject according to the presence of animals are considered, the answer is that the interest in biosecurity has increased due to the increase in the capacity and the help of the relevant subject experts comes to the fore. On the other hand, when the approaches of the farm to the subject according to the animal existence are taken into consideration, the answer that the interest in biosecurity has increased due to the increase in the capacity and the help of the relevant subject experts comes to the fore. Differences between farm sizes are significant in terms of information demand on biosecurity ($P<0.05$).

The approaches of the breeders to the four basic criteria given in response to the question of why they should comply with the biosafety rules in the first place are shown in Table 10. Here, breeders are given the chance to choose more than one answer. It is understood that the breeders especially perceive the issue of biosecurity as an awareness of the protection of animals against diseases and that this can be prevented with some measures that can be taken against health problems that may occur.

Table 10. Responses of breeders to the question "why should they apply biosecurity rules" (%)

Answers	Districts					P
	Karacabey	M.Kemalpaşa	Nilüfer	Osmangazi	Yenişehir	
Provides economic benefits	22.9	36.2	39.1	12.5	35.1	
In obligatory cases	40.0^{b}	23.4^{b}	17.4^{b}	25.0^{b}	51.4^{a}	*
To prevent diseases	31.4	53.2	34.8	62.5	40.5	
For welfare and health	25.7	21.3	43.5	25.0	27.0	
	Farm capacity (head)					P
	20-50	51-100	>101			
Provides economic benefits	28.1	34.3	42.3			
In obligatory cases	38.2	37.1	11.5			
To prevent diseases	34.8	57.1	50.0			
For welfare and health	14.6^{c}	31.4^{b}	65.4^{a}			*

* Values with different superscripts in the same row differ at ($p<0.05$).

The answers given by the breeders to the previous questions revealed that they did not have sufficient knowledge and equipment on biosecurity. However, the subject of their behavior will be their behavior if the subject is told to them, as shown in Table 11. In this sense, promising results have been obtained. In other words, optimistic values for the future have been reached (87.5-97.1%) at the point of transferring the information to be given to the breeders on the subject into practice. In the same way, this situation shows itself in the evaluations made according to the farm capacity, and it is seen that the approach to the subject is 100% in the farms with more than >101 cattle. If the principles of biosecurity are explained, there was no difference between the districts in terms of the approach of the breeders to the application and in terms of the size of the farms compared to the $\chi 2$ analysis.

Table 11. The approach of the breeders to the application if the biosecurity principles are explained (%)

Criteria		Yes	No
Districts	M.Kemalpaşa	93.6	6.4
	Yenişehir	97.1	2.9
	Karacabey	91.4	8.6
	Nilüfer	90.9	9.1
	Osmangazi	87.5	12.5
Farms capacity (head)	20-50	89.5	10.5
	51-100	97.1	2.9
	>101	100.0	0.0

When the breeders were asked about the reasons for their lack of interest in biosecurity practice, the cost to be brought to the farm was brought into the plan as expected (Table 12). The importance of applying biosecurity rules to help control communicable diseases at the farm level has become more and more recognized internationally in recent years (More, 2007; Maunsell and Donovan, 2008; Negrón et al., 2011). This situation is especially prominent in countries where the perspective on production (animal welfare/product monitoring) has changed and increased the farm capacity.

Table 12. Reasons for not using biosecurity practices in farms (%)

Answers	Districts					P
	Karacabey	M.Kemalpaşa	Nilüfer	Osmangazi	Yenişehir	
Too costly	42.9^{b}	61.7^{b}	43.5^{b}	37.5^{b}	73.0^{a}	*
I do not have time	14.3	38.3	21.7	25.0	18.9	
I don't have enough information	11.4	27.7	34.8	50.0	35.1	
Does not prevent/reduce diseases	2.9	12.8	4.3	12.5	2.7	
I don't think	11.4	19.1	17.4	0.0	8.1	
	Farm capacity (head)					P
	20-50	51-100	>101			
Too costly	57.3^{b}	71.4^{a}	30.8^{b}			*
I do not have time	29.2^{a}	25.7^{a}	7.7^{b}			*
I don't have enough information	32.6	22.9	19.2			
Does not prevent/reduce diseases	10.1	2.9	0.0			
I don't think	11.2	8.6	26.9			

* Values with different superscripts in the same row differ at ($p<0.05$).

