ŞIRNAK ÜNİVERSİTESİ FEN BİLİMLERİ DERGİSİ
SIRNAK UNIVERSITY JOURNAL OF SCIENCES

ISSN: 2667-7083
e-ISSN:2687-3796

Research Article

Relationships Between Weather Data and Birth of Norduz Goats*

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Recieved date: 27/01/2022
Accepted date: 15/06/2022

ABSTRACT

This study was planned to reveal the frequency of birth of Norduz goats, which are traditionally bred in semi-intensive conditions in the days when audible and inaudible weather events occur, and the importance of relevant weather data. For this purpose, data was obtained from total of 139 Norduz goats bred in 11 neighboring farms located at the same coordinate (38° 34' 8.634" N, 43° 15' 53.283" E) and altitude (1656 m) in the Van Province, Eastern Turkey. Data of the age of goat (AG), horn size of goat (HG), ear size of goat (EG) sex of kid (SK), type of birth (TB), date of birth (DB) and birth time (BT) were collected 2 times in 24-hour at the kidding season between 16th February and 7th April 2016.

The other hand, from the date of birth, 2 types weather reports of the General Directorate of Meteorology were collected. In this date range according to the 1st report, 9 different weather events were observed as 26.667% few clouds (FC); 23.333% very cloudy (VC); 13.333% rain mixed with snow (RMS) and sunny (SUN); 6.667% cloudy (C), partly cloudy (PC) and heavy rain (HR); 3.333% rainy (R) and snowy (SNW). In the light of the first of these data, the air events observed in this study were accepted as audible (RMS, HR, R, SNW) and inaudible (FC, VC, SUN, C, PC) weather events. Also, the highest number of birth (n = 29) took place in RMS weather on 7th day of the 52 days birth calendar. And 5 of these births were twins. From here it was attempted to interpret the effects of audible and inaudible weather events on the birth performance of goats. On the other hand, at the 2nd report, 7 different weather forecast (daytime (DT 6.57 ± 0.18 °C), night (NT -0.29 ± 0.24 °C), sensible (ST -0.28 ± 0.14 °C), humidity (H 17.59 ± 0.55 g/kg), sight distance (SD 10.60 ± 0.28 km), pressure (P 16.04 ± 0.22 Nm^{-2}) and dew point (DP 0.72 ± 0.14 °C) were obtained from the same source and were presented.

Keywords: Air events; Environment; Norduz goat; Weather forecast.

Norduz Keçilerinin Doğumu ile Hava Verileri Arasındaki İlişkiler

ÖZET

Bu çalışma, sesli ve sessiz hava olaylarının meydana geldiği günlerde yarı-entansif koşullarda geleneksel olarak yetiştirilen Norduz keçilerinin doğum sıklığı ve ilgili hava verilerinin önemini ortaya koymak amacıyla planlanmıştır. Bu amaçla, Türkiye'nin Doğusunda yer alan Van ilinde aynı koordinatta (38° 34' 8.634" N, 43° 15' 53.283" E) ve rakımda (1656 m) bulunan 11 komşu çiftlikte yetiştirilen toplam 139 Norduz keçiden veri elde edildi. Keçi yaşı (AG), keçi boynuz uzunluğu (HG), keçi kulak uzunluğu (EG), oğlak cinsiyeti (SK), doğum tipi (TB), doğum tarihi (DB) ve doğum zamanı (BT) verileri, 16 Şubat - 7 Nisan 2016 tarihleri arasındaki doğum sezonunda 24 saat içinde 2 kez toplanmıştır.

