



A study on the effects of Covid-19 pandemic period on sheep and goat husbandry

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[Um estudo sobre os efeitos do período pandêmico da Covid-19 na criação de ovinos e caprinos]

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ABSTRACT

This study had the objective of the effects of the COVID-19 pandemic period on sheep and goat husbandry enterprises. In the study, the effects of the COVID-19 pandemic period on the land use of the enterprises, the status of continuing animal husbandry activities, the purpose of production, the characteristics of combining crop production and animal production, the number of animals in the enterprise and the status of the shepherd, the exit of animals to pasture, the supply and use of roughage and concentrate feed, and supplementary feedings were found to be significant. In addition to the uncertainties experienced, breeders were negatively affected by the quarantine and restriction processes applied in this process. They were particularly negatively affected by the problems encountered in the use of pastures and disruptions in the supply of feed, restrictions on animal movements, closure of livestock markets, disruptions in access to veterinary services and vaccine supply, social distancing, travel bans, restrictions on the import-export of products, rapid changes in the price policies of products and increased costs. As a result, it is seen that the COVID-19 pandemic period had a significant impact on sheep and goat breeding enterprises.

Keywords: sheep, goat, COVID-19, production, structural characteristic

RESUMO

Este estudo teve o objetivo de revelar os efeitos do período pandêmico da COVID-19 nas empresas de criação de ovinos e caprinos. No estudo, os efeitos do período pandêmico da COVID-19 sobre o uso da terra nas empresas, o status das atividades contínuas de criação de animais, a finalidade da produção, as características da combinação da produção agrícola e da produção animal, o número de animais na empresa e o status do pastor, a saída dos animais para o pasto, o fornecimento e o uso de ração bruta e concentrada e as alimentações suplementares foram considerados significativos. Além das incertezas vivenciadas, os criadores foram afetados negativamente pelos processos de quarentena e restrição aplicados nesse processo. Eles foram particularmente afetados negativamente pelos problemas encontrados no uso de pastagens e interrupções no fornecimento de ração, restrições à movimentação de animais, fechamento de mercados de gado, interrupções no acesso a serviços veterinários e fornecimento de vacinas, distanciamento social, proibições de viagens, restrições à importação e exportação de produtos, mudanças rápidas nas políticas de preços dos produtos e aumento dos custos. Como resultado, observa-se que o período pandêmico da COVID-19 teve um impacto significativo nas empresas de criação de ovinos e caprinos.

Palavras-chave: ovinos, caprinos, COVID-19, produção, característica estrutural

INTRODUCTION

Sheep and goats are an important source of meat, milk, leather, and fiber and this sector is important worldwide (Berihulay *et al.*, 2019). The products obtained can be transformed into high-value-added products in enterprises. In addition to meeting the need for animal protein in global food security and healthy nutrition, sheep and goat breeding has an important place

for the utilization of areas that are not suitable for agricultural production and for the livelihood of low-income families, especially in rural areas.

Although sheep and goats are often assumed to be similar in terms of management and nutritional requirements, they have some differences such as chromosome numbers, different behaviors and different management, nutritional and physiological requirements. Sheep and goats complement each other's

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Submitted: February 15, 2024. Accepted: March 2, 2024.

grazing behavior because goats prefer woody plants, while sheep prefer herbaceous plants. Sheep prefer to graze in hilly areas and foothills, while goats prefer to roam high, rugged mountains in terms of their feeding habits compared to other ruminants. This behavioral difference should be considered for grazed pasture management, necessary housing, farm structure, and marginal activity (Mazinani *et al.*, 2019; Miller and Lu, 2019).

Sheep and goats can be referred to as the animals of the future given their widespread availability, diversity, and ability to adapt to the most challenging climates in the world (Tüfekci and Tozlu Çelik, 2022). The number of sheep and goats in the world is 2,391,242,880 heads in total, of which 1,263,136,644 heads are sheep and 1,128,106,236 heads are goats. Available data show that sheep and goats have a share of 57.4% in ruminant animals (Food, 2022). The number of animals slaughtered for meat production from sheep and goats worldwide was realized as 1,085,616,534 heads. The amount of meat obtained from sheep in 2020 was 9,885,475 tons, while the amount of meat obtained from goats was 6,142,140 tons. The worldwide average sheep milk production is 10,618,551 tons and goat milk production is 20 629 610 tons. Looking at the amount of leather obtained from ovine animals, sheep leather production was 1,919,556 tons and goat leather production was 1,232,880 tons (Food, 2022).

