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/2023, 37(2), s. 323-341

ARAŞTIRMA MAKALESİ RESEARCH ARTICLE

Geliş Tarihi (Received): 18.01.2023
Kabul Tarihi (Accepted): 14.06.2023

Managerial Practices Related to The Survival of Calves in Dairy Cattle Breeding Farms in Hendek District-II[A]

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Abstract: This research was conducted out to determine the knowledge, ideas and behaviors related to the managerial practices of calf survival in dairy cattle farms in Hendek district of Sakarya province, and to analyze the status of the existing farms. In the research, were identified farms which are registered to Turkvet and e-breeding system database having 10 or more dairy cattle in Hendek district. Random sampling method was used to determine the sample size. The identified farms are divided into 5 groups which are 10-20 heads, 21-30 heads, 31-40 heads, 41-50 heads and over 50 heads of cattle. In this context, after obtaining general data about the farms, questions related to the main topics about the care and management of calves such as colostrum use, feeding practices, health protection and housing were evaluated. Milk-fed to calves, marketed milk, marketed milk + waste milk, and marketed milk + milk replacer are given in three ways. Within the scope of the size of the farms, the difference between the source of the milk consumed during the milk feeding period was found to be significant ($P<0.05$). Until the first 30 days of age, in farms with a capacity of over 30 heads, approximately 8 liters of milk are given ($P<0.05$), while in small farms, sucking milk from the mother or giving less milk is preferred. Farms are sensitive about reaching the concentrate and rough feed of the calves, and they generally apply it from the first week. The concentrated feed used in calf feeding is approximately 70% in pellet form. The weaning age of the calves is 90 days in farms with 40 heads and below and after 90 and 120 days in farms over 40 heads ($P<0.05$). Age criterion taken into consideration at weaning was found to be more important than body

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[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 7 of the 2022-01 session.
Research and Publication Ethics were followed in this study.

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Atıf/Citation: Karaca, M. and Koyuncu, M. 2023. Managerial Practices Related to The Survival of Calves in Dairy Cattle Breeding Farms in Hendek District-II. *Bursa Uludag Üniv. Ziraat Fak. Derg.*, 37(2), 323-341. https://doi.org/10.20479/bursauludagziraat.1238610

weight and feed consumption (P<0.05). While the calves are housed mainly in groups (60%) in small-scale farms, individual pens (70%) stand out among the preferences due to the increase in capacity. Small-scale farms prefer metal, wood, and brick, and large-scale farms mainly plastic and metal materials for calf shelters (P<0.05). Eight weeks or more is preferred for keeping calves in individual pens (P<0.05).

Keywords: Calf, survival, welfare, colostrum, herd size, herd management.

Hendek İlçesi Süt Sığırcılığı İşletmelerinde Buzağılarda Yaşama Gücü İle İlgili Yönetsel Uygulamalar- II

Öz: Bu araştırma Sakarya ili Hendek ilçesi süt sığırcılığı işletmelerinde buzağılarda yaşama gücü ile ilişkili yönetsel uygulamalar konusunda bilgi, fikir ve davranışları belirlemek, mevcut işletmelerin durumunu analiz etmek amacıyla yürütülmüştür. Araştırmada Türkvet ve e-ıslah sistemi veri tabanına kayıtlı Hendek ilçesindeki 10 baş ve üzeri süt sığır varlığına sahip işletmeler belirlenmiştir. Örnek büyüklüğünün belirlenmesinde tesadüfi örnekleme yöntemi kullanılmıştır. Belirlenen işletmeler 10-20, 21-30, 31-40, 41-50 ve 50 baş üzeri sığır varlığına sahip olan işletmeler olmak üzere 5 gruba ayrılmıştır. Bu kapsamda işletme ile ilgili genel veriler alındıktan sonra buzağıların bakım ve yönetimine yönelik olarak kolostrum kullanımı, besleme uygulamaları, sağlık koruma ve barındırma gibi temel konu başlıklarına yönelik sorular değerlendirilmiştir. Buzağılara içirilen süt; pazarlanan süt, pazarlanan+atık süt ve pazarlanan süt+süt ikame olarak üç şekilde verilmektedir. İşletmelerin büyüklükleri kapsamında süt verme döneminde tüketilen sütlerin kaynakları arasındaki fark önemli bulunmuştur (P<0.05). İlk 30 günlük yaşa kadar 30 baş üzeri kapasiteye sahip işletmelerde yaklaşık 8 litre süt verildiği (P<0.05), küçük işletmelerde anadan süt emme veya daha az süt verme tercih edilmektedir. İşletmeler buzağıların yoğun ve kaba yeme ulaşma konusunda hassas davranmakta, genel olarak ilk haftadan itibaren uygulamaktadırlar. Buzağı beslemede kullanılan yoğun yemin yaklaşık %70'i pelet formundadır. Buzağıların sütten kesim yaşı 40 baş ve altı işletmelerde 90. gün, 40 baş üzeri işletmelerde ise 90. ve 120. gün sonrasıdır (P<0.05). Sütten kesimde dikkate alınan yaş kriteri, canlı ağırlık ve yem tüketiminden daha önemlidir (P<0.05). Buzağıların barındırılması küçük ölçekli işletmelerde genellikle gruplar halinde (%60) olurken, kapasitenin artmasına bağlı olarak tercihler içinde bireysel bölmeler (%70) öne çıkmaktadır. Buzağı barınakları için küçük ölçekli işletmeler metal, ağaç ve tuğla, büyük ölçekli işletmeler ise ağırlıklı olarak plastik ve metalden yapılmış malzemeleri tercih etmektedirler (P<0.05). Buzağıların bireysel bölmelerde tutulma süresi olarak sekiz hafta ve üzeri tercih edilmektedir (P<0.05).

