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RESEARCH ARTICLE

Effects of COVID-19 Pandemic Period on Sheep Breeding

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ABSTRACT

The COVID-19 outbreak experienced worldwide has affected all production areas as well as livestock breeding. This study was aimed at determining the situation of sheep breeders in Ordu province during the COVID-19 outbreak and offering solution suggestions. In the study, data were collected through face-to-face interviews with 72 enterprises registered with the breeding sheep and goat breeders' association in Ordu province in 2023. In the study, it was determined that the breeders were negatively affected by the increase in feed prices (33.3%) during this period. Breeders' reasons for production (88.9%), land use (97.2%), and flock size (88.9%) were unaffected by the epidemic. It was noted that the weaning age of lambs did not change (97.2%) during the epidemic period. The pasture emergence period was not negatively affected during the epidemic period (94.4%). Breeders generally stated that they were not affected by the epidemic period in the use of roughage (84.7%), concentrate feed (83.3%), or vaccination practices (93.1%). Most of the breeders (94.4%) reported that their expectations from animal husbandry did not change after the pandemic period. After the pandemic, it was found that shepherds, fodder support, pasture improvement and health insurance support were more expected (94.4%). Breeders had problems finding a shepherd. In addition, health problems and quarantine practices affected the use of the labor force. Consequently, in order to ensure sustainable sheep production, the expectations and problems of local breeders should be taken into consideration and deficiencies should be eliminated.

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1. Introduction

Economic, social, and biological factors experienced worldwide affect the lives of living things. Climate change and epidemics are seen as a significant threat to the sustainability of many species, ecosystems, and livestock production systems around the world (Tüfekci & Tozlu Çelik, 2021). The COVID-19 outbreak of the novel coronavirus (SARS-CoV-2), which has caused a global pandemic in the world, has negatively affected human health since December 2019. It showed its effects as a socio-economic crisis on 11 March 2020. The quarantine and health problems implemented during this period caused all sectors to be negatively affected. Restriction of animal movements, shortage of shepherds, disruption of breeding activities, and veterinary practices led to a decrease in animal production. Animal welfare was also negatively affected during this period (Guan et al., 2020; Hashem et al., 2020; Vidaurreta et al., 2020). As in many other sectors worldwide, global livestock supply chains experienced a significant disruption due to the emergence of COVID-19 in early 2020 (Hashem et al., 2020; Vidaurreta et al., 2020; Almadani et al., 2022). The COVID-19 pandemic has affected many sectors such as the agricultural, feed, and food industries. Among the main impacts experienced by the agricultural sector, disruptions and delays in breeding activities in both animal and plant production due to the quarantine and restrictions imposed have caused producers to remain below their optimum production levels and thus reduced the income obtained. In

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addition, difficulties in the marketing of agricultural products, the decline in people's purchasing power, and the reduced ability of households to access affordable food have also affected the economic resilience of farmers and breeders (Faturokhman et al., 2022). Within livestock breeding, especially cattle, sheep, and goat breeding, marketing problems were undergone during the COVID-19 outbreak, which led to decrease in farmers' incomes. Although there was a decrease in purchasing power, data showed that the demand for processed livestock products during the pandemic period increased 3-4 times compared to the pre-pandemic period. This is due to a shift in consumer preferences for products with health and food safety quality standards, which points to a great opportunity for increased sales of products for beef cattle, sheep, and goats (Faturokhman et al., 2022). Food supply is a linear system in which one stage is fed by the other. It also includes many interconnected organizations, individuals, and businesses that make up this system and shape its functioning. The vulnerability of food supply and the need for transformative change are influenced by numerous shocks and stressors affecting food supply chains, such as climate change and the recent COVID-19 pandemic (Thornton et al., 2014; Garnett et al., 2020; Payne-Gifford et al., 2022; Bozma et al., 2023). Limited access to veterinary services and treatments has restricted the monitoring of animal health, resulting in a negative impact on animal welfare. This has posed risks for the spread of infectious animal diseases, human health, and food safety (Hashem et al., 2020; Mtimet et al., 2021). Problems with the supply chain have led to an increase in meat prices (Almadani et al., 2022). A study conducted in Australia reported that animal welfare is a shared responsibility during the COVID-19 pandemic and that a multi-sectoral approach to animal welfare during the crisis is therefore required (Baptista et al., 2021). It has become imperative to develop effective methods and technologies to protect animal health, human health, and food safety (Haque et al., 2021). To protect animal welfare during crises, nations should consider: national risk assessment, open communication channels, emergency plans for animal welfare, crisis response groups, and support systems for animal care providers. It is important to inform other countries to ensure that animal welfare is not jeopardized during unforeseen events (Baptista et al., 2021). The effects of global warming and the COVID-19 pandemic are dual challenges affecting high-quality livestock development (Hao et al., 2023). Challenges such as labor shortages have also emerged (Meuwissen et al., 2021).