The quantity and quality of products obtained from sheep and goats may vary depending on genetic structure and environmental impacts. Changes in environmental impacts can affect the quantity and quality of products, either positively or negatively. Apart from the current applicable environmental factors, there are also climate-related effects that cannot be controlled. Global warming causes the emergence of climatic impacts. These climatic effects include temperature, humidity, high winds, direct and indirect solar radiation. Animal health is expected to be negatively affected by increased temperatures and a greater number of pests and diseases. Mainly due to increases in rainfall and increased climate variability, there will be competition for the use of land and water resources for agricultural activities as they will also be used for animal production (Harle *et al.*, 2007). In recent years, we have started to have

many important topics, such as climate change, low carbon emissions, renewable energy, protection of natural resources, organic agriculture, biodiversity, sustainable production, employment, or economic outputs (Dilek and Yavuz, 2019). While all these developments are taking place, as of 2019, humanity has faced a brand-new situation called the COVID-19 pandemic process. There are different epidemics (Spanish flu, Asian flu, Hong Kong flu, swine flu, Ebola, etc.) that humanity has experienced from past to present, and these epidemics have had a great impact the economy, environment and many sectors (Türk *et al.*, 2020; Narin, 2021). In addition, as seen from the pandemics the world has experienced in the past, the panic and quarantine process has had a great impact on human activities and economic growth (Burgui, 2020). COVID-19 emerged in late 2019 from a new coronavirus variant, SARS-CoV-2 (Coronavirus..., 2020; Zhang, 2020; Vidaurreta *et al.*, 2020). This virus caused an unprecedented health and socioeconomic crises worldwide (Malik *et al.*, 2020; Rodriguez Morales *et al.*, 2020). In February 2020, the World Health Organization categorized the virus as high risk and a pandemic was declared in March of that year (Tiwari *et al.*, 2020). The ease of coronavirus transmission has led many countries around the world to adopt restrictive measures to control its spread (Rothan and Byrareddy, 2020). Some of these measures included quarantines, social distancing, travel bans, border controls and restrictions on the import-export of goods, suspension of many businesses and activities, and lockdowns of entire areas Coronavirus..., 2020). These measures have actively affected all sectors of the modern economy, including the livestock sector (COVID-19..., 2020; Hashem *et al.*, 2020; Grandin, 2021). The COVID-19 pandemic, which has affected the whole world, has affected millions of people. This pandemic, which has rapidly become the common, the biggest problem of humanity, has also brought uncertainties. It has been inevitable that COVID-19, which has had inevitable economic consequences, has also transformed the agricultural sector. During this transformation, it is necessary to develop a solution proposal by examining what the problems in the sheep and goat livestock sector are, what direction the change will be, what innovations it will bring and the possible effects of these innovations on agricultural employment. In this study, it is

aimed to reveal the effects of the COVID-19 pandemic period on sheep and goat breeding enterprises in Yozgat province is in the Central Anatolia Region of Türkiye.

MATERIAL AND METHODS

This study was carried out in the enterprises in Yozgat-center and in the districts where sheep and goat breeding is intensively carried out. Among these enterprises, 200 enterprises were selected as material. The main material of the study consists of the data obtained from face-to-face surveys conducted with farmers engaged in sheep and goat breeding in these enterprises between February 01, 2022, and April 15, 2022.

A stratified random sampling method was used to determine the number of enterprises within the scope of the study (Yamane, 2001). The data obtained were analyzed using the SPSS Statistical Package Program (IBM..., 2016). In determining the sample volume, 5% margin of error and 99% confidence limits were used (Erkuş *et al.*, 1996). The results obtained from the data obtained within the scope of the research were presented in percentages and frequencies. Likert Scale was used to evaluate the judgments of the breeders about the general characteristics of the enterprises, herd management practices, health protection practices, feeding and feed supply before and after the pandemic (Güriş and Astar, 2014). Cronbach's Alpha test (Merter and Vannatta, 2010) was applied to determine the reliability of this scale. The compatibility of the variables with normal distribution was determined by Kolmogorov-Smirnov test (Özdamar, 2004). It was determined that the variables did not show normal distribution and Mann-Whitney U test (Newbold, 1995) was applied to determine whether there was a difference between the two groups for continuous variables that did not show normal distribution.

RESULTS

The sociodemographic status of the breeders within the scope of the study and the general characteristics of the enterprises are given in Table 1. When the distribution of the breeders according to age are examined; it is seen that 13% in the age range of 20-30 years, 21.5% in the age range of 31-40 years, 24% in the age

range of 41-50 years, 23% in the age range of 51-60 years and 18% in the age range of 61 years and above. When the breeders are evaluated according to their educational status, it is seen that 43.5% are primary school graduates, 23.0% are middle school graduates, 19.5% are high school graduates and 7.5% are university graduates. When the general characteristics of the enterprises are examined; most of the breeders want to continue sheep and goat breeding in the future as well as using their own and state land, and the purpose of the breeder's production is to provide breeding-slaughtering-sacrificial animals. While the number of animals in more than half of the enterprises was 101-250 heads, it was determined that 28.5% of them were 251-500 heads. While 42.5% of the enterprises utilize a family labor force, 57.5% of them have a shepherd in addition to the family labor force. In addition, although crop and animal production are carried out together (73.5%), other livestock activity is also carried out (74.5%).