Anahtar Kelimeler: Buzağı, yaşama gücü, refah, kolostrum, sürü büyüklüğü, sürü yönetimi.

Introduction

Sustainable calf production is based on managerial practices, primarily in the first periods of birth. Raising healthy calves requires minimizing the calf's exposure to disease factors and maximizing the immunity level against the disease (Koyuncu and Karaca, 2018). Different welfare assessment systems are proposed to reduce mortality and improve rearing conditions in calves. European Food Safety has developed a risk analysis approach for animal welfare and has revealed a risk analysis for the welfare of calves, especially in intensive farming systems (Anonymous, 2006). 0-28 days after birth is the most critical period of calf rearing. Especially the first 15 days of the calf's life is a period in which diseases are seen the most and deaths are most common, and it is called the neonatal period. While the morbidity seen in calves in different countries of the world varies between 20.0 and 52.9%, calf mortality was found between 2-12% in some studies conducted in developed countries (Tokgöz et al., 2013).

The survival of the calves in the first days after birth depends on the correct intake of quality colostrum (Godden 2008). Colostrum quality, on the other hand, is affected by age, pre-pregnancy diet, breed, length of dry period, dystocia, and management practices (Quigley et al., 1998; Arthington, 1999; Earley and Fallon, 1999, Morin et al., 2001). Incorrect colostrum management is one of the most significant dangers for calf welfare (Koyuncu and Karaca, 2018). It is stated that approximately 31% of deaths occurring in the first 21 days of calf life can be prevented by changes in the way, time, and amount of colostrum feeding (Wells et al. 1996). Daily milk and substitute feed consumed after the colostrum feeding period are also significant for calf development. The amount of milk or milk replacer given daily is between 10-12% of live calf weight, and it is reported that there are advantages to providing milk at higher rates (Koyuncu and Karaca, 2018). Khan et al. (2007) state that if the calves are fed with milk up to 20% of their live weight, progress will be made in growth, udder development, age at first calving, and lactation milk yield. At minimum standards in the feeding of calves, to prevent calf anemia, it is included in the regulations to contain enough iron, to consume at least daily cellulose-rich feeds for two-week-old calves, and to give sufficient water. To maintain the health and well-being of calves when housed, all calves should be checked at least twice a day to ensure that they can be housed in individual quarters up to eight weeks of age and that their minimum area requirements are constant. It is also emphasized that it can move freely in its pens, lie down and always have clean and dry bedding on the floor. The calf pen material should be of construction materials that are easily accessible, affordable, minimize the labor force, do not cause adverse effects in terms of health, provide insulation in cold regions, and do not increase stress in hot areas. This study aims to reveal the conditions of nutrition, health protection, housing, and general herd management in calves in farms grouped according to farm sizes.

Material and Method

The material of this study consisted of farms that carried out dairy cattle operations registered in the database of Türkvet and the e-Islah system in 2018 in the Hendek district of Sakarya. The data obtained from the voluntary

face-to-face survey conducted with the owners of the farms with ten or more animals and within the scope of administrative practices to increase calf losses and survival were evaluated. Ethics committee approval was obtained with the decision letter of Bursa Uludağ University Research and Publication Ethics Committee dated 31.01.2022 and numbered 7 of the 2022-01 session.

A stratified sampling method was used to determine the sample size of the study. In the stratified sampling method, for each trait taken from a population, it is determined that the subgroups of the population are stratified in proportion to their size (Kavuncu, 2019). The number of villages and farms determined by this method was chosen randomly. The selected farms are divided into five groups according to their size. In the stratification process, attention was paid to the fact that each farms belongs to the group (stratum) to which it belongs.

The research determined farms with ten or more dairy cattle registered in the Turkvet and e-Islah system database in the Hendek district of Sakarya province. It has been determined that there are 593 dairy cattle farms in the determined number of villages and farms selected randomly. A 10% margin of error and 95% confidence limits were considered in determining the sample volume. The farms that make up the population are divided into five groups (10-20 heads, 21-30 heads, 31-40 heads, 41-50 heads, and 50+ heads), considering the distribution of the number of dairy cattle. The study did not include farms with a cattle presence of 10 heads or less. Following formula were used to determine the sample size;

$$n = N.s^2 / (N-1)* D^2 + s^2 \quad (1)$$

n: sample size

N: the number of farms that make up the population

s: variance shown by farms

D^2: d^2/z^2

d: the margin of error of the difference between the sample mean and the population mean

z: z value in the standard normal distribution table according to the accepted error rate

The sample size to be selected from 593 farms in the Hendek district was calculated as 159. First, the group ratios were found, then the strata's sample sizes (n) were calculated by multiplying each group by these ratios (Table 2). However, due to the small number of existing large-capacity farms, the number of farms in the 10-20 layer has been reduced, and the number of other layers has been increased as much as possible.