The biosecurity baseline data to be considered in this context can also form a basis for detailed sociological, demographic, and future studies that can also characterize biosecurity education opportunities within the farming community (Gordon et al., 2008; Heffernan et al., 2008; Buckner et al., 2011; Schemann et al., 2011). In addition to implementing biosecurity planning in entering farms; the definition and training of employees are also critical. Because the best way to directly harm and pose a potential threat to a farm is with uninformed and malicious personnel employed. For this reason, the training of the personnel is mandatory, and the employees have to comply with the working environment and conditions. The discovery and mitigation of a potential biological risk

start in the livestock farms, and the employees on the farm make the first response and prevent the problem that may occur before it grows. Personnel is in the first line of active defense against biological threats. For this reason, the training of employees is extremely important in evaluating the situation and choosing appropriate methods (Anonymous, 2008).

The evaluation of the activities carried out within the scope of herd management practices during the year by districts is given in Tables 13 and 14. In general, 12 applications were evaluated, and the breeders were given a chance to mark more than one option. Among these criteria, colostrum giving, manure cleaning, barn cleaning and animal welfare, vaccination program follow-up and balanced ration preparation appeared to be higher priority for breeders. In terms of herd management practices, the differences between the answers given to some questions in the $\chi 2$ analysis in terms of districts and herd size were found significant ($P<0.05$). The results regarding the preparation of a correct and balanced ration, the content of feed raw materials, the control of the ration and TMR applications have revealed that such applications are not considered sufficiently in small farms. It is seen that practices related to manure and shelter cleaning are taken into account less in small-scale farms, and there is a difference between groups in routine follow-up of milk quality according to farm capacity.

Table 13. Herd management practices in farms by districts (%)

Answers	Districts					P
	Karacabey	M.Kemalpaşa	Nilüfer	Osmangazi	Yenişehir	
Colostrum protocol follow-up for calves	91.4	70.2	78.3	100.0	78.4	
Correct and balanced ration preparation	34.3^{b}	34.0^{b}	52.2^{b}	62.5^{a}	62.2^{a}	*
Following the roughage quality / content of raw materials	31.4	17.0	30.4	12.5	18.9	
Regular ration control	22.9^{a}	2.1^{b}	26.1^{a}	25.0^{a}	27.0^{a}	*
Expert assistance in preparing a balanced/correct ration	22.9	14.9	17.4	25.0	21.6	
TMR is applied and selective consumption of the ration is minimal	20.0^{b}	4.3^{d}	21.7^{c}	62.5^{a}	0.0^{d}	*
Manure is removed regularly	71.4	78.7	60.9	62.5	67.6	
Attention is paid to the cleanliness of the stall and the welfare of the cattle	45.7	68.1	47.8	62.5	48.6	
Attention is paid to shelter ventilation	37.1	38.3	34.8	62.5	35.1	
Milk quality monitoring	25.7	19.1	43.5	37.5	24.3	
Routine vaccination schedule follow-up	40.0^{b}	57.4^{b}	47.8^{b}	87.5^{a}	54.1^{b}	*
Regular lameness, BCS, rumination, etc. physiological case follow-up	20.0^{b}	12.8^{b}	34.8^{b}	75.0^{a}	24.3^{b}	*

* Values with different superscripts in the same row differ at ($p<0.05$).