The effects of the COVID-19 pandemic period on the general characteristics of the enterprises are given in Table 2, Figure 1. The effect of the COVID-19 pandemic period on the land use status of sheep and goat breeders in Yozgat province was found to be significant ($P<0.05$). While 35% of the breeders reported that they could not take their animals to pasture due to the uncertainties experienced, especially during the pandemic period, they could take them to pasture late or they could not benefit from the pastures sufficiently, so the animals could not be fed sufficiently and they faced problems in renting the pastures; 65% reported that they were not negatively affected by the pandemic. The effect of the COVID-19 pandemic period on the continuation of livestock breeding activities of the breeders found to be significant ($P<0.05$). 28% of the breeders reported that treatment processes became more difficult and costs increased; 26% reported that marketing became more difficult; 15% reported that there was a lack of technical personnel in the field; 14% reported that the increase in feed prices made it more difficult to do this job economically; 7% reported that it encouraged them to do animal husbandry; 6% reported that it became challenging to do animal husbandry as a whole and 4% reported that animal diseases increased.

Table 1. Sociodemographic status of breeders and general characteristics of enterprises

Gender	n	%	Education status	n	%
Female	12	6.0	Illiterate	13	6.5
Male	188	94.0	Primary school	87	43.5
Age			Middle school	46	23.0
20-30	26	13.0	High school	39	19.5
31-40	43	21.5	University	15	7.5
41-50	48	24.0	Number of households		
51-60	47	23.5	2-3	18	9.0
61+	36	18.0	4	35	17.5
Professional experience (year)			5	53	26.5
0-10	33	16.5	6	71	35.5
11-20	65	32.5	7 +	23	11.5
21-30	33	16.5	Reason for livestock production		
31-40	27	13.5	Contribution to income	42	21.0
41 + years	42	21.0	Contribution to income-habit-sole source of income	158	79.0
Land ownership status			Herd size		
Self-government	172	86.0	50-100	22	11.0
Rent-government	20	10.0	101-250	115	57.5
Self-rent-government	8	4.0	251-500	57	28.5
Purpose of production			5001 +	6	3.0
Own need	34	17.0	Other animal husbandry activity		
Breeding-butcher-sacrificing	166	82.5	Yes	51	25.5
Shepherd status in the enterprise			No	149	74.5
Family workforce	85	42.5	Record keeping		
Shepherd-family workforce	115	57.5	Yes	62	31.0
Crop-animal production together			No	138	69.0
Yes	147	73.5	Continuing livestock activities		
No	53	26.5	I will continue	167	83.5
			I will not continue	33	16.5

Table 2. Effects of COVID-19 pandemic period on the general characteristics of enterprises

Characteristics Examined	Affected		Unaffected		P
	n	%	n	%	
Land use status	70	35.0	130	65.0	*
Continuation of animal husbandry activities	185	92.5	15	7.5	*
Purpose of production	80	40.0	120	60.0	*
Number of animals in the enterprise	99	49.5	101	50.5	*
Shepherd status in the enterprise	159	79.5	41	20.5	*
Combining crop production and animal production	181	90.5	19	9.5	*

*:P<0.05

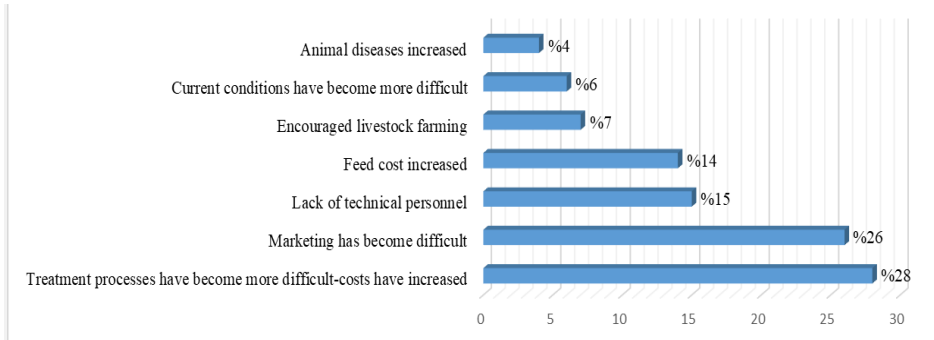
The effect of the COVID-19 pandemic period on the breeders' purpose of production was found to be significant (P<0.05). Breeders stated that during the pandemic period, they primarily used their enterprises to meet both their breeding animal needs and their own needs for animal products and that this situation was an advantage for them in the process. The effect of the

COVID-19 pandemic period on the number of animals and shepherd status in the enterprises was found to be significant (P<0.05). 46.0% of the breeders reported that they could not find a shepherd, 20% reported that they had housing problems for shepherds and 14% reported that shepherd costs increased. The effect of the COVID-19 pandemic period on the combination