Table 1. Number of farms visited by farm sizes

	Groups	The calculated number of farms	Number of farms visited
Farm capacity (head)	10- 20	115	69
	21-30	28	36
	31-40	8	25
	41-50	5	14
	>50	5	16
	Total	159	160

The main points determined for the survey; General data about the farms are listed as colostrum, feeding, health, and housing. The forms obtained at the end of the survey application were processed into the Google forms program and transferred to Microsoft Excel. Numeric (frequency) and proportional values were calculated for the answers given to each question in the questionnaire form, and tables were prepared. The differences of the responses in terms of farm sizes were tested with the Chi-Square Analysis (Minitab 2014).

Results and Discussion

How and how much milk the calves consume during the period they are fed with milk after colostrum feeding is essential. Calves need to consume sufficient milk during this period regarding body development. The answers to the questions prepared to reveal the practices followed for feeding the calves with milk; sucking the mother, artificial feeding (using bottle and nipple buckets), and artificial feeding (feeding in bulk with bottle or nipple buckets) (Table 2), ($P<0.05$). In a survey conducted in Canada, 92% of breeders used teat bucket feeding and 18% bottle feeding method (Vasseur et al., 2010). In Brazil, it is stated that 49% of the breeders prefer bottle feeding, 40% bucket, and 11% suckling (Hotzel et al. 2014). Klein-Jobstl et al. (2015) stated that in Austria, calves are fed with udder buckets (75%) and buckets without heads (14%), and these values remain at the same levels as the operating capacity increases.

Table 2. Methods of calves drinking milk

		Answers					
		Sucking		Artificial feeding (bottle-nipple buckets)		Artificial feeding (feeding in bulk with bottle or nipple buckets)	
		N	%	N	%	N	%
Farm capacity (head)	10-20[a]	44	63.8	11	15.9	14	20.3
	21-30[b]	7	19.4	19	52.8	10	27.8
	31-40[b]	2	8.0	18	72.0	5	20.0
	41-50[b]	0	0.0	12	85.7	2	14.3
	> 50[b]	0	0.0	16	100.0	0	0.0
	Total	53	33.1	76	47.5	31	19.4

$\chi 2 < 0.05$

Milk fed to calves; marketed milk is divided into three groups as marketed+waste milk and marketed milk+ milk replacer. It is seen that the calves are fed with more than 50% of the marketed milk in the farms with a capacity of less than 40 heads, and that the farms above 40 head are fed with the marketed milk + milk replacer (Table 3). Within the scope of the size of the farms, the difference between the source of the milk consumed during the milk feeding period was found to be significant ($P<0.05$). In studies comparing milk and milk replacer feed at the point of source of milk to be given to calves during the milk drinking period, milk replacers have higher energy and more nutritional value and have an effect on reducing morbidity and mortality rates in calves (Davis and Drackley, 1998, Godden et al., 2005). It has been stated that the milk + milk replacer feeding system

marketed for calves is preferred in 89%, and feeding with waste milk is preferred in only 42.5% of the farms. The reason why milk replacer are preferred more is that they provide better development in calves (Vasseur et al., 2010).

Table 3. Source of milk used in feeding calves

		Criteria					
		Marketed milk		Marketed milk + waste milk		Marketed milk + milk replacer	
		N	%	N	%	N	%
Farm capacity (head)	10-20[e]	64	92.8	5	7.3	0	0.0
	21-30[d]	25	69.4	4	11.1	7	19.4
	31-40[c]	14	56.0	6	24.0	5	20.0
	41-50[b]	3	21.4	5	35.7	6	42.9
	> 50[a]	3	18.8	4	25.0	9	56.3
	Total	109	68.1	24	15.0	27	16.9

$\chi 2<0.05$

The use of milk from sick or treated cows in calves is common in farms. It shows that the products that can be considered waste milk may be higher in large farms and that they should be kept at this source, considering the number of calves (Table 4). The difference between farm sizes and the waste milk feeding method is significant ($P<0.05$). It is stated that waste milk is applied in 48.2% of the calf-feeding farms in Canada, 30% in the USA, and 35% in Brazil (Vasseur et al., 2010; Santos and Bittar, 2015). Klein-Jobstl et al. (2015), breeders have different practices in feeding calves with waste milk. It is stated that feeding with waste milk is applied only to male calves 35%, 31.7% to all calves, and 19.2% only when necessary. As a result of the research, it is seen that the breeders have hesitations about waste milk in calf feeding. Taking into account the risk of contamination by pathogens to calves, the danger that may arise for the newborn calf, which has not yet gained passive immunity, can be eliminated by pasteurized waste milk (Selim and Cullor 1997; Godden et al., 2003).