Öte yandan, doğum tarihinden itibaren Meteoroloji Genel Müdürlüğü'nün 2 tip hava durum raporu toplandı. 1. rapora göre bu tarih aralığında 9 farklı hava olayı gözlenmiştir: %26.667 az bulut (FC); %23.333 çok bulutlu (VC); %13.333 karla karışık yağmur(RMS) ve güneşli (GÜNEŞ); %6.667 bulutlu (C), parçalı bulutlu (PC) ve şiddetli yağmurlu (HR); %3.333 yağmurlu (R) ve karlı (SNW). Bu verilerden ilki ışığında, bu çalışmada gözlemlenen hava olayları duyulabilir (RMS, HR, R, SNW) ve duyulamaz (FC, VC, SUN, C, PC) hava olayları olarak kabul edilmiştir. Ayrıca, en yüksek doğum sayısı (n = 29) 52 günlük doğum takviminin 7. gününde RMS havasında gerçekleşmiştir. Ve bu doğumların 5'i ikizdi. Buradan duyulabilir ve duyulamayan hava olaylarının keçilerin doğum performansı üzerindeki etkileri yorumlanmaya çalışılmıştır. Öte yandan 2. raporda, 7 farklı hava tahmini (gündüz (DT 6.57 ± 0.18 °C), gece (NT -0.29 ± 0.24 °C), hissedilen (ST -0.28 ± 0.14 °C), nem (H 17.59 ± 0.0.00 g/kg), görüş mesafesi (SD 10,60 ± 0,28 km), basınç (P 16,04 ± 0,22 Nm^{-2}) ve çiy noktası (DP 0,72 ± 0,14 °C) verileri aynı kaynaktan elde edilmiş ve sunulmuştur.

Anahtar kelimeler: Hava olayları; Çevre; Norduz keçisi Hava tahmini.

1. INTRODUCTION

Sheep and goats respond to extreme weather conditions to the extend of their morphological, physiological, behavioral and largely genetic basis (Jose et al., 2016a). The organism struggles for the regular operation of this mechanism. The effects that this situation creates in the living organism are listed as follows. While the effects of stress are generally examined under 3 headings: Growth and production, Animal reproduction, Disease susceptibility. Said regulatory systems also creates stress indicators in 4 headings on animals: Behavioral changes, Hormonal indicators, Immunological markers, Genomic and proteomic markers (Manuja et al., 2012). When this regulation mechanism is insufficient for various reasons, an increased amount of response occurs due to stress. In fact, all this mechanism itself is a stress factor alone.

Other hand, temperature felt and perceived by living things is different from the actual temperature. Because, temperature is significantly affected by meteorological factors such as

thermometer temperature, relative humidity, wind and radiation. For this reason, it is recommended to use the humidity value and the temperature value together when calculating the felt temperature value (Anonymous, 2022a). The change in ambient temperature is referred to as the macro-environment. Farm animals are highly affected by this large and uncontrolled change. In addition, metabolic and behavioral events occur to compensate for changes in ambient temperature in animals. However, events that cannot be controlled and prevented by the animal can occur during extreme temperature changes.

As a matter of fact, high and low voice are the most widely known stress factors. Also, sudden noise causes pupillary dilation (Algers et al., 1978). Regularly rising, fluctuating and ongoing voice level is another important stress factor. This may be caused by natural events such as thunder and lightning strikes, or it may be human induced such as aircraft and helicopter noise, large machinery. Castelhano-Carlos and Baumans (2009) have reported that the effects of audible sound on animal productivity and behaviour depend on not only its intensity or loudness (dB), frequency (Hz), duration and vibration potential but also on the hearing ability of the animal species and breeds. Most studies of external sounds in animals are concerned with sound intensity (loudness) rather than frequency (pitch) (Delpietro, 1989; Weeks et al., 2009). And intermittent sounds are generally considered the most worrisome (Delpietro, 1989; Talling et al., 1998). Arehart and Ames (1972) reported that adrenal and pituitary weights of sheep exposed to noise decreased in their study. Also, depending on the age and physiological state of the animal, the exposure time of animals to stress is very important. Sound is periodic pressure changes that can be perceived by our ear in the atmosphere. Animals can detect low and high frequency sounds that exceed the hearing threshold of humans. The intensity of voice is called the strength and is measured in decibels (dB). Hearing range of cattle is 80-90 dB, this value is around 70 dB in sheep (Weeks et al., 2009) had been reported (Akkuşçi, 2021). The structural direction of the voice also determines the frequency that measured in Hertz (Hz) (Berglung et al., 1999). More waves generated from a source in a second increase the audible frequency. Sheeps have been reported to hear voices with frequencies between 125 Hz and 40 kHz. The other hand, hearing frequencies in goats ranged from 78 Hz to 37 kHz. And also, goats are with 78 Hz frequency sensitivity so this limit is approximately 18 kHz (1 octave) higher than humans (60 dB). The other hand, goats have a range of good sensitivity between 250 Hz and 16 kHz (Heffner and Heffner, 1990). In addition, goats are very sensitive to 7 kHz band frequency

sounds (Arehart and Ames, 1972). It had been stated that at 60 °F (15.56 ℃), the relative humidity drops from 80% to 20%, reducing the sound level of a listener ½ mile away from the noise source by 3 dB (at 1.000 Hz) (Anonymous, 2022b).