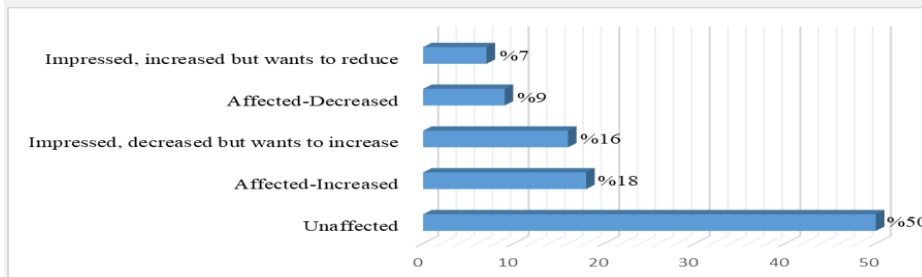
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of plant production and animal production was found to be significant ($P < 0.05$). The enterprises were negatively affected by the disruptions in the supply of rough and concentrate feeds used in

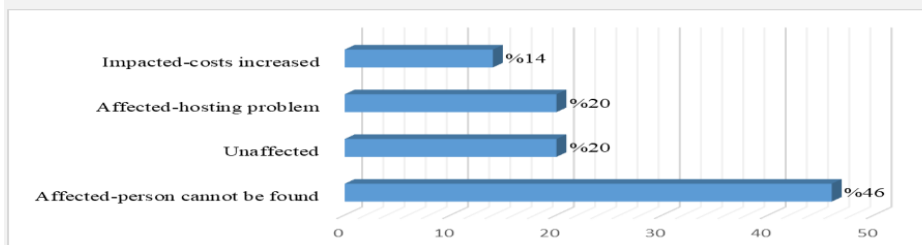
this process, the rapid changes, and fluctuations in the price policies of the products, and the quarantine and restriction processes that the breeders were exposed to in this process.



The impact of the COVID-19 pandemic period on the livestock activities of breeders



The effect of COVID-19 pandemic period on the number of animals in the enterprise



The effect of COVID-19 pandemic period on the shepherd situation in the enterprise

Figure 1. Effects of COVID-19 pandemic period on the removal of animals to pasture and supplementary feeding status

In sheep and goat breeding, animals can meet most of their feed requirements from natural grazing areas such as meadows and pastures. Therefore, adequate utilization of pastures by sheep and goat is an important issue in the economic production of livestock. Information on feeding and feed supply practices in the enterprises is given in Table 3. 81.5% of the breeders reported that they keep their animals in pasture for 8-10 months. It was reported that 55% of the breeders used hay, 26.5% alfalfa, 18.5% beet pulp and vetch as roughage sources,

77.5% barley and 20% factory feed as concentrate feed sources. 87.5% of the breeders reported that they give additional feeding to pregnant sheep-goats, lambs, and kids before vaccination. In addition, 91% of the breeders stated that they procure roughage and concentrate feed from their own and neighboring enterprises.

COVID-19 effects on feeding and feed supply in enterprises are given in Table 4, Figure 2. The effect of the COVID-19 outbreak period on

animals' access to pasture was found to be significant ($P<0.05$). In the enterprises, 11% of the breeders reported that they could not take their animals to pasture, 10% reported that they experienced delays or losses in renting pastures due to uncertainties, and 26% reported that their animals could not be fed adequately due to the inability to utilize the pastures sufficiently.

The effect of the COVID-19 pandemic period on roughage and concentrate feed utilization in the enterprises was found to be significant ($P<0.05$). Breeders reported that they focused on production in their own enterprises during this period and the use of roughage in the enterprise increased. In addition, 30% of the breeders reported that it became difficult to purchase with the increase in feed prices. The effect of the COVID-19 pandemic period on the supply of roughage and concentrate feed in the enterprises was found to be significant ($P<0.05$). The effect of the COVID-19 pandemic period on the status of supplementary feeding in sheep and goat breeding enterprises where the study was conducted was found to be significant ($P<0.05$). When Figure 2 is examined, 66% of the breeders reported that supplementary feeding practices increased in their enterprises because they could not benefit from natural resources sufficiently, while 19% reported that supplementary feeding practices decreased in their enterprises due to the financial difficulties they experienced in this process.

When the findings related to herd management practices in enterprises are analyzed in Table 5; 78.5 of the enterprises have Akkaraman sheep and Hair goat breeds; 21.5 of the enterprises have Kangal sheep and Hair goat breeds. Considering both the climatic conditions and meadow-pasture conditions in Yozgat province, most of the breeders of Akkaraman sheep and Hair goat breeds, which are also the most widely bred in our country, can be associated with the fact that our local breeds are satisfied with their productivity in extensive conditions and are very well adapted to the conditions of the region.

In the enterprises examined in the study, the average breeding period for sheep and goats was determined as 2-3 years for males and 3-5 years for females. Considering the way of providing breeding animals, most of the owners (78%) stated that they provided breeding animals from their own enterprises. The effect of the COVID-19 pandemic period on the supply of breeding animals from herd management practices in the enterprises was found to be significant ($P<0.05$). In the supply of breeding animals in the enterprises, 78% of the breeders reported that they were negatively affected by this process, especially due to the restriction of animal movements and the closure of livestock markets, while 22% reported that they were unaffected.