Table 4. Feeding with waste milk

		Answers			
		Yes, when needed		No	
		N	%	N	%
Farm capacity (head)	10-20[a]	5	7.2	64	92.8
	21-30[b]	9	25.0	27	75.0
	31-40[c]	12	48.0	13	52.0
	41-50[c]	9	64.3	5	35.7
	> 50[c]	10	62.5	6	37.5
	Total	45	28.1	115	71.9

$\chi 2 <0.05$

Table 5 shows the amount of milk given until the first 30 days of age, which is the most sensitive period in calves on the farms. The difference between the size of the farm and the daily amount of milk given up to 30 days of age was significant ($P<0.05$). In a study conducted, the daily amount of milk given up to the age of 30

days is less than 4 liters (41%), 6 liters (28%), and free with the mother (23%), these values are similar to the farms with a capacity of 21-30 heads (Santos et al., 2015). In Canada, the milk feeding plan applied by the breeders is 4 liters of milk per day given in 2 meals in the first week or milk replacer (Vasseur et al., 2010). It is stated that traditionally known calf feeding with more than 10-12% of body weight has benefits such as growth, early breeding, and increasing milk production in the first lactation (Jasper and Weary 2002, Rincker et al. 2006, Khan et al., 2007; De Paula Vieira et al., 2008; Borderas et al., 2009).

Table 5. The daily amount of milk given to calves up to 30 days of age

		Criteria					
		< 5 liter		≥ 5 liter		Next to mother, free	
		N	%	N	%	N	%
Farm capacity (head)	10-20[a]	23	33.3	13	18.8	33	47.8
	21-30[b]	16	44.4	14	38.9	6	16.7
	31-40[c]	8	32.0	15	60.0	2	8.0
	41-50[d]	0	0.0	14	100.0	0	0.0
	> 50[d]	2	12.5	14	87.5	0	0,0
	Total	49	30.6	70	43.8	41	25.6

$\chi 2 < 0.05$

As the calves grow, their consumption also increases. However, it is necessary to meet this only from milk, to get used to different feed sources that are not economical when evaluated from both the physiological development of the calves and economically, and to create conditions where they will experience less stress during the weaning period. While farms that give less than 5 liters of milk to calves from 31 days until weaning concentrates under 40 heads, they prefer to drink 5 liters or more of milk in farms over 40 heads (Table 6). Regarding farm sizes, the difference between the daily amount of milk given from the age of 31 days to weaning was found to be significant ($P<0.05$). Santos and Bittar (2015), in their study, determined that the daily amount of milk given to the calves from the age of 31 days to weaning was less than 4 liters (58%), 6 liters (23%) and free (8%) next to the mother. It is similar to the method applied in farms with a capacity of over 40 heads in the study. Vasseur et al. (2010) in Canada, it was stated that while it was continued as 5.5 liters in 2 meals, it was adjusted to 3 liters in 2 meals in the week before weaning.

Table 6. The daily amount of milk given to calves from 31 days of age to weaning

		Criteria			
		< 5 liter		≥ 5 liter	
		N	%	N	%
Farm capacity (head)	10-20[c]	57	82.6	12	17.4
	21-30[c]	32	88.9	4	11.1
	31-40[c]	17	68.0	8	32.0
	41-50[b]	6	42.9	8	57.1
	> 50[a]	3	18.8	13	81.3
	Total	115	71.9	45	28.1

$\chi 2 < 0.05$

For calves, suitable conditions should be provided from the first week of life for free water intake, rumen function, and early feed intake from the appropriate period (Kertz et al. 1984). During this period, it should not be thought that feeding with milk replaces water. Regarding farm sizes, the difference between the calf reaching the water was insignificant. Klein-Jobstl et al. (2015) reported that the share of farms that provide access to water for calves in the first 1-3 weeks after birth is 71.5%. Santos and Bittar (2015) stated that access to water for calves is on the first day (53%) and the 5th day (35%), and in the USA, it takes place within an average of 15 days (Vasseur et al. 2010).

Table 7. Time for calves to reach water

		Criteria							
		First day		After day 5th		After day 10th		Pasture	
		N	%	N	%	N	%	N	%
Farm capacity (head)	10-20	49	71.0	14	20.3	3	4.3	3	4.3
	21-30	20	55.6	13	36.1	0	0.0	3	8.3
	31-40	14	56.0	10	40.0	1	4.0	0	0.0
	41-50	6	42.9	8	57.1	0	0.0	0	0.0
	> 50	9	56.3	6	37.5	1	6.3	0	0.0
	Total	98	61.3	51	31.8	5	3.1	6	3.8

$\chi 2$=15.405

For the physical and functional development of the rumen in ruminants, the offspring should start to concentre and roughage consumption as early as possible. Concentrated feed consumption, essential for rumen development, starts from the first week in most farms (Table 8). It has been stated that the calves' access to roughage is around 85% within 1-3 weeks, and there is no significant difference in terms of farm capacities (Klein-Jobstl et al. 2015). In Brazil, the age at which roughage is given to calves is from the first day (22%), from the 5th day (31%), from the 15th day (19%), and after weaning (22%) (Santos and Bittar 2015).