This study was carried out to calculate the frequency of birth of goats raised away from environmental sound factors in audible (RMS, HR, R, SNW) and inaudible (FC, VC, SUN, C, PC) weather events. For this purpose, various birth records of goats were noted in relation to these weather events and the results of macro-environmental factors (DT, NT, ST, H, SD, P, DP) were presented as support information. Thus, it was aimed to reveal the current condition of the birth times and weather conditions of Norduz goats.

2. MATERIALS AND METHODS

2.1 Settlement

The study was carried out at 1656 m above sea level and at 38° 34' 8.634" N, 43° 15' 53.283" E coordinates in Bardakci Village in Tusba district of Van Province. These animals were housed in the location where they would be least affected by weather events (Figure 1).

Figure 1. The position of the corral with goats

In order for wind, humidity and temperature to have an important, audible effect, sound receivers need to be well placed away from the source of noise (Anonymous, 2022b). Similarly, there were no structures in the vicinity at the height that would prevent the view of the sky and the movement of air for animals. Moreover, the farms where this study was carried out were 28.205 km away from the nearest airport as a bird's flight distance (Van Ferit Melen Airport; 38° 28' 3.59" N 43° 19' 33.60" E) (Figure 2).

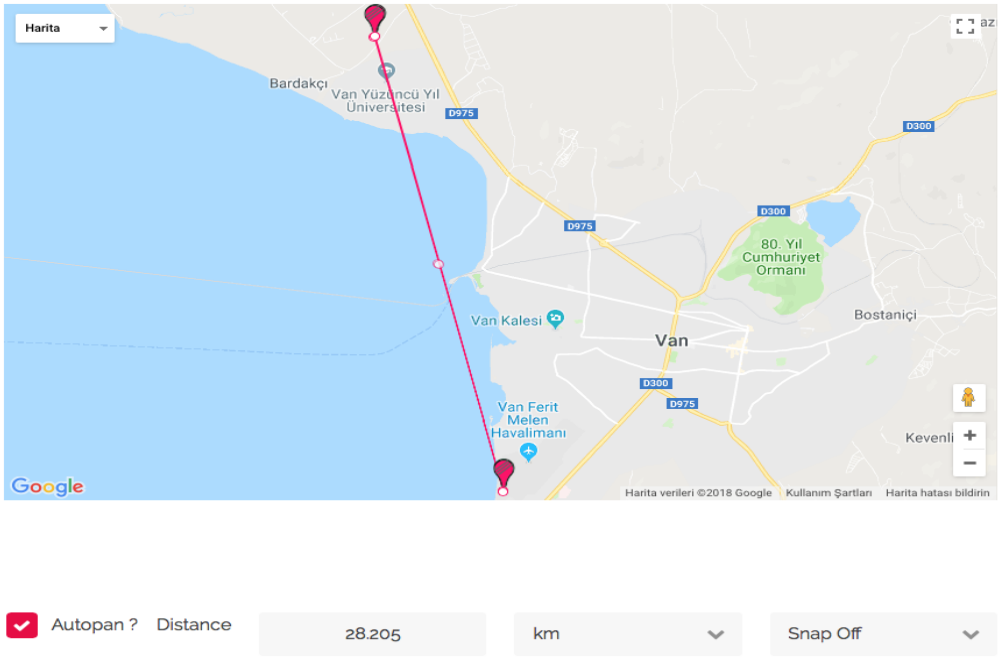

Figure 2. Air distance between the farms and nearest airport

2.2 Animal material and farm conditions

Animal material of the study was the 139 Norduz goats which 2,3,4 and 5 aged known to be pregnant. The birth numbers of all goats were confirmed with the account "age-1". Animals that had miscarriages in previous years were not included in the study.

During the grazing season, goats were grazed on pasture, and fed with ad libitum alfalfa straw each evening during the summer months. During the mating season, rams were added to the herd where all goats come together at the end of the summer months. Semi-intensive feeding during pregnancies was being done and the goats were fed with alfalfa hay or straw in winter and some concentrated mixtures in the last days of pregnancy in late winter. These animals completed the pregnancy period under similar conditions of care and feeding on 11 neighboring, farms surrounded by small houses with single or two floors that owned by farm owners only.