Table 3. Feeding and feed supply applications in enterprises

Pasture feeding duration (month)	n	%	Supplementary feeding status	n	%
6	37	18.5	Mating	45	22.5
8	112	56.0	Birth period	30	15.0
10	51	25.5	Lamb-kid	75	37.5
Types of roughage used			All	25	12.5
Straw	110	55.0	Doesn't do	25	12.5
Vetch	7	3.5	Supply of roughage in the enterprise		
Alfalfa	53	26.5	Own enterprise	126	63.0
Beet pulp	30	15.0	Peripheral enterprise	56	28.0
Types of concentrate feed used			Other	18	9.0
Compound feed	40	20	Supply of concentrate feed in the enterprise		
Barley	155	77.5	Own enterprise	39	19.5
Wheat	5	2.5	Peripheral enterprise	18	71.5
			Feed factory	143	9.0

Table 4. Effects of COVID-19 pandemic period on the feeding and feed supply in enterprises

Characteristics Examined	Affected		Unaffected		P *
	n	%	n	%	
Animals going out to pasture	94	47.0	106	53.0	*
Use of roughage in enterprises	100	50.0	100	50.0	*
Consumption of concentrate feed in enterprises	140	70.0	60	30.0	*
Roughage and concentrate feed supply	146	73.0	54	27.0	*
Additional feeding status	170	85.0	30	15.0	*

*:P<0.05

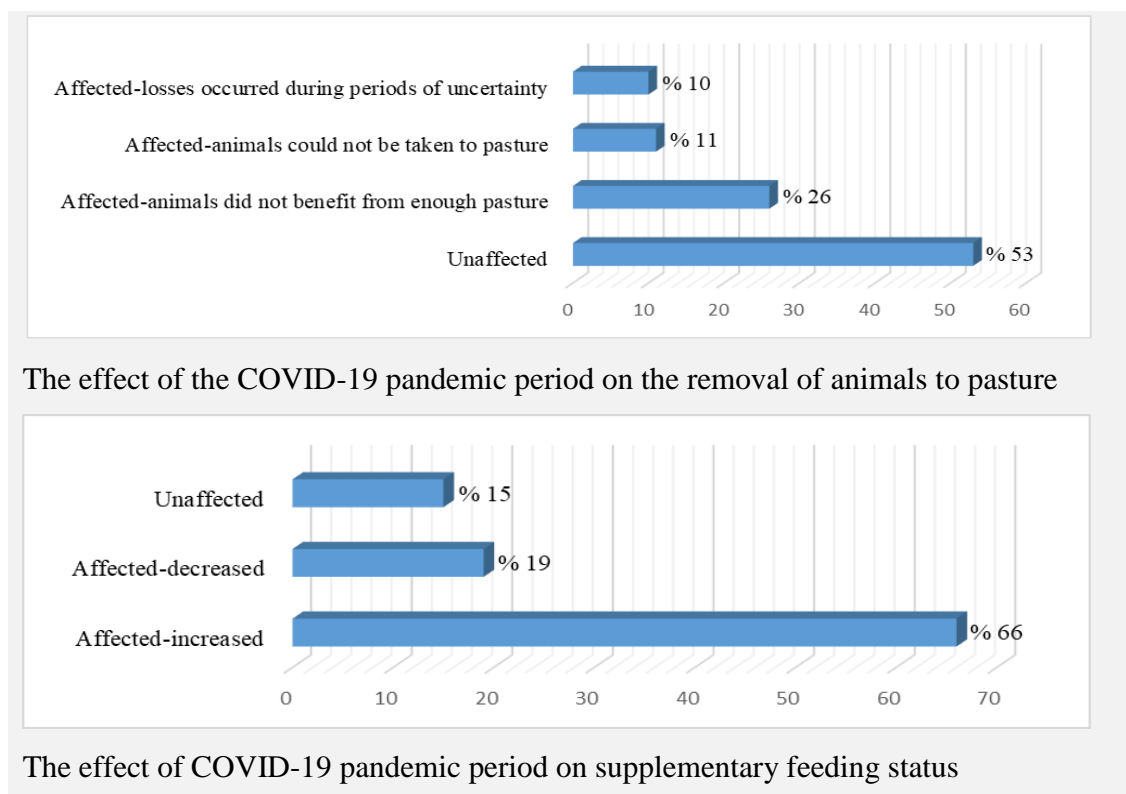


Figure 2. Effects of COVID-19 pandemic period on the removal of animals to pasture and supplementary feeding status.

When the health protection practices in the enterprises were examined; 83.0% of the breeders reported that they did not have regular health checks in their enterprises, 57.5% reported that they paid attention to vaccination practices, and 72.5% reported that they helped with vaccination practices together with the veterinarian. In 88.5% of the enterprises, it was reported that disinfection was carried out with liming or disinfectant material. It was reported that the most common diseases in the enterprises were parasitic diseases with 57.0%, followed by diarrhea with 26.5%, respiratory-oral diseases with 13.5% and Brucella disease with 3%.