Table 8. Age of reaching roughage in calves

		Criteria					
		First week		First 30 day		Pasture	
		N	%	N	%	N	%
Farm capacity (head)	10-20	36	52.2	27	39.1	6	8.7
	21-30	26	72.2	6	16.7	4	11.1
	31-40	19	76.0	6	24.0	0	0.0
	41-50	9	64.3	5	35.7	0	0.0
	> 50	12	75.0	4	25.0	0	0.0
	Total	102	63.8	48	30.0	10	6.2

$\chi 2$=12.856

More than 60% of the concentrate feed used in calf feeding is in pellet form in all farms (Table 9). The difference between the physical form of the dense feed used according to the farm's size was insignificant. It has

been determined that 40% of pellet feed and 59% of coarsely ground feed are preferred in calf feeding (Santos and Bittar 2015).

Table 9. The physical form of concentrate feed given to calves

		Criteria					
		Coarsely milled		Finely milled		Pellet	
		N	%	N	%	N	%
Farm capacity (head)	10-20	11	15.9	15	21.7	43	62.3
	21-30	6	16.7	6	16.7	24	66.7
	31-40	1	4.0	5	20.0	19	76.0
	41-50	0	0.0	0	0.0	14	100.0
	> 50	0	0.0	1	6.3	15	93.8
	Total	18	11.3	27	16.9	115	71.8

$\chi 2$=15.054

Weaning is the most critical transition period in nutrition for calves, incredibly stressful for the animal, and challenging for the producer. In determining the weaning age, it would be correct to consider factors such as operating conditions, breed, and developmental status. A study conducted at the point of weaning of calves determined that gradual and abrupt weaning practices in farms were 67% and 33%, respectively (Stanek et al., 2014). It has been determined that the weaning ages of the calves differ on the farms. The age of weaning varies according to the farms' criteria as a basis (Table 10). Especially in the small farm size group, it is seen that the calves receive milk for a more extended period due to the market value of milk, budgeting for other feed sources, and the use of a pasture system ($P<0.05$).

Table 10. Weaning age of calves (days) according to herd size

		Criteria									
		45		60		90		120		180	
		N	%	N	%	N	%	N	%	N	%
Farm capacity (head)	10-20[b]	2	2.9	14	20.3	27	39.1	6	8.7	20	29.0
	21-30[b]	1	2.8	10	27.8	17	47.2	2	5.6	6	16.7
	31-40[b]	0	0.0	4	16.0	12	48.0	6	24.0	3	12.0
	41-50[a]	0	0.0	0	0.0	7	50.0	7	50.0	0	0.0
	> 50[b]	0	0.0	5	31.3	6	37.5	5	31.3	0	0.0
	Total	3	1.9	33	20.6	69	43.1	26	16.3	29	18.1

$\chi 2$ <0.05

The critical thing in the weaning management of calves is to gradually reduce milk and milk replacer consumption, increase feed consumption, and implement the application gradually. When and by which criteria this application should be made depends on the preference of the farms. Commonly applied weaning criteria are listed as age, live weight, and intensive feed consumption amount. The study revealed that farms' weaning criteria vary according to their preferences, not capacity (Table 11). The difference between the weaning criteria was significant ($P<0.05$).

Table 11. Weaning criteria for calves

		Criteria					
		Age		Live weight		Concentrate feed consumption	
		N	%	N	%	N	%
Farm capacity (head)	10-20[c]	53	76.8	6	8.7	10	14.5
	21-30[c]	28	77.8	4	11.1	4	11.1
	31-40[a]	12	48.0	12	48.0	1	4.0
	41-50[c]	8	57.1	4	28.6	2	14.3
	> 50[b]	6	37.5	8	50.0	2	12.5
	Total	107	66.9	34	21.3	19	11.8

$\chi 2$ <0.05

It is stated that age is considered at a rate of 61.7% as a criterion for weaning calves (Stanek et al. 2014). Another study stated that the age criterion was preferred by 60%, and weaning was applied after the 90th day (41%) or the 150th day (40%). It was stated that after the age criterion, live weight (25%; 90-120 kg (55%)) and concentrate feed intake (15%; >900 g (63%)) criteria were used, respectively (Santos and Bittar, 2015). Vasseur et al. (2010) reported that 66.7% of the farms preferred age as the weaning criterion, followed by intensive feed intake with 43.9%. Weaning criteria were determined according to 7 weeks age, live weight of 82 kg, and concentrate feed intake of 2 kg, but many breeders stated that the weaning criteria were age.

It has been determined that large-capacity farms are more sensitive about the vaccination of calves. It is observed that care is taken to make brucella, foot-and-mouth disease, and pox vaccinations applied within the scope of the ministry's vaccination program above 40% in all farms (Table 12). The difference between the size of the farm and the vaccines administered was significant (P<0.05). In a study conducted in Brazil, it is stated that anthrax (34%) and rabies (17%) are the most common vaccines applied in farms, while 19% of farms do not prefer to be vaccinated (Santos and Bittar 2015).