Sheep and goat breeding is an effective animal husbandry activity that provides income in areas where active agricultural production cannot be carried out and prevents migration to cities. Pasture areas, natural vegetation, geographical characteristics, and the cultural and socio-economic structure of Türkiye are very suitable for sheep breeding. Both in the world and in Türkiye, small ruminant livestock is the most important form of utilization of land where crop production cannot be carried out (Akçapınar, 2000). The Black Sea Region has a suitable structure for sheep breeding due to its mountainous, hilly land structure, climate, and socio-economic structure. The lack of sufficient land in the region, especially the presence of stony, sloping, and hilly lands, allows sheep and goat breeding as alternative animal husbandry. Sheep breeding is a part of the Black Sea ecology. It is an important animal husbandry activity for the region and Ordu province in terms of providing income during every period of the year (Tozlu Çelik, 2016). The rugged and inadequate land in the region severely limits the opportunities for the people living here to engage in different agricultural activities. For this reason, sheep breeding constitutes an important source of income for the people of this region in terms of having the potential to provide income continuously throughout the year and utilizing inefficient lands (Tozlu Çelik, 2016; Alkan & Türkmen, 2021). In this study, it was aimed at determining the effect of the COVID-19 outbreak on sheep breeders in Ordu province and making recommendations.

2. Materials and Methods

The Ordu province is the third-largest city in the Eastern Black Sea Region of the Black Sea Region. The provincial territory lies between 40°18' and 41°08' north latitudes and 36°52' and 38°12' east longitudes. The surface area of the province is 5.952 km^2. It has a topographically rugged and mountainous region, is dominated by the Black Sea climate. Hazelnut orchards dominate the province from the coastline up to an altitude of 1000 meters, and there are also various field lands and forests. There are pastures and plateaus in areas above 1000 meters. It is reported that the pasture potential of Aybastı, Gölköy, Kabadüz, Korgan, Kumru, and Mesudiye districts is suitable for the development of cattle and sheep breeding (T.C. Tarım ve Orman Bakanlığı, 2014).

Permission to conduct the study was obtained with the decision of the Ordu University Social Sciences and Humanities Research Ethics Committee dated March 2, 2023, and numbered 2023-36. For this study, data were collected by a face-to-face survey method in 2023 with 72 enterprises out of 1729 enterprises that are members of the Ordu Province Breeding Sheep and Goat Breeding Association (T.C. Tarım ve Orman Bakanlığı, 2023). In similar survey studies, it was reported that at least 3% (Yamane, 2010) or 10% (Sümbüloğlu & Sümbüloğlu, 2000) of the population would be sufficient to determine the sample size. In this study, data were collected from sheep breeders by face-to-face survey study survey using simple random sampling method. The evaluation of the obtained data was analyzed with the SPSS (26.0 Version) statistical program for analyze, descriptive statistics, and frequencies (SPSS, 2016). The results of the data collected within the research framework are presented as percentages and frequencies.

3. Results and Discussion

3.1. Socio-Economic Status of Breeders

The livestock sector in Türkiye is one of the sectors most affected by global climate change due to the predominance of rural economic structures and developing livestock-based industries. Health and welfare in animal production are integral parts of environmental sustainability (Tüfekci & Tozlu Çelik, 2021). Since sheep production in Türkiye is predominantly small-scale and pasture-based, the animal products obtained constitute the main food source for agricultural enterprises, and accordingly, the income from sheep production is generally at low levels (Şen et al., 2023).

The data on the socio-economic status of sheep breeders in the study are given in Table 1. According to the findings obtained, it was determined that 48.6% of the sheep breeders lived in the village, 44.4% in the district, and 7% in the province, and the majority of the sheep breeders were males (94.4%), and most of the respondents were in the middle age group of 41-60 years old (54.2%). The number of breeders with 1-4 households was 63.9%, and nuclear family structures constituted the majority. The level of education of the breeders with at least a primary school education was found to be 97.2%. Those who make a living only by farming are 80.5%, and the majority (90.3%) are property owners and nomadic sheep breeding is practiced in Ordu province.