Table 14. Herd management practices in farms by farm size (%)

Answers	Farm capacity (head)			P
	20-50	51-100	>101	
Colostrum protocol follow-up for calves	74.2[b]	94.3[a]	80.8[b]	*
Correct and balanced ration preparation	32.6[c]	54.3[b]	76.9[a]	*
Following the roughage quality / content of raw materials	11.2[c]	31.4[b]	50.0[a]	*
Regular ration control	11.2[b]	20.0[b]	38.5[a]	*
Expert assistance in preparing a balanced/correct ration	7.9[c]	22.9[b]	53.8[a]	*
TMR application is used and the selective consumption of the ration is minimal.	5.6[b]	14.3[b]	34.6[a]	*
Manure is removed regularly	68.5	68.6	80.8	
Attention is paid to the cleanliness of the stall and the welfare of the cattle	48.3	60.0	69.2	
Attention is paid to shelter ventilation	28.1[b]	42.9[b]	65.4[a]	*
Milk quality monitoring	15.7[c]	34.3[b]	53.8[a]	*
Routine vaccination schedule follow-up	37.1[c]	65.7[b]	88.5[a]	*
Regular lameness, BCS, rumination, etc. physiological case follow-up	10.1[b]	28.6[b]	65.4[a]	*

* Values with different superscripts in the same row differ at ($p<0.05$).

The answers given to the breeders' questions regarding the farms' hygiene infrastructure are shown in Tables 15 and 16. Breeders commented on more than one subject. According to this, the issues of keeping young people separate from adults and giving birth in a separate section took place in front of other topics in the districts and general. A similar situation was obtained from the results of the evaluation made according to the farm capacities. Breeders' approach to assessment questions reveals a low level of internal biosecurity on farms. Such an approach can be explained by a low level of internal biosecurity and suggests that breeders tend to ignore applying the right management strategies to reduce disease spread in their herds (Brennan and Christley, 2013). Because internal biosecurity practices require breeders to take some precautions themselves, they may encounter some biosecurity recommendations that they consider time-consuming and impractical (Gordon et al., 2008). In terms of the hygiene infrastructure in the farms, the differences between the answers given to the questions according to the size of the farm, especially the birth hygiene, were found significant ($P<0.05$).

Table 15. Evaluation of the hygiene infrastructure in the farms according to the districts (%)

Answers	Districts				
	Karacabey	M.Kemalpaşa	Nilüfer	Osmangazi	Yenişehir
Calves are kept separate	20.2	66.0	60.9	75.0	83.8
Work layout from young animals to adults	9.0	8.5	21.7	12.5	13.5
The same materials are not used for young and adults	5.6	10.6	17.4	12.5	21.6
Lastly, sick animals are taken care of	11.2	19.1	26.1	25.0	32.4
Regular abortion follow-up is done	2.2	0.0	4.3	0.0	8.1
Aborting animals leave the herd	9.0	14.9	17.4	12.5	18.9
After the abortion, the pen is cleaned and disinfected	7.9	6,4	21.7	12.5	16.2
Births are done in a separate space	19.1	53.2	47.8	12.5	45.9
A compartment reserved for sick animals is not used as birth pen	11.2	4.3	21.7	12.5	8.1
The pen is cleaned after each birth	11.2	27.7	34.8	25.0	29.7
All postpartum items are cleaned, disinfected or disposable items are used	10.1	10.6	17.4	37.5	27.0
Herdsman differ between age groups or change clothes and equipment	5.6	4.3	21.7	12.5	2.7
Hands are cleaned and disinfected during the transition between age groups	6.7	2.1	8.7	12.5	8.1

Table 16. Evaluation of hygiene infrastructure in farms according to farm capacity (%)

Answers	Farm capacity (head)			P
	20-50	51-100	>101	
Calves are kept separate	61.8	82.9	61.5	
Work layout from young animals to adults	15.7	14.3	15.4	
The same materials are not used for young and adults	11.2	20.0	23.1	
Lastly, sick animals are taken care of	21.3	28.6	38.5	
Regular abortion follow-up is done	2.2[b]	0.0[b]	15.4[a]	*
Aborting animals leave the herd	15.7	20.0	23.1	
After the abortion, the pen is cleaned and disinfected	10.1[b]	17.1[b]	26.9[a]	*
Births are done in a separate space	37.1[b]	60.0[a]	65.4[a]	*
A compartment reserved for sick animals is not used as birth pen	6.7[b]	17.1[b]	34.6[a]	*
The pen is cleaned after each birth	19.1[b]	42.9[a]	46.1[a]	*
All postpartum items are cleaned, disinfected or disposable items are used	16.9	22.9	30.8	
Herdsman differ between age groups or change clothes and equipment	5.6[b]	11.4[b]	19.2[a]	*
Hands are cleaned and disinfected during the transition between age groups	2.2[c]	11.4[b]	26.9[a]	*

* Values with different superscripts in the same row differ at ($p<0.05$).