Table 12. Primary diseases seen in calves

		Criteria							
		Diarrhea		Pneumonia		Diarrhea-Pneumonia		Unknown/Other	
		N	%	N	%	N	%	N	%
Farm capacity (head)	10-20[d]	34	49.3	2	2.9	5	7.2	28	40.6
	21-30[d]	22	61.1	0	0.0	2	5.6	12	33.3
	31-40[b]	10	40.0	4	16.0	6	24.0	5	20.0
	41-50[c]	7	50.0	2	14.3	4	28.6	1	7.1
	> 50[a]	7	43.8	4	25.0	4	25.0	1	6.3
	Total	80	50.0	12	7.5	21	13.1	47	29.4

$\chi 2$ <0.05

Diarrhea cases are generally over 40% in farms, and the biggest problem observed after diarrhea has been recorded in cases where diarrhea and pneumonia occur together (Table 12). It is seen that the diseases did not decrease with the increase in the farm capacity, and there was not much change in the sick calf cases (P<0.05). It is stated that a significant portion of calf losses occur as a result of diarrhea (Hotzel et al., 2014). In another

study, it is stated that diarrhea (48%), pneumonia (22%), and tick fever (21%) cases come to the fore, similar to the results of the research (Santos and Bittar, 2015). It is understood that the most significant risk for calves is diarrhea, a severe illness leading to death, especially in the first weeks of life.

One of the most controversial issues within calf welfare is using individual pens (Rushen et al. 2008). It is seen that the calves are mainly kept in groups (Table 13). The difference between the housing systems according to the size of the farms was found to be significant (P<0.05).

Table 13. Calf housing systems

		Criteria					
		Group		Individual pens (inside)		Individual pens (outside)	
		N	%	N	%	N	%
Farm capacity (head)	10-20[d]	63	91.3	6	8.7	0	0.0
	21-30[d]	30	83.3	5	13.9	1	2.8
	31-40[c]	15	60.0	6	24.0	4	16.0
	41-50[a]	4	28.6	5	35.7	5	35.7
	> 50[b]	5	31.3	6	37.5	5	31.3
	Total	117	73.1	28	17.5	15	9.4

$\chi 2$ <0.05

It has been stated that 88.8% of the individual pens are used as the calf housing system used in the farms, and there is no difference in preferences according to the size of the farms (Klein-Jobstl et al., 2015). In another study conducted the same way, it was stated that 97% of the farms house their calves in individual huts and stalls (Stanek et al., 2014). It is stated that after birth, 55% of the calves are kept in groups and 45% in individual pens (Santos and Bittar, 2015). In this context, a group housing system is mandatory for calves older than eight weeks, according to European Union regulations (Anonymous, 1997). Okuyucu (2016) states that the growth performance of the calves housed in an individual shed at the age of 0-60 days is higher than the calves housed in groups (P<0.05). Akbay (2010) states that 60.9% of farms prefer individual calf pens. Şahanoğlu (2014), on the other hand, states that in 95% of the farms, calves are housed as a group.

Epidemiological studies show that the pathogens responsible for increased calf death and morbidity are more prevalent in group shelters than in individual hutches (Losinger and Heinrichs, 1997, Svensson et al., 2003). The advantages of hosting as a group are unclear; recent studies show that there may be some benefits of keeping calves in group shelters that provide more opportunities for social interactions and daily behavior and facilitate their physical movements (Jensen et al., 1997; Chua et al., 2002).

It is essential for the welfare of the calves that they are housed in a different place from the other animals in the holdings. It was determined that in a significant part of the farms visited, calves were housed in a section reserved for young cattle (Table 14). The difference between the calf pens according to the size of the farms was significant (P<0.05).

Table 14. The layout of calf pens

		Criteria			
		Inside the barn		In a place reserved for young cattle	
		N	%	N	%
Farm capacity (head)	10-20[b]	34	49.3	35	50.7
	21-30[a]	6	16.7	30	83.3
	31-40[b]	8	32.0	17	68.0
	41-50[b]	5	35.7	9	64.3
	> 50[b]	5	31.3	11	68.8
	Total	58	36.2	102	63.8

$\chi 2 < 0.05$

The choice of an open or closed environment is essential in selecting where the calves will be housed. Indoor environments have disadvantages for calf health, such as the fact that many animals breathe the same air, increasing the risk of disease transmission in the environment. Outdoor housing may expose calves to adverse environmental conditions such as heat, cold, wind, and rain (Hanninen et al., 2003). In a study conducted in Austria, 46.3% of the farms were in the barn where the calves and cattle are located; It was revealed that 38.2% of them were housed in a separate place for calves. It was stated that this situation did not differ according to the size of the farms (Klein-Jobstl et al., 2015). Although the use of outdoor sheds for calves is common in Canada and the USA, it is stated that 79.6% of the surveyed farms house them in barns (Vasseur et al., 2010). Stanek et al. (2014), it was determined that 55% of the holdings preferred open area, 18% chose a place in the barn, and 16% housed them in the barn next to the cattle.