In another study conducted in Ordu province, 59.21% of the 76 farmers surveyed were primary school graduates, 14.47% were secondary school graduates, 22.36% were high school graduates, and 3.95% were undergraduate graduates (Ateş & Çam, 2022). It was reported that the level of education did not make a difference in production, management, or additional business ventures ($p = 0.139$). In the same study, the level of education, experience, age, and moonlighting status of the breeders did not affect flock size, the number of lambs obtained per ewe, lamb survival, and enterprise management in sheep enterprises. It was reported that sheep breeders in Ordu province mostly carry out hazelnut production and animal production together, and some breeders participate in production with a small number of animals as a hobby because they cannot break away from their traditions (Ateş & Çam, 2022). It has been reported that there are very few female flock owners among the breeders; the average age of the flock owners is around 49, and the young generations are not very keen on sheep breeding (Ateş & Çam, 2022). In the study conducted to determine the effects of the COVID-19 pandemic on agricultural food production and farmers in Konya, the average age of agricultural workers was 53.95, and 91.3% of them were male. Of the respondents, 55.3% were primary school graduates; 68.7% had an income above their expenses; 72.0% had a nuclear family; 55.3% were engaged in dry farming; 90% were breeders; and 72.7% worked mainly in the summer months. As a result of the study, it was reported that 88% of those working in the agricultural sector were concerned about harvesting and sales and that these concerns were mostly (35.6%) due to price instability (Uğur & Buruklar, 2022). In our country, factors such as the low level of education and income of ovine breeders in general and breeding by very small family enterprises with production techniques that continue from father to son cause problems in the input supply of enterprises and the marketing of products (Sarıca et al., 2004; Ceyhan et al., 2015a, 2015b; Kandemir et al., 2015). The education, age, and gender findings obtained in the study were found to be similar to those reported in the literature (Ateş & Çam, 2022; Uğur & Buruklar, 2022).

Table 1. Data on socio-economic status of sheep breeders.

Residence	**n**	**%**	**Age**	**n**	**%**
Province	5	7.0	19-40 years	24	33.3
District	32	44.4	41-60 years	39	54.2
Village	35	48.6	Age 61 and over	9	12.5
Gender			**Occupation**		
Female	4	5.6	Farmer	58	80.5
Male	68	94.4	Public-private sector	14	19.5
Education			**Household**		
Illiterate	2	2.8	1-4 persons	46	63.9
Primary education and above	70	97.2	5-7 people and above	26	36.1
Cultivation Type			**Ownership Status**		
Nomad	72	100.0	Owner	65	90.3
			Tenant-partner	7	9.7

3.2. Breed of Sheep and Flock Size

The most common sheep breed in Ordu province is the Karayaka breed. It is important for animal breeders to carry out studies on the pure breeding of the Karayaka breed and increasing its productivity in the province. The Karayaka breed has varieties with different live weights depending on care and feeding. In Ordu province, it has been observed that there are Karayaka sheep reaching 40-45 kg live weight towards the coast and 30 kg live weight in high areas. It is estimated that this situation might be due to care and feeding. Karayaka sheep breed ranks second after Kıvırcık breed in terms of meat quality in Türkiye (Tozlu Çelik, 2016).

Data on sheep breeding practices are given in Table 2. The majority (84.7%) of the breeders stated that they do this work as the only source of livelihood, and 83.3% of them stated that they want to continue animal husbandry in the future. While more than half (51.4%) of the breeders stated that the purpose of production was to produce breeding, 31.9% for butchering, and 16.7% for sacrificial animals, 70.8% stated that they provided additional feeding to animals in certain periods. While 51.4% of the breeders reported that the breeding period of ewes was 6 years or more, 84.7% stated that the breeding period of rams was 1-4 years. In addition, 66.7% of the breeders stated that they used shepherds and had difficulty finding a shepherd.

Table 2. Data on some breeding practices in enterprises-1.

Reason for Keeping Livestock	**n**	**%**	**How Many Years Have You Been Keeping Livestock?**	**n**	**%**
Sole source of income	61	84.7	1-20 years	37	51.4
Additional source of income	11	15.3	More than 20 years	35	48.6
Purpose of Production			**Future Livestock Production Status**		
Butchery	23	31.9	Yes	60	83.3
Sacrifice	12	16.7	No	12	16.7
Breeding	37	51.4			
			Duration of Use of Females in Breeding		
Shepherd Status			1-5 years	35	48.6
Yes	48	66.7	More than 6 years	37	51.4
No	24	33.3			
			Duration of Use of Rams in Breeding		
Supplementary Feeding			1-4 years	61	84.7
Yes	51	70.8	More than 5 years	11	15.3
No	21	29.2			

3.3. Breeding Practices

When Table 3 is analyzed, it is seen that 87.5% of the breeders have a herd size of 50–200 heads, and 12.5% have a herd size of 200 heads or more. The weaning age of lambs is mostly 3-6 months (79.2%). It was determined that health controls were generally carried out by public veterinarians (70.8%). It was observed that vaccinations were performed by veterinarians. In 48.6% of the enterprises, it was determined that the breeder could also vaccinate himself and animal losses were higher (63.9%) in the winter months when cold temperatures were experienced. Improvement of pen conditions and care and feeding in winter conditions can prevent, especially the loss of offspring.