The effects of the COVID-19 pandemic period on health protection practices in enterprises are given in Table 6, Figure 3. The effect of the COVID-19 pandemic period on the regular health checks of the sheep and goat breeders in the farms where the study was conducted was found to be significant (P<0.05). Percent 17 of the breeders reported that they were negatively affected due to the lack of experienced personnel and increase in wages during the pandemic period, while 83% reported that they were not affected. The effect of the COVID-19 pandemic period on vaccination in the enterprises was found to be significant (P<0.05). Percent 47.5 of the breeders reported that they were negatively

were affected due to the increases in vaccine prices and the problems encountered in the supply of vaccines. The effect of the COVID-19 pandemic period on disinfection practices in enterprises were found to be significant ($P<0.05$). During the pandemic period, 57% of the breeders reported that they paid more attention to disinfection practices in their enterprises and 43% reported that they were not affected. The effect of the COVID-19 pandemic period on the

diseases seen in the farms where the study was conducted found to be significant ($P<0.05$). When Figure 6 is examined, 42% of the breeders reported that the diseases seen in their enterprises increased during the pandemic period, while 27% reported that the diseases seen in their enterprises decreased during this period. On the other hand, 31% of the breeders reported that they were not affected by this process.

Table 5. Herd management and health protection practices in enterprises

Sheep-goat breeds	n	%	Age at first breeding female (month)	n	%
Akkaraman-Hair goat	157	78.5	12	134	67.0
Kangal- Hair goat	43	21.5	24	66	33.0
Breeding period female (year)			Age at first breeding male (month)		
2	30	15.0	12	57	28.5
3	71	35.5	24	110	55.0
4	41	20.5	36	33	16.5
5	48	24.0	Age at weaning (month)		
6	10	5.0	3	50	25.0
Breeding period male (year)			4-5	16	8.0
2	36	18.0	Does not separate	134	67.0
3	113	56.5	Milking status		
4	29	14.5	Yes	15	7.5
5	22	11.0	No	185	92.5
Breeding animal supply			Utilization of milk		
Own enterprises	156	78.0	Cheese-yoghurt	15	7.5
Livestock market	22	11.0	Lamb-kid	185	92.5
Other enterprises	15	7.5	Lactation duration (month)		
Government institutions	7	3.5	4	34	17.0
			5	166	83.0
Regular health checks			Disinfection application status		
Yes	34	17.0	Yes-disinfectant	45	22.5
No	166	83.0	Yes-liming	132	66.0
Vaccine status			No	23	11.5
Breeder-Veterinarian	145	72.5	Diseases seen in enterprises		
Veterinarian	55	27.5	Parasitic diseases	114	57.0
Vaccination			Respiratory tract-foot and mouth disease	27	13.5
Yes-on a program	115	57.5	Diarrhea	53	26.5
No	85	42.5	Brucella	6	3.0

Table 6. Effects of COVID-19 pandemic period on health protection practices in enterprises

Characteristics Examined	Affected		Unaffected		P *
	n	%	n	%	
Regular health checks in the enterprise	34	17.0	166	83.0	*
Vaccinations	95	47.5	105	52.5	*
Disinfection application in enterprises	113	56.5	87	43.5	*
Diseases seen in enterprises	138	60.0	62	31.0	*