It has been found that the highest rate of budget allocation for health protection practices in farms, according to districts, is in Mustafakemalpaşa with 89.4% (Table 17). One of the most important reasons for this is that large farms are located in this district. As the capacity of farms increases, the budget allocated to health protection practices also increases. It is seen that this rate reaches 100% in farms with 101 cattle or more. The rate of budget allocation for health protection in all farms was about 73.9%. According to the $\chi 2$ analysis, there was no difference between the districts in terms of budget allocation for health protection practices. However, the differences between farm sizes are important in terms of the necessity of applying biosafety rules ($P<0.05$).

Vaccination is at the forefront of health protection practices. An important issue that should not be forgotten is that it is always easier and cheaper to protect the farms from disease than to treat infections. The follow-up of in-farm biosecurity principles provides the source of this. Veterinary and health costs include payments made for veterinary examinations and medicines during the period. The share of this value in the total farmexpenses is a criterion that shows the farms' level of compliance with preventive health practices. According to the $\chi 2$ analysis, there was no difference between the districts regarding budget allocation for health protection practices. However, the differences between the size of the farms in terms of the necessity of applying the biosecurity rules are significant ($P<0.05$).

Table 17. Budgeting for health protection practices (%)

Criteria		Yes	No	P
Districts	M.Kemalpaşa	89.4	10.6	
	Yenişehir	64.9	35.1	
	Karacabey	69.7	30.3	
	Nilüfer	61.9	38.1	
	Osmangazi	75.0	25.0	
Farms capacity (head)	20-50[b]	67.4	32.6	
	51-100[b]	70.6	29.4	*
	>101[a]	100.0	0.0	

* Values with different superscripts in the same column differ at ($p<0.05$).

Biosecurity practices have been considered the third-level bovine viral diarrhea virus (Lindbeng and Houe, 2005). At the same time, biosecurity practices are considered necessary protective measures to control diarrhea and respiratory disorders in calves (Borrington et al., 2002). With the implementation of biosecurity measures, the spread of the disease will slow down, and productivity will be increased again in the herd. Therefore, the expected results with increased productivity can be listed as higher income, good animal welfare, improved positive immune responses to vaccines, the morale for breeders, and revival of positive expectations for the future (Brennan and Christly, 2013).

Zoonotic diseases are infectious diseases caused by bacteria, fungi, viruses, and parasites transmitted from animals to humans or from humans to animals. It is vital for breeders to know the factors that may cause the emergence of zoonotic diseases and the ways of transmission, in order to protect themselves in this regard. Based on the evaluation of this point within the scope of biosecurity measures, the approaches of the breeders on the subject are given in Table 18. According to the districts, the rate of those who stated that they did not have knowledge varied widely between 4.3% and 21.3%. It has been revealed that they are aware of the importance of the issue depending on the capacity increase within the scope of the farm size.

Table 18. Awareness of breeders about zoonotic diseases transmitted from animals to humans (%)

Criteria		I don't know	I know, but I don't take precautions	I know, I'm taking the necessary precautions	P
Districts	M.Kemalpaşa	21.3	19.1	59.6	
	Yenişehir	5.6	30.6	63.9	
	Karacabey	8.8	14.7	76.5	
	Nilüfer	4.3	39.1	56.5	
	Osmangazi	12.5	37.5	50.0	
Farms capacity (head)	20-50[a]	16.1	29.9	54.0	*
	51-100[c]	5.7	28.6	65.7	
	>101[b]	3.8	3.8	92.3	

* Values with different superscripts in the same column differ at ($p<0.05$).