Ateş and Çam (2022) reported in their study in Ordu province that 59.27% of the enterprises had less than 100 heads of sheep, and the average number of animals per enterprise was 102 heads. As a result of the study, it was recommended that those with less than 100 sheep per enterprise should be encouraged to increase the number of animals, and the problem of finding a shepherd should be solved in order to reach a more profitable, innovative, and sustainable situation for sheep farming enterprises in Ordu province.

Sheep breeding in Ordu province is generally carried out in rural areas with small flocks in the family enterprise style. In the breeding studies to be carried out in order to increase sheep yields, it is necessary to determine the current potential of the animals and to decide which breeding programs will be applied. For this reason, the records kept in the enterprises of the breeders are of great importance (Tozlu Çelik, 2016). In addition to the existing subsidies, it is important to promote sheep products and to provide subsidies to producers for the processing and marketing of the products obtained at a good price. In addition to the old animal shelters, the lack of knowledge of shepherds on issues such as herd management and animal diseases causes animal losses. The most important problem in sheep breeding enterprises is labor and feed expenses. In addition to these problems, the fact that the owners do not have sufficient knowledge about lamb growth and fattening and that they generally provide breeding from within the enterprise is among the general breeding problems (Ceyhan et al., 2015a, 2015b).

Table 3. Data on some breeding practices in enterprises-2

Herd Size	**n**	**%**	**Vaccination Status**	**n**	**%**
50-200	63	87.5	Yes	63	87.5
250 and above	9	12.5	No	9	12.5
Lamb Weaning Age			**Vaccination Person Vaccinated**		
2 months	11	15.3	Veterinarian	37	51.4
3-6 months	57	79.2	Breeder	35	48.6
More than 6 months	4	5.5	**Mother's Milk Intake in The First Week**		
			Yes	72	100.0
Health Control			**Season with High Animal Losses**		
Public veterinarian	51	70.8	Spring	26	36.1
Private veterinarian	21	29.2	Winter	46	63.9

3.4. Effects of COVID-19 Pandemic Period on Sheep Farming Enterprises

In the study, the data obtained from the questionnaire conducted to determine the impact of sheep breeders during the COVID-19 pandemic period are given in Table 4. In the study, it was stated that the breeders were negatively affected by the increase in feed prices (33.3%) during the epidemic period. The finding of increased feed costs in this study is similar to that reported by Mtimet et al. (2021). Breeders' reasons for production (88.9%), land use (97.2%), and flock size (88.9%) were not affected by the pandemic. The weaning age of lambs did not change (97.2%) during the pandemic and the period of pasture emergence was not negatively affected (94.4%). Breeders generally highlighted that they were not influenced by the epidemic period in the use of roughage (84.7%), concentrate feed (83.3%), or vaccination practices (93.1%). Most of the breeders (94.4%) reported that their expectations from animal husbandry did not change after the pandemic period. After the pandemic, it was determined that the expectations of shepherds, feed support, improvement of pastures, and health insurance support were higher (94.4%). Breeders had problems finding shepherds. Health problems and quarantine practices affected the use of the labor force. In general, 52.8% of sheep breeders in Ordu province stated that they were not affected by the COVID-19 outbreak. This finding was similar to that reported by Uğur and Buruklar (2022).

During the epidemic period, national and international restrictions on health control practices and budgetary constraints caused problems in the detection and control of animal diseases. During the COVID-19 pandemic, many logistics systems, such as livestock production systems and their supply chains, faced supply disruptions. In particular, there was a problem of access to agricultural inputs (such as animal equipment, vaccines, etc.) (Hashem et al., 2020). Studies have reported that the sales of farmers' crops and livestock products were adversely affected primarily due to quarantine practices during the COVID-19 outbreak (Jaacks et al., 2021). COVID-19 caused a decrease in the labor force during the pandemic period. Especially the problem of finding shepherds became more prominent during this period (Hashem et al., 2020; Uğur & Buruklar, 2022). The problem of difficulty in finding a shepherd in this study is similar to the ones reported in the literature (Biswal et al., 2020; Hashem et al., 2020; Uğur & Buruklar, 2022).