Goats were being traditionally bred with sheep on each of the farms. More living space (>2 m^2 for per animal) than necessary (Anonymous, 2021) were for each animal in farms.

2.3 Birth data

Data of 161 kids born from 139 Norduz goats data was gained between 16th February to 7th April 2016. In the period of kidding, birth data were collected in two times a day (morning and evening). Thus, data of birth date (BD), birth time (BT), type of birth (TB: Single, Twin), sex of kids (SK: Female, Male), age of goat (AG: 2,3,4,5), horn size of goat (HG:Hornless, Short-horned, Long-horned) and ear size of goat (EG:Earless, Short-eared, Long-eared) were received and coded (Demir, 2016).

2.4 Meteorological data

From 16th February 2016, when the births started, the weather reports of Tuşba district of Van were regularly collected from the official web page of the General Directorate of Meteorology (Anonymous, 2016c, Demir 2016). According to the reports, 9 different weather events were observed as few clouds (FC), very cloudy (VC), rain mixed with snow (RMS), sunny (SUN), cloudy (C), partly cloudy (PC), heavy rain (HR), rainy (R) and snowy (SNW). In addition to these, data of temperature (daytime (DT), night (NT), sensible (ST)), humidity (H), sight distance (SD), pressure (P) and dew point (DP) were obtained from the same source. After then, the relationship between weather forecast (DT, NT, ST, H, SD, P, DP) and birth data were analyzed. (Koser Eliçin, 2008).

2.5 Statistical method

Data were analyzed using SPSS statistics program. Because of Duncan's multiple-range test is most suitable procedure that can be used, it was used at $P<0.05$ significant level. As a result of the analysis, all values were expressed as least square means ± standard error (S.E.). Statistically significant differences between any two means (determined by Fischer's least significant difference (L.S.D.)) were associated with P-values of less than 0.05.

3. RESULTS

161 kids were born from 139 Norduz goats in the kidding season (February 16 and April 7, 2016). A total of 9 weather events were observed characteristics of audible (RMS, HR, R, SNW) and inaudible (FC, VC, SUN, C, PC) in the 52-day birth calendar. In this process, childbirth took place only at 31 days, the other 21 days were empty. In the first 13 days of the birth calendar, there was a birth every day. The relevant data were presented in Table 1. While

there are inaudible weather events on 23 days of the active 31 days of the birth calendar; There were weather events that could be audible in 8 days. Moreover, FC (26.667) and VC (23.333) weather events had the highest percentages in the 31 days.

Weather data and numerical data of the season of birth (goat and kid) were presented graphically in Figure 3. As seen here, the appearance of the bell curve that constitutes the birth of goats was obtained in a healthy way in the first 13 days as can be seen in Figure 3.