*:P<0.05

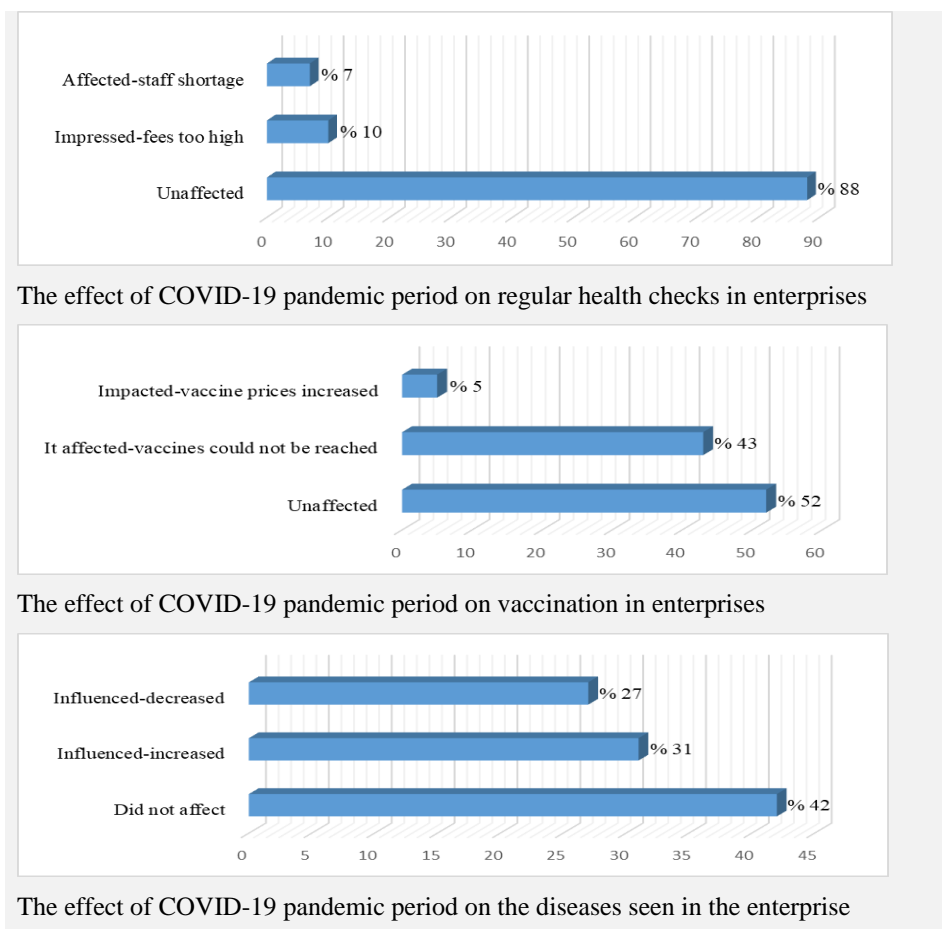


Figure 3. Effects of COVID-19 pandemic period on regular health checks, vaccination and diseases are seen in enterprises.

DISCUSSION

In the enterprises examined, it is seen that the owners are generally in the middle-age group and have a certain experience in sheep and goat breeding, as well as breeding as a long-term and important source of livelihood and as a family business. This situation is similar to the results of the sociodemographic status of sheep and goat breeders obtained in studies conducted in different regions and provinces of Türkiye (Bakır and Mikail, 2019; Demir and Tuncer, 2023; Köseman *et al.*, 2022; Kul *et al.*, 2022; Tamer and Sarıözkan, 2017). The labor force needed in animal husbandry practices in our country is generally provided by family members. The number in family members of most of the sheep and goat breeders in the study were determined as 5-6 people. The results obtained are similar to the results of different studies conducted in

different regions and provinces of our country (Acıbuca and Budak, 2021; Demir and Tuncer, 2023; Özsayın and Everest, 2019). It can be said that this situation is because sheep and goat breeding is a line of work in the rural population, as well as the need for family labor force due to the fact that the enterprises are small family businesses. In addition, when the situation of having a shepherd is examined, it is stated that 42.5% of the breeders use family labor force and 57.5% of them have a shepherd in addition to the family labor force. In addition, it was reported that women and children are actively involved in production in the enterprises. Sreekumar and Sreenivasaiah (2015) and Yiakoulaki *et al.* (2022) reported in their studies that small ruminant farming is practiced within the family of the breeders and most of the enterprises are family-type. For this reason, it was reported that most of the employees in the enterprises

consisted of family members of the breeder and that non-family employees were generally hired to meet the demands during peak periods (animal breeding, births).

Sheep and goats are animals that can make the best use of pasture and use pasture at all times of the year. In our country, sheep and goat breeding is mostly based on pasture and in most of our regions, most of the feed requirements of animals are met from natural grazing areas such as pastures and plateaus. Therefore, this situation is one of the most important economic advantages of sheep and goat breeding. In the study, when the effect of the COVID-19 pandemic period on the land use status of sheep and goat breeders was examined; 35% of the breeders reported that they could not take their animals to pasture due to the uncertainties experienced especially during the pandemic period, they could take them late or they could not benefit from the pastures sufficiently, so the animals could not be fed sufficiently and they faced problems in renting the pastures, while 65% reported that they were not affected by this process. When the effect of the COVID-19 pandemic period on the continuation of livestock breeding activities of the breeders is examined, the breeders stated that treatment processes became difficult and costs increased, marketing became difficult, there was a lack of technical personnel in the field, especially the increase in feed, which prices made it even more difficult to do this job economically, while 7% of the breeders reported that this situation encouraged them to do animal husbandry. Studies have reported that the pandemic and restrictive measures, increased stress or anxiety affects breeders directly and indirectly, but it is understandable due to uncertainty about their health and future, as well as the economic, political and social consequences of the pandemic (Hashem *et al.*, 2020; Parlapani *et al.*, 2020; Reile *et al.*, 2021). In a study by Yiakoulaki *et al.* (2022), 49% of the breeders stated that their daily work routines were negatively affected due to the pandemic and restrictive measures for more than one month. In addition, in the same study, 1.1% of the breeders reported that they considered the pandemic as a positive factor in terms of their professional activities.

Grazing time in pastures may vary according to the species of animals, grazing season, altitude of

the pasture, availability, and nutritional value of forages (Zarovali *et al.*, 2006). In previous studies, it has been reported that the daily grazing time of sheep and goats also varies (Evangelou *et al.*, 2014; Damalis, 2021). As a result of the study, while the effect of the COVID-19 pandemic period on the movement of animals to pasture was found to be significant, 47% of the breeders in the enterprises reported that they could not take their animals to pasture, that they experienced delays or losses in renting pastures due to the uncertainties experienced, and that their animals could not be fed adequately due to the inability to utilize the pastures sufficiently. Some studies have reported that quarantine and restriction processes during the pandemic caused restrictions on the movement of animals on pastures, difficulties in accessing animal feed, restrictions in the continuous feeding of livestock due to social distancing measures, and import-export restrictions of goods (Hashem *et al.*, 2020; Zhang, 2020). However, Yiakoulaki *et al.* (2022) reported that breeders did not face such barriers in their study. This result is in line with our study result that 53% of the breeders reported that they were not negatively affected by the pandemic process when their animals went out to pasture. While evaluating these differences, current practices in breeding systems should also be taken into consideration.