According to the $\chi 2$ analysis, there was no difference between the districts regarding the breeders' knowledge about zoonotic diseases transmitted from animals to humans. However, the differences between the size of the farms in terms of the necessity of applying the biosecurity rules are significant ($P<0.05$). Smith and Grotelueschen (2004), state that the control of infectious diseases is based on increased host resistance to infection, elimination of sources of infection, and prevention of contact that result in transmission. It is important to remember that comprehensive biosecurity implementation programs, whether state or private, are part of the overall approach to controlling infectious diseases.

The climatic conditions of our country create a suitable habitat for most ectoparasites. Some diseases seen in farm animals must be transmitted biologically and mechanically (Oğuz et al., 2016). Flies cause economic losses in cattle breeding due to the diseases they cause and the loss of production (Anonymous, 2018). The results of the control methods against external parasites and biting insects are shown in Tables 19 and 20 according to the

districts and the size of the farms. Differences were significant in terms of the distribution of control methods against ectoparasites and biting insects according to districts and farm sizes (P<0.05).

Table 19. Distribution of external parasites and pest control methods by districts (%)

Answers	Districts					P
	Karacabey	M.Kemalpaşa	Nilüfer	Osmangazi	Yenişehir	
Suitable drugs, fly tapes, etc. used, different measures can be used if he develops resistance to them	31.4[b]	36.2[b]	21.7[b]	87.5[a]	37.8[b]	*
An integrated method can be used against this type of pest. Instead of increasing the resistance of insects to pesticides, methods should be used to break their resistance	17.1	10.6	0.0	0.0	10.8	
There is always a prevention exercise, but not successful	8.6[c]	29.8[b]	39.1[a]	0.0[c]	8.1[c]	*
No control application	51.4	27.7	39.1	12.5	40.5	

* Values with different superscripts in the same row differ at (p<0.05).

Table 20. Distribution of external parasites and pest control methods by farms capacity (%)

Answers	Farm capacity (head)			P
	20-50	51-100	>101	
Suitable drugs, fly tapes, etc. used, different measures can be used if he develops resistance to them	32.6	34.3	50.0	
An integrated method can be used against this type of pest. Instead of increasing the resistance of insects to pesticides, methods should be used to break their resistance	0.0[c]	17.1[b]	34.6[a]	*
There is always a prevention exercise, but not successful	22.5	14.3	15.4	
No control application	42.7[a]	42.9[a]	11.5[b]	*

* Values with different superscripts in the same row differ at (p<0.05).

The answers given by the breeders regarding the cleaning and disinfection processes after using the equipment are given in Tables 21 and 22 according to the districts and farm sizes. According to the $\chi 2$ analysis, there was no difference between the districts in disinfecting the equipment used between uses. The rate of those who say that no cleaning is done is 6.7-23.6%. It is something that should be taken with caution. Those who stated that they do cleaning and disinfection together vary between 22.5-60.0%. When evaluated according to the operating capacity, it can be said that the importance of the subject is understood more or the application conditions are formed as the number of animals increases. It has been determined that cleaning the equipment only or applying both cleaning and disinfection is about 85% in farms with more than 101 heads. In terms of farm sizes, the difference between the values given for the answer that each animal is cleaned and disinfected after use is significant (P<0.05).

Table 21. Distribution of disinfection of used equipment between uses by districts (%)

Answers	Districts				
	Karacabey	M.Kemalpaşa	Nilüfer	Osmangazi	Yenişehir
It is not cleaned and disinfected after use	11.4	23.4	26.1	25.0	13.5
It is cleaned after each use, but not disinfected	48.6	38.3	39.1	37.5	48.6
It is cleaned and disinfected after each use	28.6	31.9	21.7	37.5	35.1

Table 22. Distribution of disinfection of used equipment between uses by farms capacity (%)

Answers	Farm capacity (head)			P
	20-50	51-100	>101	
It is not cleaned and disinfected after use	23.6	14.3	7.7	
It is cleaned after each use, but not disinfected	47.2	45.7	26.9	
It is cleaned and disinfected after each use	22.5^{b}	31.4^{b}	57.7^{a}	*

* Values with different superscripts in the same row differ at ($p<0.05$).

