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A Study on Structural Characteristics of the Cattle Barns in İspir County of Erzurum Province

Mete YANAR[1], Abdulkerim DİLER[2], Recep AYDIN[3], Rıdvan KOÇYİĞİT[4], Veysel Fatih ÖZDEMİR[5]✉
Mesut TOSUN[6]
[1,3,4,5,6]Atatürk University, College of Agriculture, Department of Animal Science, Erzurum, Türkiye, [2]Department of Plant and Animal Sciences, Vocational School of Technical Sciences, Erzurum, Türkiye.
[1]https://orcid.org/0000-0002-5311-5675, [2]https://orcid.org/0000-0001-7958-6179, [3]https://orcid.org/0000-0001-9319-9319
[4]https://orcid.org/0000-0001-9979-0804, [5]https://orcid.org/0000-0003-3035-7695, [6]https://orcid.org/0000-0001-6251-2771
✉: veyselfatihozdemir@gmail.com

ABSTRACT
This study was carried out to determine the structural characteristics of the barns and related problems in the cattle enterprises in İspir county of Erzurum province. For this purpose, a face-to-face survey was conducted with 325 randomly selected enterprise owners. It was determined that 94.7% of the barns in the enterprises in the county consisted of tied free-stall barns. Furthermore, 33% of the barns were between 16 and 20 years old and 31.2% of them were older than 21 years. Stone (95.4%) and brick (66.2%) were commonly used as building materials in the construction of the barn walls, and mainly galvanized sheet metal (77.4%) was used for the roof. The barn floor was also determined to be mostly concrete (61.9%) or stone (48.2%). Some of the standard barn elements were available in almost all of the enterprises in the county, such as feeder (100.0%), urinary canal (85.3%), window (96.7%), however other elements such as the feeding alley (6.6%), automatic waterer (1.3%) and ventilation holes (22.8%) were available in a small number of enterprises. The relationship between the number of windows in the barns, the level of farm size and the level of education of the breeders was found to be statistically significant (P<0.01). The percentage of enterprises with two windows in their barns was the highest (48.2%) in the county, and this was followed by enterprises with three, four, one and five windows in the barn, respectively.

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Erzurum İli İspir İlçesindeki Sığır Barınaklarının Yapısal Özellikleri Üzerine Bir Araştırma

ÖZET
Bu çalışma, Erzurum ili İspir ilçesinde sığırcılık işletmelerinde bulunan barınakların yapısal özelliklerini ve bunlarla ilgili sorunları belirlemek amacıyla yürütülmüştür. Bu amaçla, şansa bağlı olarak seçilen 325 işletme sahibi ile yüz yüze anket yapılmıştır. İlçedeki işletmelerde mevcut sığır barınaklarının %94,7'sinin bağlı duraksız kapalı ahırlardan oluştuğu belirlenmiştir. Ahırların %33'ünün 16-20 yaşında olduğu, %31,2'sinin ise 21 yıldan daha fazla kullanıldığı tespit edilmiştir. Ahır duvarları inşasında yapı malzemesi olarak genellikle taş (%95,4) ve tuğladan (%66,2) yararlanıldığı, çatısında ise çoğunlukla galvaniz sac (%77,4) kullanıldığı saptanmıştır. Ahır zemininin ise büyük oranda beton (%61,9) veya taş (%48,2) olduğu tespit edilmiştir. Yemlik (%100,0), idrar yolu (%85,3), pencere (%96,7) gibi standart barınak elemanlarının işletmelerin büyük çoğunluğunda bulunduğu ancak yemlik yolu (%6,6), otomatik suluk (%1,3) ve havalandırma deliklerinin (22,8%) az sayıda işletmede bulunduğu tespit edilmiştir. Barınaklardaki pencere sayıları ile işletme büyüklüğü ve yetiştiricilerin öğrenim durumları arasındaki ilişki istatiksel olarak önemli (P<0,01) bulunmuştur. Ahırında iki pencere bulunan işletmelerin oranı ilçede en yüksek olup (%48,2) bunu ahırında sırasıyla üç, dört, bir ve beş pencere bulunan işletmeler takip etmiştir.

Zootekni

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INTRODUCTION

Although world population has been increasing geometrically in recent years, food producing has gone up arithmetically in the world. As a result of this, the world population grew faster than food production and tended to exceed it in a short time. Due to this fact, food shortages in many countries have become a significant threat to human beings (Özsağlıcak and Yanar, 2021). Cattle are one of the most significant farm animals that produce animal-sourced foods such as milk and meat. The main purpose of cattle raising is to obtain the highest possible yield at the minimum cost. This can only be possible if the animals in the farm are fed adequately and have the high genetic capacity. Another requirement for profitable cattle farming is to provide appropriate environmental conditions in the barn. The terms of environmental conditions cover all factors affecting the growth, development and yield of animals. These ones can be classified as climatic, structural, social and other factors. In barns, temperature, relative humidity, air movements, and lighting are climatic factors, and ventilation, insulation status of the barn, and equipment are called structural factors. While animal density, water supply and feeding practices are social factors and odor, atmospheric pressure, dust, presence of pathogenic microorganisms is considered as other factors (Avci, 2015).

The environmental requirements of cattle are determined and applied mainly on the basis of human needs when cattle breeders do not have enough information about animal physiology (Akman, 2003). Providing the environmental conditions suitable for humans (especially temperature) in the barn for cattle often leads to detrimental consequences. For this reason, it is highly important to reveal the structural conditions and environmental features of the cattle barns and to determine the deficiencies and malpractices in these barns. The most suitable barn types that can provide the optimum environmental conditions for the animals can be determined by studies to be carried out in different geographical regions of Türkiye. Therefore, some studies were conducted to reveal the characteristics of the barn in different regions of the country (Mundan et al., 2018; Ünlü, 2018; Alkan and Güney, 2019; Bakır and Kibar, 2019; Bakır and Kibar, 2020; Kılıç et al., 2020; Öcal, 2020; Yılmaz et al., 2020; Kaygısız and Özkan, 2021).