The materials used in constructing the pens designated as calf habitats vary according to the farms preferences and the region's conditions. The materials of calf sheds in the farms visited are listed as wood (231%), plastic (12.8%), metal (39.1%), and brick (25.0%) (Table 15). The difference between the materials used in the calf pens according to the farm's size was significant ($P<0.05$). In a study conducted in Elazig, 50% brick, 20.2% concrete, and adobe are followed as building materials for the calf pen on farms (Singin, 2016). It is stated that in the Czech Republic, the use of plastic (61%) is prominent in the materials used for calf pens, followed by wood (29%) and metal (4.6%) materials (Stanek et al., 2014). In Canada, it has been revealed that 45.9% of the surveyed farms use metal or wood materials widely (Vasseur et al., 2010). Uncomfortable conditions for calves are a source of stress in terms of calf development performance. Stress is essential for dairy producers because the long-term effects can affect the development and reproductive performance of future breeder calves.

Table 15. Materials used in calf pens

		Criteria							
		Wood		Plastic		Metal		Brick	
		N	%	N	%	N	%	N	%
Farm capacity (head)	10-20[c]	23	34.3	2	3.0	16	23.9	26	38.8
	21-30[d]	8	23.5	4	11.8	16	47.1	6	17.6
	31-40[d]	3	12.0	3	12.0	12	48.0	7	280
	41-50[a]	2	14.3	7	50.0	5	35.7	0	0.0
	> 50[b]	0	0.0	4	25.0	12	75.0	0	0.0
	Total	36	23.1	20	12.8	61	39.1	39	25.0

$\chi 2$ <0.05

It has been determined that the bedding material used in the calf sheds in a significant part of the farms is straw (Table 16). The difference between the bedding material used in the calf sheds was insignificant regarding farm sizes. During rest, the preferred litter material in the calf compartment should be soft, dry, and clean. Studies indicate that rubber pads should be preferred instead of concrete pads (Hanninen et al. 2003). In a survey study, it was stated that concrete (74%) is preferred as the shelter base material, and straw (65.4%) is used as bedding material (Vasseur et al., 2010). It is stated that straw (22.3%), rubber/plastic pads (20.7%), soil (18.1%), and sawdust (17.6%) are used as litter material in farms in Elazig (Singin, 2016). As a result of the research carried out in Konya and Muş, it was stated that there is no use of litter material in the farms (Uzal and Uğurlu 2006; Şeker et al., 2012). Akbay (2010), on the other hand, states that as a result of her research in Tekirdağ province, the number of farms with suitable bedding material is very few, and they prefer straw litter at a rate of 10.5%.

Table 16. Bedding material used in calf pens

		Criteria							
		Straw		Sawdust		Straw-Sawdust		Other	
		N	%	N	%	N	%	N	%
Farm capacity (head)	10-20	47	68.1	11	15.9	2	2.9	9	13.0
	21-30	26	72.2	6	16.7	1	2.8	3	8.3
	31-40	19	76.0	4	16.0	2	8.0	0	0.0
	41-50	10	71.4	2	14.3	2	14.3	0	0.0
	> 50	11	68.8	1	6.3	4	25.0	0	0.0
	Total	113	70.6	24	15.0	11	6.9	12	7.5

$\chi 2$=19.391

To prevent the calves from being exposed to environmental factors, movement to group housing after being housed individually for a certain period after birth is necessary. The length of time that the breeders who keep their calves in individual pens keep their calves separate varies (Table 17). It is seen that the response to keep in the individual compartment over eight weeks stands out at 33.1% in existing farms (P<0.05). Results similar to research results In a survey conducted in Bangladesh, it was stated that they grouped their calves after eight weeks (61%) (Chowdhury et al., 2017). In a study conducted in Austria, calves are kept in individual pens for up

to 6 weeks (37%), and it is reported that the rate of those who keep them up to 6 weeks (40%) increases in those with larger holding capacity (Klein-Jobstl et al., 2015). Livesey et al. (1998) stated that bleeding wounds were alleviated in heifers housed in the hay area but increased in those housed in small compartmented areas. The mistake can be made of prejudicing the welfare of animals about different systems. At this point, there is a need to evaluate production systems from different perspectives. Even in the same herd, there may be differences in the welfare levels of the animals depending on the care-management ability of the breeder (Koyuncu and Altıncekic, 2007).