Conclusion

Biosecurity refers to management practices that protect the health of livestock and workers by raising awareness of conditions that could potentially adversely affect animals and humans. On the other hand, biological risk management is a general awareness training process against the elements that may arise from infectious diseases that enter or spread on a livestock farm. In this study carried out from these points, the awareness of the biosecurity phenomenon in the districts that stand out in dairy cattle breeding in Bursa province was revealed within the scope of the district and farms scales.

It has been determined that some of the dairy cattle farms evaluated in Bursa do not have enough knowledge and practice in terms of biosecurity practices. In contrast, others are reluctant to practice or emphasize economic difficulties even though they know. At this point, one should not forget that financial benefit in every farm would be achieved by correct targets, better management of resources, protection of assets, and avoiding costly mistakes. Another important point is that farms' lack of biosecurity sensitivity in farms will cause serious problems in the fight against epidemic diseases, environmental protection, and food safety.

Acknowledgments

This study was produced from Şehri YILMAZ's Master Thesis.

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Research and Publication Ethics were followed in this study.

Ethics committee approval was obtained with the decision letter of Bursa Uludağ University Research and Publication Ethics Committee dated 31.01.2022 and numbered 6 of the 2022-01 session.

References

Anonim, 2008. Biosecurity and Biological Risk Management for Livestock Enterprises, University of Florida. (Erişim tarihi: 12.10.2018).

Anonim, 2018.http://traglor.cu.edu.tr/objects/objectFile/tcfdm9mU-2232013-48.pdf (Erişim tarihi: 20.12.2018).

Barr, D. J. 2008. Analyzing 'visual world' eye-tracking data using multilevel logistic regression. *Journal of memory and language*, *59*(4), 457-474.

Barrington, S., Choinière, D., Trigui, M., and Knight, W. 2002. Effect of carbon source on compost nitrogen and carbon losses. *Bioresource Technology*, *83*(3), 189-194.

Bish, A. and Michie, S. 2010. Demographic and attitudinal determinants of protective behaviours during a pandemic: a review. *British Journal of Health Psychology*, *15*(4), 797-824.

Brennan, M. L. and Christley, R. M. 2013. Cattle producers' perceptions of biosecurity. *BMC Veterinary Research*, 9:71.

Buckner, C. D., Bremer, V.R., Klopfenstein, T.J., Erickson, G. E. Vander Pol, K.S., Karges, K. K. and Gibson, M.L. 2011. Evaluation of a prefermentation-fractionated by-product corn grain dry milling ethanol process in growing and finishing cattle diets. *The Professional Animal Scientist*, 27(4), 295-301.

Callan, R. J. and Garry, F. B. 2002. Biosecurity and bovine respiratory disease. *The Veterinary Clinics of North America. Food Animal Practice*, *18*(1), 57-77.

Defra, 2002. Department for Environment, Food and, Rural Affairs.

Ellis-Iversen, J., Cook, A.J.C., Watson, E., Nielen, M., Larkin, L., Wooldridge, M. and Enticott, G. 2008. The spaces of biosecurity: prescribing and negotiating solutions to bovine tuberculosis. *Environment and Planning,* 40: 1568–1582.

Gordon, H.G., Oxman, A.D., Kunz, R., Vist, G.E., Falck-Yetter, Y. and Schünemann, H.J. 2008. What is "quality of evidence" and why is it important to clinicians? US National Library of Medicine National Institutes of Health. BMJ. Vol: 336.

Heffernon, C., Nielsen, L., Thomson, K. and Gunn, G. 2008. An exploration of the drivers to bio-security collective action among a sample of UK cattle and sheep farmers. *Preventive Veterinary Medicine*, 87(3-4): 358-372.

Hersom, M., Irsik, M. and Thrift, T. 2017. Biosecurity and Biological Risk Management for Livestock Enterprises. UF/IFAS Biosecurity and Biological Risk Management for Livestock Enterprises Handbook.