Erzurum province has an important place in terms of cattle breeding in Türkiye. The number of cattle in the province was 827,806 heads and 937847 tons of milk was produced from 315594 dairy cows in 2019 (TUİK, 2021). İspir county which is one of the 20 counties of Erzurum province, is located 143 km northwest of Erzurum city center at the intersection of North East Anatolia and Eastern Black Sea Region. The county is surrounded by high mountains from the north and south. Within the boundaries of the county, there are many mountains having altitudes between 2400 and 3900 meters. İspir county is located in a transition zone and the climate that prevails in the county is a transition climate between the continental climate and the maritime climate (Koçyiğit et al., 2022). Compared to other counties of Erzurum, the winter season is milder. However, the temperature differences between winter and summer and the day and night are quite high. Climatic characteristics show further differences along the Çoruh River, which passes through the borders of the county by forming a valley and a basin. The county is quiet suitable for animal husbandry due to its natural and geographical conditions. According to statistics data, the total number of cattle available in 2019 in the county was 21924, the number of dairy cattle was reported as 8263 and the total amount of milk produced was 24483 tons (TUIK, 2021).

Although studies were conducted to determine the structural characteristics of barns in cattle enterprises in Yakutiye (Çapadağ, 2016), Hınıs (Diler et al., 2016) and Narman (Diler et al., 2018) counties of Erzurum, no study was carried out in İspir county. Therefore, the present study was conducted in this region, which differs significantly from the central and southern counties of Erzurum in terms of climatic conditions to reveal deficiencies in terms of equipment and structural features of cattle barns and reveal concerning problems to suggest solutions.

MATERIAL and METHOD

The study has been approved by Atatürk University Faculty of Agriculture Ethics Committee Chairmanship and then was conducted on the owners of randomly selected dairy cattle enterprises in İspir county of Erzurum province. A face-to-face survey was conducted with 394 individuals, and data obtained from a questionnaire consisted of the material of the current research. After visiting the cattle enterprises, their current situation was investigated by observation along with survey questions. Since the population is limited in addition to the variance being unknown, there are qualitative variables dependent on probability, the formula given below was used to determine the sample size of the study as suggested by

Arıkan (2007).

$$n = \frac{N.t^2.p.q}{(N-1).D^2 + t^2.p.q}$$

In this formula;

n=Minimum number of samples, N=Population size, D=Acceptable or desired sampling error (5%), t=Table value (t=1.96 for α= 0.05), p=The rate to be calculated (0.5), q=1-p.

$$n = \frac{2107.(1.96)^2.0.5.(1-0.5)}{(2107-1).(0.05)^2+(1.96)^2.0.5.(1-0.5)} = 325$$

The estimated minimum sample size was found to be 325 using the formula given above. After calculating the minimum sample counts, the number of surveys increased by 21.23%. The final number of surveys to be carried out in the villages of the İspir county of Erzurum province was determined as 394. The data obtained from the survey work were transferred to Excel 2010 computer program prior to statistical analysis. Number of cattle in the farms were grouped as less than 11, 11-20, 21-30, 31-40 and more than 40 heads. Additionally, the educational status of the cattle breeders was grouped as illiterate, literate, primary school graduate, secondary school graduate and high school graduate. Chi-Square analysis available in SPSS statistics program were utilized to determine effects of the number of cattle in the farms and the educational status of the owners of the enterprises on the structural characteristics of barns in these enterprises (SPSS, 2011).

RESULTS and DISCUSSION

Barn Types

In the present study, it was revealed that 94.7% of the enterprises in İspir county have tied free-stall closed barns and 4.3% of them have tied-stall closed barns. Additionally, the percentages of open, semi-open and free-stall closed barns in the county were also very low (Figure 1). Similarly, results of the studies conducted in Central Anatolia and Eastern Anatolia (Uğurlu and Şahin, 2010; Şeker et al., 2012; Tilki et al., 2013; Bakan, 2014) agree with the findings of the present study. However, the percentage of closed barns with tied-stall in İspir county (4.3%) was found to be lower than the findings of studies carried out in both the Black Sea Region (Tugay and Bakır, 2006; Yenice and Savaş 2016) and the West Anatolia Region (Demirhan and Yenilmez, 2019; Kılıç et al., 2020). On the other hand, Yener et al. (2013) reported that 17.5% of barns are closed barns and 82.5% are semi-open barns in the South East Anatolia Region.