Due to the land and crop production structure of Ordu province, the fact that ovine breeding enterprises are small, widespread, and dispersed in the form of enterprises prevents the breeders from reaching the desired income in the marketing of the products. In addition to this, the fact that ovine breeders do not act together in the marketing stage of the products they obtain and the operating expenses of the ovine breeders cause many intermediaries between sellers and buyers, and this situation leads to economic problems. The fact that almost all of the available land is hazelnut, untimely, excessive, and irregular grazing of meadow and pasture areas, problems related to the supply of roughage, the problem of finding a shepherd, the lack of milk collection, and cold chain facilities in enterprises can be counted as general breeding problems (Tozlu Çelik, 2016).

During the pandemic period, restrictive measures did not have any impact on the parameters of sheep farming systems. In some studies, it was reported that the outbreak period negatively affected only the daily working routine of the breeders in enterprises with high sheep numbers (Yiakoulaki et al., 2022), while there are studies reporting problems in the raw material supply chain, finding laborers, and marketing of products (Biswal et al., 2020). In this study, the finding of not being affected by the COVID-19 outbreak as a general condition is similar to that reported by Yiakoulaki et al. (2022).

Table 4. Data reflecting the affected status of sheep breeders from COVID-19 pandemic period

Affected by COVID-19	**n**	**%**	**Herd Size Affected?**	**n**	**%**
Not affected	38	52.8	Not affected	64	88.9
Encouraged to keep livestock	3	4.2	Affected	8	11.1
Existing conditions became more difficult	7	9.7	**Was Pasture Access Affected?**		
Feed cost increased	24	33.3	Not affected	68	94.4
			Affected	4	5.6
Reason for Production Has It Been Affected?			**Has The Use of Roughage Been Affected?**		
Not affected	64	88.9	Not affected	61	84.7
Affected	8	11.1	Affected	11	15.3
Was Land Use Affected?			**Has The Use of Concentrated Feed Been Affected?**		
Not affected	70	97.2	Not affected	60	83.3
Affected	2	2.8	Affected	12	16.7
Did It Affect Weaning Age?			**Vaccination Affected?**		
Not affected	70	97.2	Not affected	67	93.1
Affected	2	2.8	Affected	5	6.9
Expectation After The Pandemic			**Has The Expectation Changed After The Pandemic?**		
Shepherd support	2	2.8	Yes	4	5.6
Feed support	2	2.8	No	68	94.4
Shepherd, feed, pasture improvement and health insurance support	68	94.4			

In a study conducted in Niğde province, it was aimed to examine the structural characteristics and biosecurity practices of sheep farms. As a result of the study, it was recommended to train breeders and implement strategic programs against diseases and other factors affecting production on sheep farms. In the same study, it was reported that the preparation of strategic programs for hygiene practices in sheep breeding against possible diseases may be an important support for future epidemic disease periods (Şen et al., 2023).

In a study conducted in Türkiye, it was reported that some of the negative effects on meat prices were compensated as a result of live animal imports to reduce the effects of uncertainty due to the COVID-19 outbreak. In order to secure access to lamb meat during the pandemic period, it has been suggested to improve price stability, support it through tax exemptions, carry out live animal sales through the live animal exchange, and establish digital sales channels (Mikail & Kaplan, 2021; Bozma et al., 2023).

4. Conclusion

The results of the study showed that flock size, pasture access, roughage, and concentrate feed use were not affected during the COVID-19 period in sheep breeding enterprises in Ordu province. During this epidemic period, it was reported by the breeders that the cost of feed increased and it was difficult to find a shepherd. It was determined that sheep breeders demanded especially feed, shepherd, pasture improvement, and health insurance support after the epidemic.

As a result, it is important to complete the deficiencies by taking into account the problems experienced during the COVID-19 epidemic period in order not to disrupt production and to ensure food safety. Taking precautions not only for the pandemic but also for changing climatic conditions is necessary for sustainable sheep breeding. Strategic plans should be made and more studies should be carried out so that sheep breeding is not adversely affected by epidemics and climatic changes. There is a need for self-sufficient animal food production planning at the national level.

Compliance with Ethical Standards

Ethics committee permission for this study was received by the decision of Ordu University Social and Human Sciences Board dated March 2, 2023 and numbered 2023-36.

Conflict of Interest

The authors declare that they have no conflict of interest.

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