Hoe, F. G. H. and Ruegg, P. L. 2006. Opinions and practices of Wisconsin dairy producers about biosecurity and animal well-being. *Journal of Dairy Sc*ience, 89(6), 2297-2308.

Koyuncu, M., Altınçekiç Ş.Ö. 2007. Çiftlik Hayvanlarında Refah. *Bursa Uludag Üniv. Ziraat Fak. Derg.,* 21:2, 57-64.

Köseman A. 2008."AB Müzakere Süreci ve Hayvan Refahı", *Türktarım Dergisi*, (ss.62-64)

Köseman, A. and Şeker, İ. 2016. Malatya İlinde Sığırcılık İşletmelerinin Mevcut Durumu: II. Hayvan Sağlığı ve Ahır Hijyeni Perspektifinde Biyogüvenlik Uygulamaları. *Kocatepe Veterinary Journal*, 9(1): 61-69.

Maunsell F. and Donovan G.A. 2008. Biosecurity and risk management for dairy replacements. *Veterinary Clinics of North America: Food Animal Practice*, 24(1):155-90. doi: 10.1016/j.cvfa.2007.10.007.

Minitab Inc., 2014. (MINITAB release 17: statistical software for Windows) (Minitab Inc., USA).

More, K. 2007. Scientific aspects of polymer electrolyte fuel cell durability and degradation, Chemical Reviews, 107 (10), 3904-3951

Negron, M., Raizman, E.A., Pogranichniy, R., Hilton, W.M. and Levy, M. 2011. Survey on management practices related to the prevention and control of bovine viral diarrhea virus on dairy farms in Indiana, United States. *Prev.Vet.Med*. 99,130–135.

Oğuz, B., Özdal, N. ve Değer. S. 2016.Stomoxys (Diptera, Muscidae) sinekleri ve taşıdığı bazı önemli paraziter hastalıklar. *Kocatepe Veterinary Journal*, 9(2):97-104.

Schemann, K., Taylor, M.R., Toribio, J.A. and Dhand, N.K. 2011. Horse owners' biosecurity practices following the first equine influenza outbreak in Australia. *Preventive veterinary medicine*, *102*(4), 304-314.

Sibley, R. 2010. Biosecurity in the dairy herd. In Pract. 32, 274–280. doi:10.1136/inp.c3913.

Smith, D. R. and Grotelueschen, D.M. 2004. Biosecurity and biocontainment of bovine viral diarrhea virus. *Veterinary Clinics: Food Animal Practice,* 20(1), 131-149.

Sümbüloğlu, K., Sümbüloğlu, V. 2002. Biyoistatistik, Hatipoğlu Yayınları, Ankara.

Talafha, A. Q., Lafi, S. Q., and Ababneh, M. M. 2008. The effect of estrus synchronization treatment on somatic cell count of transitional-anestrus Local-Damascus crossbreed goats' milk. *Tropical Animal Health and Production*, *40*(3), 185-192.

Villarroel, A., Dargatz, D.A., Lane, V.M., McCluskey, B.J. and Salman, M.D. 2007. Suggested outline of potential critical control points for biosecurity and biocontainment on large dairy farms. *Journal of the American Veterinary Medical* Association 230: 808–819.

Wallace, R.L. 2003. Practical and sensible dairy farm biosecurity. Proceedings of the 6th Western Dairy Management Conference _March 12- 14 2003_Reno NV- 202.

Wells, S.J., Dee, S. and Godden, S. 2002. Biosecurity for gastrointestinal diseases of adult dairy cattle. *The Veterinary Clinics of North America. Food Animal Practice*, *18*(1), 35-55.

Yener, H., Atalar, B. and Mundan, D. 2013. Şanlıurfa ilindeki sığırcılık işletmelerinin biyogüvenlik ve hayvan refahı açısından değerlendirilmesi. *Harran Üniversitesi Veteriner Fakültesi Derg*isi, 2(2) 87-93.