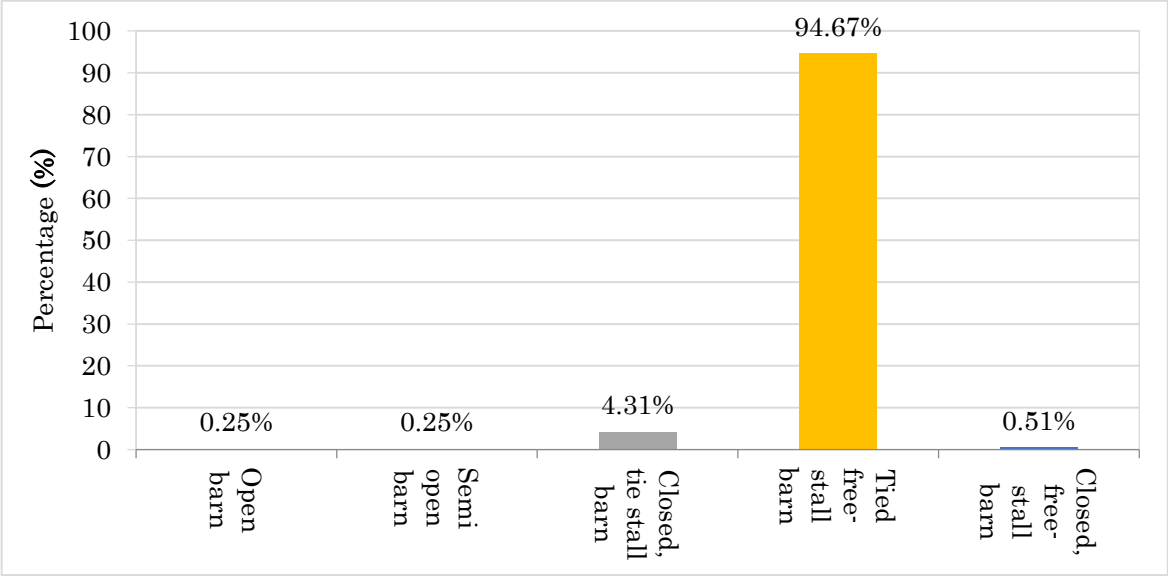

Figure1. Barn types
Şekil 1. Ahır tipleri

Dou et al. (2001) reported that 68% of the cattle enterprises had tied-stall barns in the state of Pennsylvania. Moreover, Sheppard et al. (2011) determined that less than 31% in Western Canada and 80% of the cattle barns in St. Lawrence Plains were tied-stall barn. In these types of barn workers mostly experience tedious difficulties and inadequacies in the application of the most important tasks such as feeding, manure extraction, milking, and irrigation. Therefore, younger generations, especially women, do not want to be employed in animal farming work (Anonymous, 2018). Additionally, Valde et al. (1997) noted that tied-stall barns have a higher incidence of clinical mastitis and suggested that free-stall barns should be preferred for lower disease incidence and higher fertility status. Furthermore, Gökalp (2019) stated that free-stall barns are the most widely used housing system in dairy cattle breeding, but these barns are only profitable in enterprises with 60 or more dairy cattle.

Thoughts of the Cattle Breeders Concerning the Effect of Their Barns on Both Health of Humans and Animals

Majority of the participants stated that their barns had no adverse influence on the human's health (81.5%), animals' growth and development (83.2%) and milk yield (83.5%) (Figure 2a, b, c).

Contrary to the findings of the present study, 48.79% of the owners of the enterprises in Kars province stated that their health was adversely affected due to the structural characteristics of the barns. Furthermore, in the same study in more than half of the enterprises, milk production (57.04%) and cattle growth (57.04%) were reported to be negatively affected due to inadequate barn structure (Tilki et al., 2013).

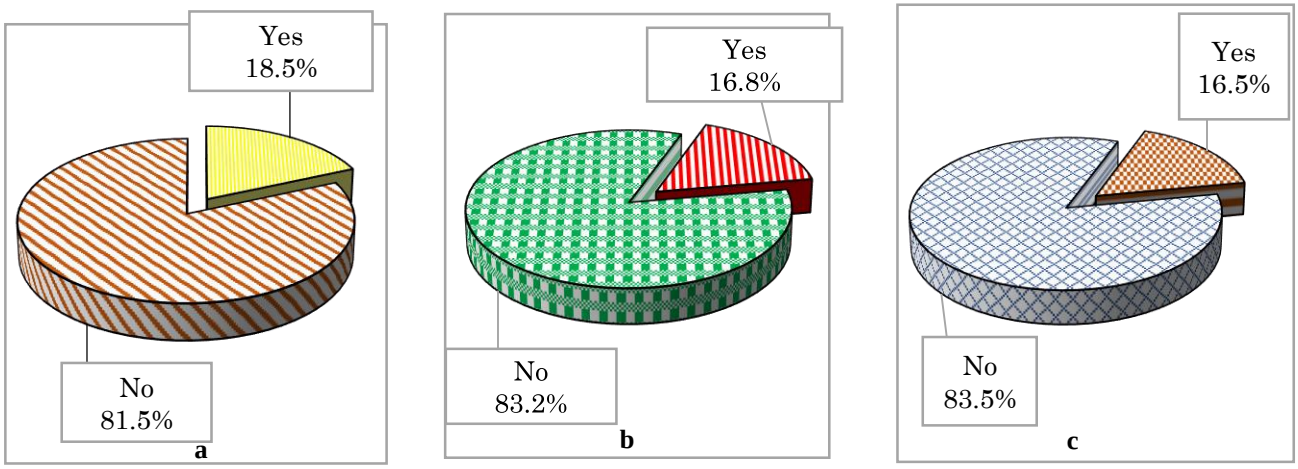

Figure 2. Does the barn environment adversely affect the health of the breeders (a), the growth and development of the animals (b), and the milk production of cows (c).

Şekil 2. Ahır ortamı yetiştiricilerin sağlığını (a), hayvanların büyüme ve gelişmelerini (b), ineklerin süt verimini olumsuz yönde etkiliyor mu?

Similarly, Aydın et al. (2016) also indicated that in the majority of the enterprises in Hınıs county of Erzurum province barn structure adversely affected the health of enterprise owners (88.8%), milk yield (88.6%), and growth and development of animals (81.0%). It could be seen that the results determined in Ispir county were worse compared to other regions of Türkiye. The findings could be attributed to low level of awareness and the lack of information of the breeders about the negative effects of barn conditions on yield and health in İspir county. It was also determined that there were significant ($P<0.05$) relation between education level of the breeders and their thoughts about influence of their barns on the health as well as milk yield.

Age of the Barn Facilities

The age of the barns in the İspir county was determined to be generally over 15 years (64.2%) and the number of newly built barns is quite low (3.0%). The percentages of the barns aged less than 5 years were determined as 3.0%, between 6-10 years 14.0%, between 11-15 years 18.8%, between 16-20 years 33.0% and for 21 years and above 31.2% in the county (Figure 3). The findings of the present study are in accordance with the findings of Aydın et al. (2016) in terms of the age of barns buildings which were younger than 10 years of age (17.0%), however lower than the reports of Güler et al. (2017) for the same building age groups (40.4%). Additionally, the findings of the current study are in harmony with the results of Tilki ve ark. (2013) in central county of Kars as well as Bakan (2014) in Ağrı Province.