Livestock farming is an important component of the global food supply chain (Taylor *et al.*, 2020). The livestock sector is estimated to account for about 40% of the value of global agricultural production. Livestock play an important role in maintaining food security and meeting socio-economic needs in all different livestock systems (Hashem *et al.*, 2020). Gortázar and de la Fuente (2020) reported in their study that the COVID-19 pandemic could severely affect animal health as the sudden restriction on human activities and the subsequent economic crisis could affect farming and veterinary services. The prolonged duration of the economic crisis could jeopardize the overall capacity of regional, national, and international veterinary services, making the long-term effects of COVID-19 on animal health largely dependent on the impact of the crisis on farmers' livelihoods and the capacity of animal health services (Schwabenbauer, 2012; Woods, 2011). Hashem *et al.* (2020) reported that the

COVID-19 pandemic has negatively disrupted animal welfare-related activities. It was reported that sudden restrictions on the activities of farmers, workers and veterinarians led to inadequate implementation of daily routine agricultural work, limiting close monitoring of the care, requirements, and health status of the poultry, and thus preventing timely, accurate intervention to overcome increasing problems. In addition, labor shortages, strong decline in consumer purchasing power and intensification of health services have been reported as other factors that negatively affect the sustainability of the livestock sector. In our study; 17% of the breeders stated that they were negatively affected by the lack of experienced personnel and the increase in wages during the epidemic period due to regular health checks in the enterprise; 47.5% of the breeders reported that they were negatively affected by the increases in vaccine prices and the disruptions encountered in the supply of vaccines; 42% of the breeders reported that the diseases seen in their enterprises increased during the epidemic period, while 27% reported that the diseases seen in their enterprises decreased in this process; 57% of the breeders reported that they paid more attention to disinfection practices in their enterprises and increased during the epidemic period. Yiakoulaki *et al.* (2022) reported that the pandemic and restrictive measures can be expected to improve hygienic conditions on farms, but in their study, 7.4% of the breeders did not improve the hygiene rules on farms within the scope of public health protection.

The COVID-19 pandemic has disrupted the sustainability of livestock systems in different areas, from the production process to marketing and consumption of animal products. The main factor driving the logistical disruption of production was the lack of access to agricultural inputs such as animal feed resources, livestock movements for pasture and water, restrictions on seasonal border crossings with ruminant animals (transhumance), and animal equipment such as vaccines and other important production inputs (Food..., 2020; Hashem *et al.*, 2020; Zhang *et al.*, 2020). The restrictions imposed to cope with the health problems caused by the epidemic have significantly strained and negatively affected all economic sectors of the modern global economy. In particular, the livestock sector and related industries are among the most affected sectors.

This is mainly due to limitations of animal movement and reduced availability of production inputs (Hashem *et al.*, 2020). These restrictions have led to significant disruptions in the livestock supply chain, reducing the economic and productive efficiency of the livestock industry. It has been reported that during this period, global total meat production is expected to decrease (1.7%) due to animal diseases and market disruptions. Additionally, during this period, international meat prices fell by 8.6%, and the sharpest decrease was observed in small ruminants (Guidelines..., 2020; Food..., 2020).

CONCLUSION

As a result, the COVID-19 pandemic forced us to take some precautions in our country, as well as all over the world. These precautions included quarantine practices, restrictions on product supply, restrictions on animal movements, the closure of livestock markets, disruptions in vaccine supply, social distance, travel bans and restrictions on the import-export of products, and the suspension of many businesses and activities. These precautions have significantly affected the livestock sector, which is directly and indirectly linked to many sectors. In the face of these rapid changes that have occurred at the global level in recent years, the fact that the nutrition of the increasing world population and the accessibility of animal-based foods have been brought to the agenda once again, and that countries should attach importance to their existing resources in this sense. In addition to having a long-term cultural importance in the regions where sheep and goat breeding is carried out in our country, it also meets the needs and consumption of many families economically. In addition to the existing problems in sheep and goat breeding, which can be done in almost every region of our country, the disruptions brought by the COVID-19 pandemic period have also been added. Considering that the results of the changes will continue in the coming periods, it is necessary to improve sheep and goat breeding and provide remarkable and encouraging support for the future. Particular attention should be paid to providing social status to farmers who are or will be raising sheep and goats breeding and providing support in the marketing of the products obtained.

ACKNOWLEDGEMENTS

This study was undertaken as a summary of the first author's MSc thesis. The study was conducted with the permission of the Yozgat Bozok University Ethics Committee dated 24.06.2022 and numbered 34/08.

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