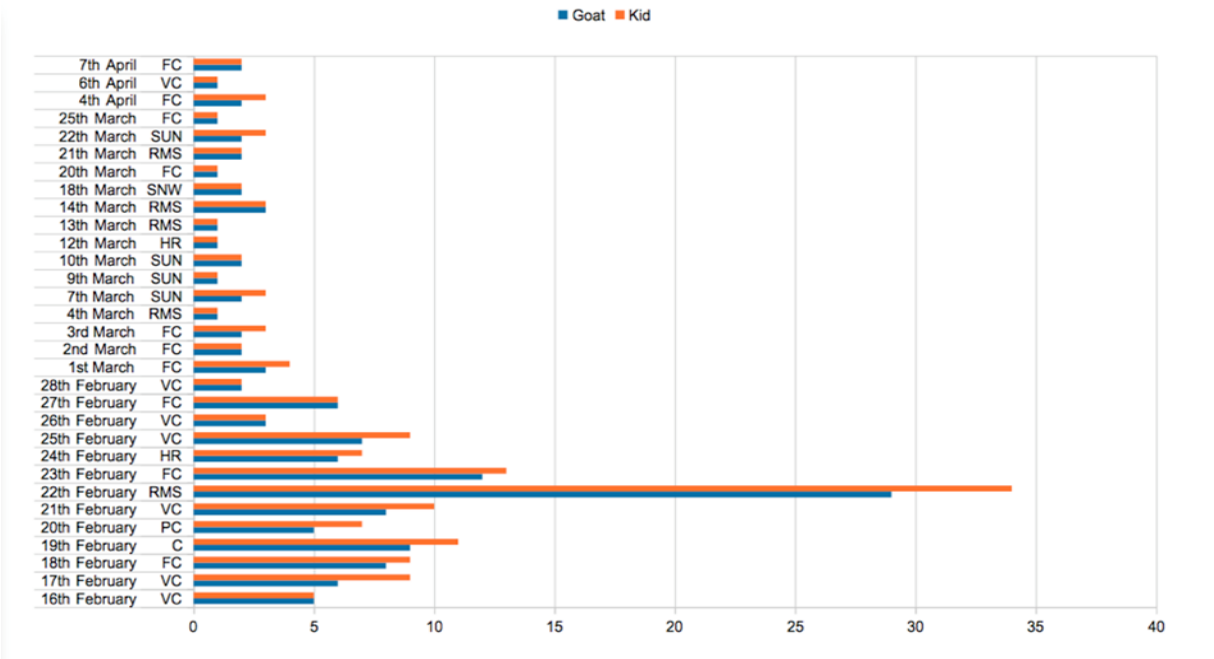

Figure 3. Graphical representation of births by weather event

The highest number of births (n=29) occurred in RMS weather events on the 7th day of births. Also, in this study, RMS weather has been seen more than other audible weather events. Although the highest number of births for 1 day occurs in this weather event, the total is only 13.333% (Table 1). In addition, the 6th (VC; n=8) and 8th (FC; n=12) days of birth were also important in the chart that formed the bell curve. Because these two, were the largest number of weather events observed (Table 1).

Table 1. Weather data by day of kids birth

	Weather Condition											
	Audible					Inaudible						
	RMS	HR	R	SNW	Σ	FC	VC	SUN	C	PC	Σ	General Σ
Birth days												
N	4	2	1	1	8	8	7	4	2	2	23	31
%	13.333	6.667	3.333	3.333	26.667	26.667	23.333	13.333	6.667	6.667	74.194	100
Non-birth days												
N	_	1	2	2	5	5	3	4	1	3	16	21
%		4.762	9.524	9.524	23.810	23.810	14.286	19.048	4.762	14.286	76.190	100

It was understood that the animals performed the birth event on inaudible days at a higher rate. The number of days of inaudible weather events (n=23) during birth season were occurred about four times more than the number of days of audible weather events (n=8). The results of the analysis of comparison of goats and their kid's data with audible and inaudible weather events were presented (Table 2).

Data of 139 goats (AG, HG, EG), 161 kids (TB, SK) and 2 weather events (audible and inaudible) that obtained from 11 farms were compared in same table. It is observed that 94 goats (67.626 %) in the total of the enterprises gave birth in inaudible weather event. The remarkable point here was that similar results were obtained when numerical analysis was made on the basis of farms. For example births on all farms for RMS (25.180 %) and VC (24.460 %) weather events had similar results related with many births. On the contrary, except the 1st farm with 1 birth, no birth on the R (0.179 %) weather event was. Similar to the results of R weather, SNW (1.439 %) weather was observed, only the 7th farm. Whereas in the RMS and VC weather events with a maximum % in Σ, births were made in all farms. Similar results have been observed with respect to AG characteristics on R and SNW weather events when compared to births. The goats responded negatively to HR and R weather events in terms of HG characteristics, similar to R and SNW weather events in terms of EG characteristics. Furthermore, when air events related to the birth of 161 kids were examined, a homogeneous distribution except R and SNW weather were seen.