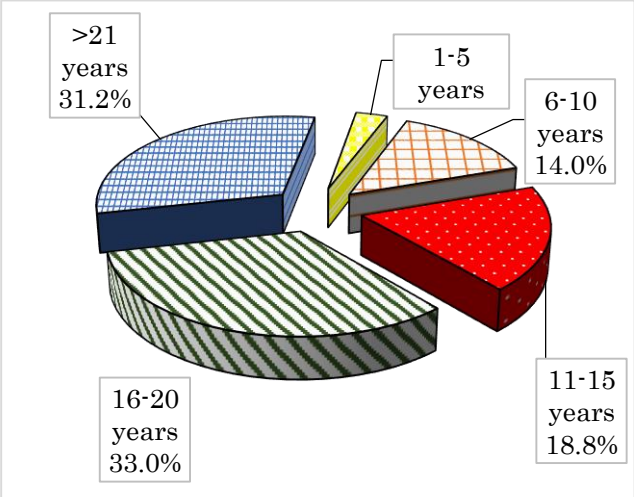

Figure 3. Age of the barns

Şekil 3. Ahırların yaşları

Location of Barns

In dairy cattle enterprises, barns are recommended to be detached in terms of animal health, welfare, and productivity. In İspir county 80.5% of the barns were determined to be detached from the house building (Figure 4). The percentages of detached barn building were reported as 63%, 77%, 70.7% and 75% in

Kahramanmaraş (Kaygısız and Tümer 2009), in Muş (Şeker et al., 2012), in Hınıs (Aydın et al., 2016) and Narman counties of Erzurum province (Güler et al., 2017), respectively. The findings of the present study were determined to be higher than results of these reports. However, the results of the current study were lower than those that were reported for Ergani county of Diyarbakır province (90.4%), Malatya (91.9%), and Muş (85.8%) (Han and Bakır, 2010; Köseman and Şeker, 2016; Bakır and Kibar 2020). Furthermore, it was determined that the relationship between the location of the barns and the educational levels of the owners of the enterprises was statistically significant ($P<0.05$).

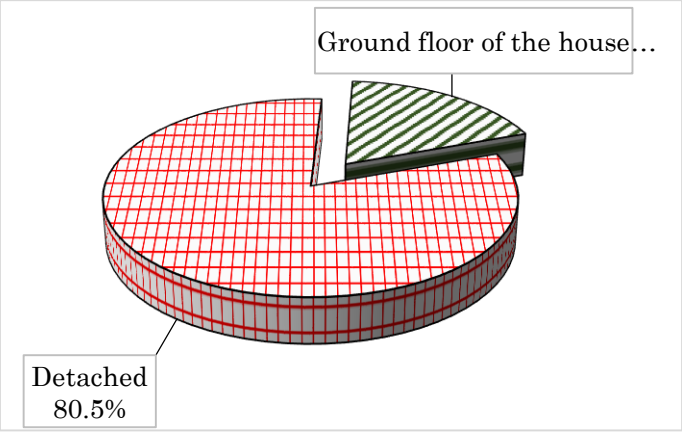

Figure 4. Location of the barns
Şekil 4. Ahırların lokasyonları

Building Materials Utilized for the Construction of Barn Walls

Stone (95.4%) and bricks (66.2%) were determined to be commonly used building material on the construction of the barns' walls in İspir county (Figure 5). Stone is a sturdy, readily available and free construction material, as well as a traditional construction material used by farmers in the İspir county. Therefore, it may be possibly the main reason for the use of stone commonly in barn buildings of İspir county. Similarly, Şeker et al. (2012) reported that stone (42.1%), briquette (39.7%) and mudbrick (18.2%) were widely used in barn construction in Muş province. Furthermore, in Narman county of Erzurum province stone (55.3%), brick (32.7%) and mudbrick (12.0%) were reported to be the most widely used building materials (Güler et al., 2017). On the other hand, Aydın et al. (2016) reported that in Hınıs which is another county of Erzurum province, mudbrick was used most commonly with 45.6% in barn's walls, and it was followed by brick (25.8%), stone (25.5%), wood (2.2%) and briquette (0.8%). Furthermore, the wall building material in 69.56% of the dairy cattle barns was reported to be brick, 13.04% was stone and 8.70% was briquette in the Çankırı province (Yıldız, 2013). Similarly, Kurç and Kocaman (2016) determined that brick, concrete, briquette, sheet metal along with brick and sheet metal were used as wall materials in barns in 80.65%, 3.23%, 3.23%, 3.23% and 8.06% of the enterprises respectively in Malkara county of Tekirdağ province. In contrast, oak, a wood material, was used as wall construction material in most (79.17%) of the cattle barns in Şenpazar county of Kastamonu province (Şahin, 2016). In addition, while stone was used together with wood material in the construction of barn walls in 4.16% of the enterprises, only brick was used in 16.67% of the barns.

Furthermore, Bardakcioglu et al. (2004) reported that 62.6% of the barn walls were made of bricks, 34.4% of perforated bricks, and 3% of other materials (briquettes, mudbrick, etc.) in Aydın province. In Kahramanmaraş province, it was also reported by Kaygısız and Tümer (2009), walls of the cattle barns in Kahramanmaraş province were constructed by using stone (33%), mudbrick (% 26), Briquette (% 40) and lumber (1%) materials.