Table 17. The retention time of calves in individual pens (week)

		Criteria							
		1-4		4-6		6-8		> 8	
		N	%	N	%	N	%	N	%
Farm capacity (head)	10-20[a]	7	19.1	11	30.6	8	22.2	10	27.8
	21-30[b]	2	6.7	11	36.7	6	20.0	11	36.7
	31-40[c]	0	0.0	3	13.0	8	34.8	12	52.2
	41-50[c]	0	0.0	0	0.0	3	21.4	11	78.6
	> 50[c]	0	0.0	0	0.0	7	43.8	9	56.3
	Total	9	5.6	25	15.6	32	20.0	53	33.1

$\chi 2 < 0.05$

It is seen that the cleanliness of the calf pens is given importance in all the farms evaluated (Table 18). According to the size of the farm, the difference in the cleaning of the calf pens was found to be significant ($P<0.05$). The results of the survey study conducted in Austria were similar to the research results, and the establishments that regularly and infrequently cleaned their shelters were found to be 61.0% and 34.5%, respectively (Klein-Jobstl et al., 2015).

Table 18. Cleaning the calf pens

		Criteria			
		Regular		Irregular	
		N	%	N	%
Farm capacity (head)	10-20[a]	49	71.0	20	29.0
	21-30[b]	29	80.6	7	19.4
	31-40[c]	25	100.0	0	0.0
	41-50[c]	14	100.0	0	0.0
	> 50[c]	16	100.0	0	0.0
	Total	133	83.1	27	16.9

$\chi 2 < 0.05$

The answers given to the question "Do you perform dehorning of calves" are yes (17.5%) and no (82.5). These responses revealed that the dehorning practice was not given enough importance in the farms (Table 19) ($P<0.05$). A study conducted in Afyonkarahisar stated that 17.8% of the farms performed dehorning of calves

(Şahanoğlu 2010). In another study, it is stated that the application of dehorning is applied at a rate of 96% in dairy farms (Stanek et al. 2014).

Table 19. Dehorning application

		Answers			
		Yes		No	
		N	%	N	%
Farm capacity (head)	10-20[d]	5	7.3	64	92.8
	21-30[d]	1	2.8	35	97.2
	31-40[b]	9	36.0	16	64.0
	41-50[c]	4	28.6	10	71.4
	> 50[a]	9	56.3	7	43.8
	Total	28	17.5	132	82.5

$\chi 2$ <0.05

The number of farms that apply dehorning is 28, which is relatively low. As a method, it is seen that these farms prefer electrical (42.9%) and chemical dehorning (57.1%) at very close rates (Table 20). In a survey conducted for farms that use dehorning at a high rate, the methods they use are listed in order of priority as electric (48.1%), gas (29.8%), and chemical cautery (19.8%) (Stanek et al. 2014). Şahanoğlu (2014) states that chemical etching (88.9%) and electric etching (11.1%) techniques are used in dehorning farms.

Table 20. Methods of dehorning application

		Criteria			
		Electrical		Chemical	
		N	%	N	%
Farm capacity (head)	10-20	3	60.0	2	40.0
	21-30	0	0.0	1	100.0
	31-40	4	44.4	5	55.6
	41-50	2	50.0	2	50.0
	> 50	3	33.3	6	66.7
	Total	12	42.9	16	57.1

$\chi 2$=1.777

It has been revealed that 32.1% of 28 farms perform the dehorning procedure within the first 2-4 weeks and 28.6% within 4-6 weeks (Table 21). The difference between the age of dehorning according the size of the farms was not found significant.

Table 21. Age of dehorning (week)

		Criteria							
		< 2		**2-4**		**4-6**		**> 6**	
		N	%	N	%	N	%	N	%
Farm capacity (head)	10-20	2	40.0	0	0.0	1	20.0	2	40.0
	21-30	0	0.0	1	100.0	0	0.0	0	0.0
	31-40	2	22.2	4	44.4	2	22.2	1	11.1
	41-50	0	0.0	1	25.0	3	75.0	0	0.0
	> 50	2	22.2	3	33.3	2	22.2	2	22.2
Total		6	21.4	9	32.1	8	28.6	5	17.9

χ^2=11.694

Conclusion

In this study, managerial practices related to calves survivability in dairy cattle farms in Hendek district of Sakarya province were compared regarding farm sizes. The use of milk marketed for calf feeding in their farms adversely affects their profitability. It has been determined that using milk replacers with milk is not preferred, especially in small-scale farms, and as the farm capacity grows, the use of milk replacers with milk increases. It has been determined that the calves are housed in small-scale farms in a way that is not suitable for animal welfare. Due to the physical conditions of some of the villages visited, the barns are entirely indoors. It has been observed that keeping animals of all ages together in this type of barn creates problems, especially in calves, which are the most sensitive due to ventilation-related issues. It is seen that a significant part of the breeders cannot give up their habits, and they are lacking in researching and applying new techniques for increasing calf welfare and living power. For this reason, training should be a priority for young people, women, and large-capacity farms that are more open to learning. At this point, breeders' associations, universities, and public institutions should set new targets to change breeders' general perceptions and attitudes. Although the answer to the question of what we can do for the welfare of the calves in the farms is relatively high in theory, limited progress can be made in the farms in practice. At the point reached today, although experimental and observational studies have identified critical risk factors for increasing the viability of newborn calves, unfortunately, their implementation is not always realized at the farm level.

Acknowledgments

This study was produced from Merve KARACA'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 7 of the 2022-01 session.

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