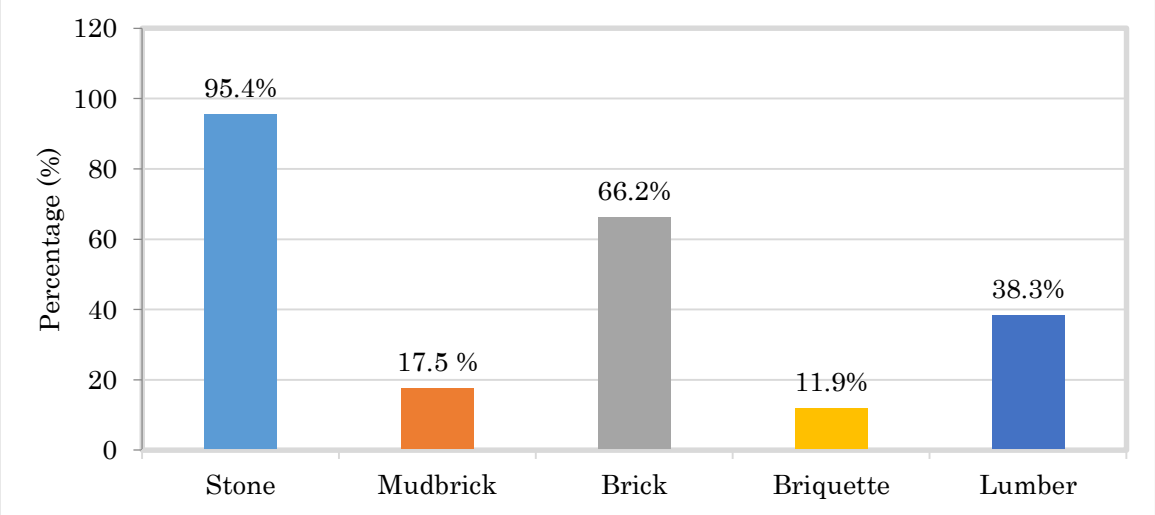

Figure 5. Building materials used for the walls of the barns
Şekil 5. Ahır duvarları için kullanılan yapı malzemeleri

Structural Materials Used for Barn Roofs

In İspir county, galvanized sheet metal was mostly preferred for the construction of barn roofs in the county (65.4%), followed by concrete (15.0%), soil (mud) (10.8%) and lumber (8.8%) (Figure 6). Similarly, galvanized sheet metal and concrete were reported to have been used for the construction of the barn roof in 48.1% and 22.6% of the enterprises respectively in Narman county of Erzurum province (Güler et al., 2017). However, in Yakutiye county of Erzurum, the percentage of enterprises that preferred galvanized sheet metal for roof construction was reported as 84.2% (Çapadağ, 2016). Furthermore, the sheet metal (56.5%) was determined to be widely used among the roofing materials in dairy cattle enterprises in Aydın province, while different construction materials such as eternite (25.3%), tile (13.1%) and thatch or nylon (5.1%) were also used in these enterprises (Bardakçıoğlu et al., 2004).

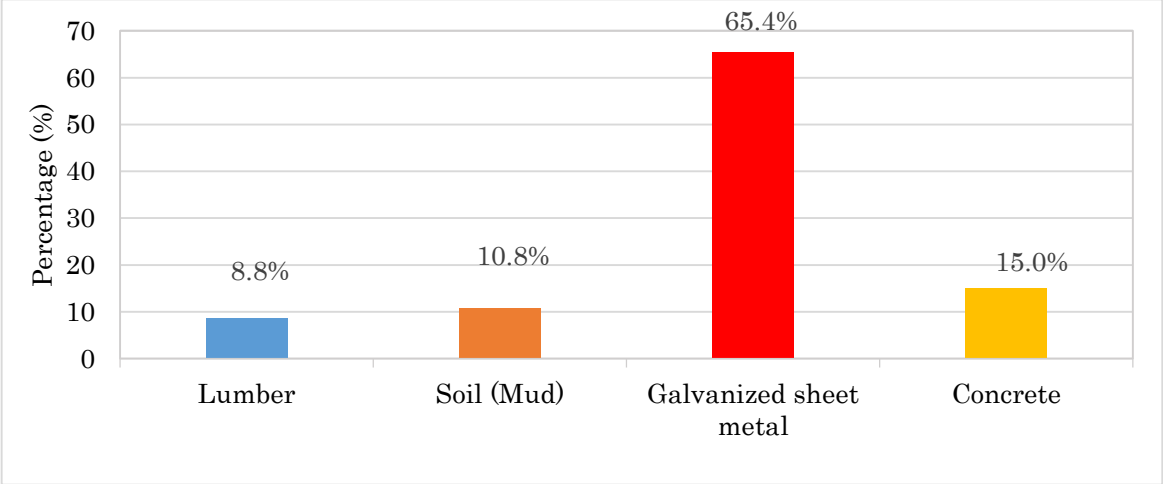

Figure 6. Building materials used for the constraction of barn roofs
Şekil 6. Ahır çatılarının yapımında kullanılan yapı malzemeleri

Building Materials Utilized for Constructing of Barns' Floors

While only one structural material was used for construction of the barn floors, it was observed that more than one type of material was used in some of the barns. The building material used for construction of the barns' floors in the majority (61.9%) of the cattle farms in the İspir county is concrete. However, stone (22.0%), compacted soil (28.2%), and wood (27.9%) are the other materials preferred by the owners of the enterprise (Figure 7). It is recommended that the floor material of cattle barns should be stable, durable, impermeable, resistant to chemicals and urine and easy to clean. Even though the most economical floor material is compacted soil, the floor should be concrete for better animal cleanliness and easier manure cleaning (Özhan et al., 2009; Yıldız, 2013). In many studies conducted in different provinces and counties in Türkiye, it was reported that the use of concrete in the construction of barn floors was quite common (Yener et al., 2013; Bakan, 2014; Köseman and Şeker 2016; Mundan et al., 2018; Demirhan and Yenilmez, 2019; Bakır and Kibar 2020). Moreover, Vasseur et al. (2010) reported that concrete (74.4%) was the most commonly preferred flooring material in the barns of cattle farms in Pennsylvania state of the USA.

Structural Materials Utilized for Building Feeders in Cattle Barns

Lumber (70.8%) and concrete (29.2%) are the most widely preferred for constructing of the feeders in the enterprises in İspir county of Erzurum province (Figure 8). Similarly, Aydın et al. (2016) reported that 61.2% of the enterprises used concrete and 38.8% used wooden materials for the construction of the feeders in Hınıs county. On the other hand, Güler et al. (2017) reported that in the Narman county of Erzurum province, in 48.1% of the enterprises, feeders were made of lumber materials and in 35.6% of them they were made of concrete. However, in contrast to the present study, they also reported that galvanized sheet metal was another material used for feeder construction (16.3%).

It was also stated in several other studies that the use of concrete is more common in the making of feeders, in 98.4% of the enterprises in Ankara, 89.4% Aksaray (Tatar, 2007), and in all of the enterprises in the Ahlat county of Bitlis (Bayraktar et al., 2010) feeders were made of concrete. The possible reasons for the widespread usage of concrete feeders in barns could be easy to clean, as that well as they can be filled with water for the watering of the animals.

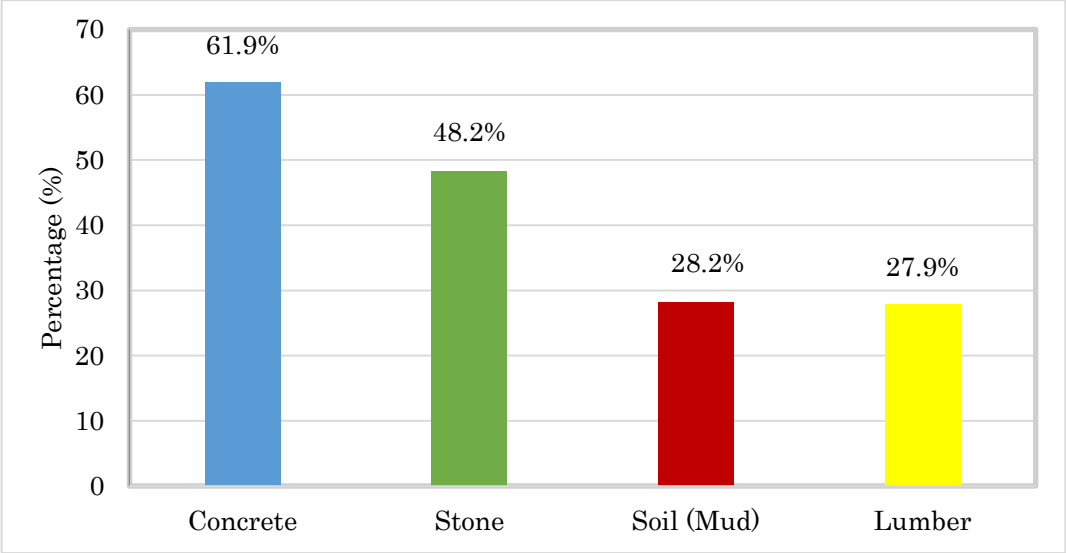

Figure 7. Building materials used for the construction of the floors of the barns
Şekil 7. Ahırların zeminlerinin yapımında kullanılan yapı malzemeleri

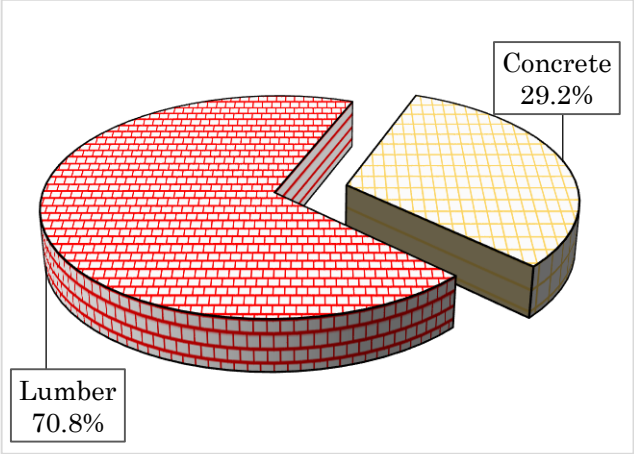

Figure 8. Building materials used to make the feeder
Şekil 8. Yemlik yapımında kullanılan yapı malzemeleri

Interior Design of the Cattle Barns

In the construction of cattle barns, design, types, locations, and sizes of the structural elements such as feeders, waterers, stalls, urinary channels, tying arrangements and feed alleys, etc. should be planned taking into account the ease of the working of workers as well as health and welfare of the animals. Some of the standard barn structural elements were available in almost all of the enterprises in the county such as feeder (100.0%), urinary canal (85.3%), window (96.7%). However, other elements such as the feeding alley (6.6%), the automatic watering system (1.3%), and the ventilation holes (22.8%) were available in a small number of enterprises (Figure 9). Results of a study conducted by Aydın et al., (2016) indicated that in the enterprises not having feeding alley where feeders were built in a position adjacent to the barn walls, breeders have to get too close to cows to feed them. In addition to this, they noted that breeders might encounter high injury risk as a consequence of this practice. Güler et al. (2017) found that only 6.3% and 6.7% of the enterprises, respectively, in Narman county of Erzurum had feeding alley and automatic waterers in their barns. Additionally, it was reported by Bayraktar et al. (2010) that only 30.43% of the enterprises in Adilcevaz county of Bitlis province had feeding alley in their barns.

Daytime Lighting of the Cattle Barns

Having enough light during the daytime enables better observation of cow signals and allows breeders to detect signs of heat, lameness, blood, and discharge. Additionally, better lighting barn also improves workers' efficiency, comfort and safety. In the planning of the barns, windows are important in terms of ventilation and lighting. In barns with insufficient lighting, it is difficult to perform routine work inside the barn such as feeding and cleaning, the probability of accidents increases during the entrance and exit to the barn, and the animals cannot benefit from natural light (Özhan et al., 2009). It was determined for the daytime lighting of the barn most of the breeders (92.9%) in İspir county used windows and electric bulbs together (Figure 10). Although the percentage of lighting through windows was 6.6%, the percentage of enterprises that used only electricity for barn lighting was determined as 0.5%. Since lighting with electricity is an additional cost to the company, the use of windows for this purpose is recommended for profitable cattle farming (Özdemir and Karaman, 2008). However, as a result of not giving the necessary importance to cleanliness in most of the barns in the county, it was observed that the glasses of windows were extremely dirty and dusty and this situation

prevented the animals housed in these barns from benefiting from sunlight sufficiently.

Tugay and Bakır (2006) reported that in 52% of the dairy cattle farms in Giresun province, the barns had sufficient lighting and these enterprises provided the lighting through the windows. In the Hınıs county of Erzurum province, 63.5% and 36.5% of the enterprises were reported to provide natural lighting and electricity for the interior lighting of the barns respectively (Aydın et al., 2016). Daş et al. (2014) determined that almost in all barns in Bingöl province, interior lightning of the barn was provided by electricity. Therefore, the number of barns that provided lighting by using sunlight was reported as quite low.

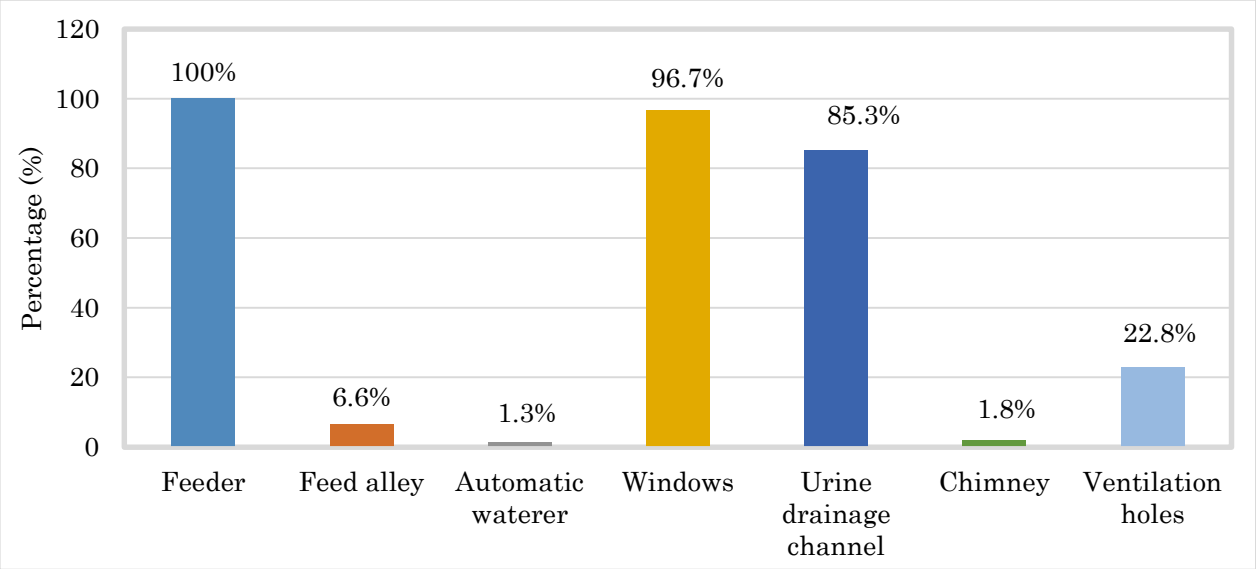

Figure 9. Structural elements existing in the barns
Şekil 9. Ahırlarda mevcut yapısal elementler

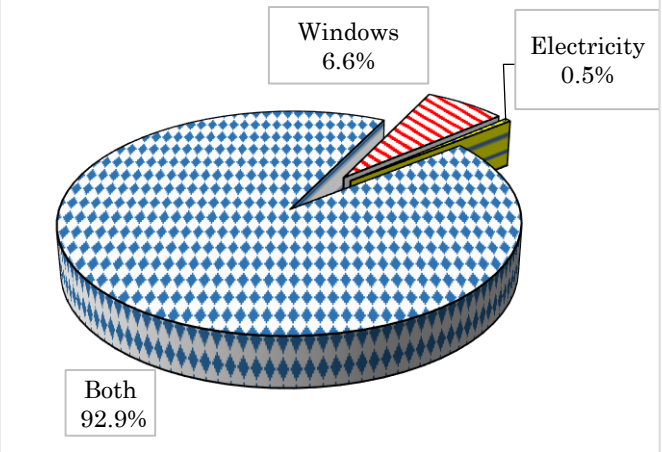

Figure 10. Techniques for daytime lighting of barns
Şekil 10. Ahırların gündüz aydınlatma teknikleri

The Number of Windows in the Barns

The number of windows in the barns is highly important for a sufficient lighting. Although the percentage of enterprises with 2 windows in their barns was the highest (48.2%) in the county, this was followed by enterprises with 3, 4, 1 and 5 windows in the barn, respectively (Figure 11). Similarly, Güler et al. (2017) reported that the barns with 2 windows (47.5%) were quite common in Narman county, followed by the barns with 4-5 windows. Furthermore, Aydın et al. (2016) indicated that barns with 3 (36.3%) and 4 (40.0%) windows were common in most of the enterprises in Hınıs county. It was also determined that there was a significant relationship ($P<0.0.1$) between the number of barn windows in the barns in the county and the size of the enterprise along with the educational status of the owners of the enterprises.

The Number of Ventilation Chimneys of the Barns

The number of ventilation chimneys in the barn is important for removing the warm air, humidity, bad odors, and gases in the barn. The number of barn chimneys in the enterprises also differs in a similar way as the number of windows in the enterprises. It was determined that 77.4% of the enterprises in the county did not have a ventilation chimney, and the enterprises with a chimney generally had 1 or 2 chimneys (Figure 12). In this case, the discharge of dirty air from the barn is only provided through windows or doors. Similarly, Kılıç et al. (2020) reported that in 58% of dairy farms in Kütahya province dirty barn air was discharged by keeping the windows open. In addition, it was determined that the number of air discharge chimneys in the barns was significantly ($P<0.01$) related to the size of the enterprise in the county.

Tilki et al. (2013) stated that 6.3% of cattle enterprises in Kars province did not have barn ventilation chimneys, while 3.6 of them had one ventilation

chimney. Unalan et al. (2013) reported that 78.1% of the enterprises in Niğde province did not have ventilation chimneys in the barns, while Kılıç et al. (2020) pointed out that only 2% of the barns in cattle farms in Kütahya province did not have barn chimneys. It was also reported that 8.5% of the animal barns in the Tokat province enterprises did not have ventilation chimneys, and doors and windows are used for air discharge (Özdemir, 2007). Aydın et al. (2016) noted that the number of barns with 2, 3 and 4 chimneys in cattle farms was quite common in Hınıs county of Erzurum province. Similarly, most of the cattle enterprises in Muş province had barn ventilation chimneys and percentage of cattle barns having ventilation chimney was 90.8% (Bakır and Kibar, 2020). On the other hand, Öztürk (2009) noted that ventilation chimneys existed in 55.17% of the enterprises in Mardin province. Likewise, most of the enterprises in Narman county of Erzurum have 1 or 2 chimneys (45.7% and 40.0%) (Güler et al., 2017).

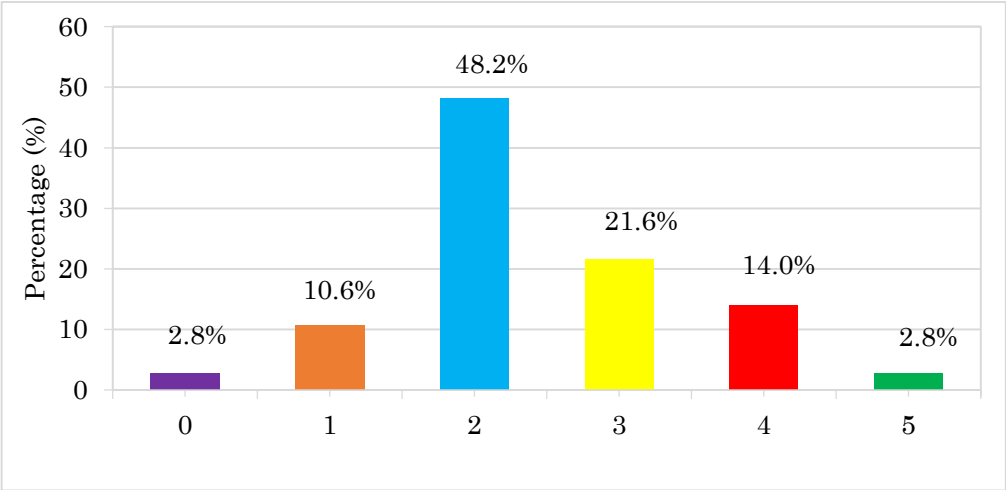

Figure 11. Number of windows in the barn
Şekil 11. Ahırdaki pencere sayısı

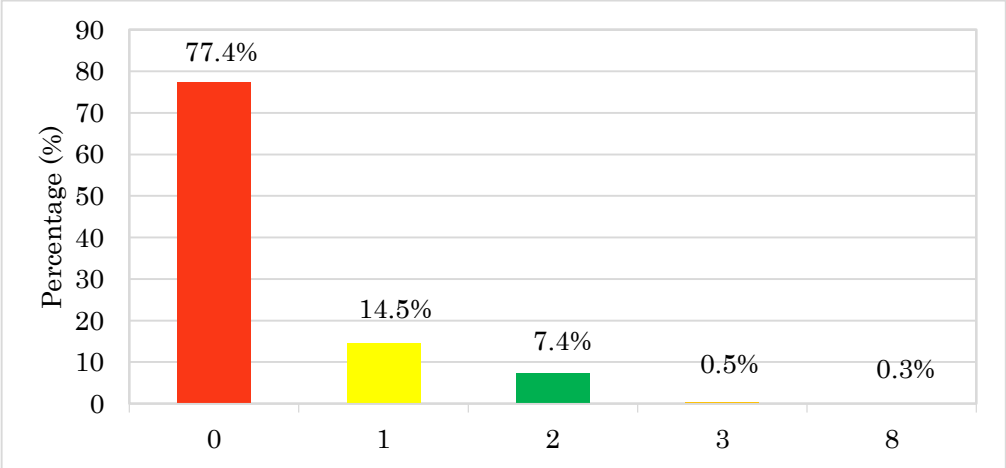

Figure 12. Number of ventilation chimneys of the barns
Şekil 12. Ahırlardaki havalandırma bacası sayısı

CONCLUSION and SUGGESTIONS

This study was carried out to determine the structural characteristics of barns and related problems in cattle enterprises in İspir county of Erzurum province. The findings revealed that the required standards were not followed in the planning and construction of the barns in the county. Most barns were not planned according to animal welfare and conditions that will provide better atmospheric conditions inside the barn. A big majority of the barns were determined to be in a tied free-stall closed barn plan, and the air discharge chimneys and windows in the barns were insufficient. For these reasons, it is difficult to provide the optimum temperature, humidity, and quality air for cattle. In almost all of the enterprises in the county barns were determined to be detached as recommended to provide better welfare to the cattle. The barn walls were commonly made of stone and brick, galvanized sheet metal material was widely utilized for the barns' roofs, concrete was used on the barn floor. These practices look promising for the cattle farming of the county. It would be appropriate to increase usage automatic cow drinkers to provide continuous water supply to the animals and to install a water system inside the barn

for this purpose. The information support and investment incentives to be given to the enterprises in the region, it would be possible to modernize the barns and ensure the barns that will be built in the future to be sufficient to provide the optimum welfare for the cattle. In this way, a more profitable cattle farming may be achieved for the breeders of the county.

Statement of Conflict of Interest

Authors have declared no conflict of interest.

Author's Contributions

Authors declares the contribution of the authors is equal.

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