Table 2. Comparison of birth data with weather events

		Weather Condition											
		Audible					Inaudible						General Σ
		RMS	HR	R	SNW	Σ	**FC**	**VC**	**SUN**	**C**	**PC**	**Σ**	
Farm	1	2 1.439%	1 0.179%	1 0.179%	_	4 2.888%	7 5.036%	2 1.439%	_	2 1.439%	2 1.439%	13 9.353%	17 12.230%
	2	1 0.179%	_	_	_	1 0.179%	_	7 5.036%	1 0.179%	_	_	8 5.756%	9 6.475%
	3	4 2.888%	_	_	_	4 2.888%	4 2.888%	5 3.597%	_	1 0.179%	_	10 7.194%	14 10.072%
	4	2 1.439%	1 0.179%	_	_	3 2.158%	4 2.888%	4 2.888%	3 2.158%	3 2.158%	_	14 10.072%	17 12.230%
	5	6 4.317%	_	_	_	6 4.317%	_	4 2.888%	_	1 0.179%	_	5 3.597%	11 7.914%
	6	3 2.158%	_	_	_	3 2.158%	1 0.179%	2 1.439%	_	7 5.036%	_	10 7.194%	13 9.353%
	7	6 4.317%	3 2.158%	_	2 1.439%	11 7.914%	5 3.597%	2 1.439%	_	2 1.439%	1 0.179%	10 7.194%	21 15.108%
	8	2 1.439%	1 0.179%	_	_	3 2.158%	1 0.179%	3 2.158%	_	1 0.179%	3 2.158%	8 5.756%	11 7.914%
	9	1 0.179%	_	_	_	1 0.179%	1 0.179%	1 0.179%	1 0.179%	1 0.179%	_	4 2.888%	5 3.597%
	10	5 3.597%	1 0.179%	_	_	6 4.317%	3 2.158%	3 2.158%	1 0.179%	2 1.439%	_	9 6.475%	15 10.791%
	11	3 2.158%	_	_	_	3 2.158%	_	1 0.179%	1 0.179%	1 0.179%	_	3 2.158%	6 4.317%
	Σ	35 25.180%	7 5.036%	1 0.179%	2 1.439%	45 32.374%	26 18.705%	34 24.460%	7 5.036%	21 15.108	6 4.317%	94 67.626%	139 100%
AG	2	11 7.914%	1 0.179%	1 0.179%	2 1.439%	15 10.791%	15 10.791%	14 10.072%	2 1.439%	2 1.439%	1 0.179%	34 24.460%	49 35.252%
	3	12 8.633%	2 1.439%	_	_	14 10.072%	6 4.317%	11 7.914%	3 2.158%	4 2.888%	2 1.439%	26 18.705%	40 28.777%
	4	8 5.756%	2 1.439%	_	_	10 7.194%	5 3.597%	6 4.317%	2 1.439%	13 9.353%	1 0.179%	27 19.424%	37 26.619%
	5	4	2	_	_	6	_	3	_	2	2	7	13

		Weather Condition											
		Audible					Inaudible						General Σ
		RMS	HR	R	SNW	Σ	**FC**	**VC**	**SUN**	**C**	**PC**	**Σ**	
		2.888%	1.439%			4.317%		2.158%		1.439%	1.439%	5.036%	9.353%
	Σ	35 25.180%	7 5.036%	1 0.179%	2 1.439%	45 32.374%	26 18.705%	34 24.460%	7 5.036%	21 15.108%	6 4.317%	94 67.626%	139 100%
HG	Hornless	6 4.317%	–	–	1 0.179%	7 5.036%	9 6.475%	9 6.475%	2 1.439%	8 5.756%	2 1.439%	30 21.583%	37 26.619%
	Short-horned	–	–	–	–	–	2 1.439%	–	–	1 0.179%	1 0.179%	4 2.888%	4 2.888%
	Long-horned	29 20.863%	7 5.036%	1 0.179%	1 0.179%	38 27.338%	15 10.791%	25 17.986%	5 3.597%	12 8.633%	3 2.158%	60 43.165%	98 70.504%
	Σ	35 25.180%	7 5.036%	1 0.179%	2 1.439%	45 32.374%	26 18.705%	34 24.460%	7 5.036%	21 15.108%	6 4.317%	94 67.626%	139 100%
EG	Earless	2 1.439%	–	–	–	2 1.439%	5 3.597%	3 2.158%	2 1.439%	3 2.158%	1 0.179%	14 10.072%	16 11.511%
	Short-eared	5 3.597%	3 2.158%	–	–	8 5.755%	5 3.597%	5 3.597%	1 0.179%	3 2.158%	2 1.439%	16 11.511%	24 17.266%
	Long-eared	28 20.144%	4 2.888%	1 0.179%	2 1.439%	35 25.180%	16 11.511%	26 18.705%	4 2.888%	15 10.791%	3 2.158%	64 46.043%	99 71.223%
	Σ	35 25.180%	7 5.036%	1 0.179%	2 1.439%	45 32.374%	26 18.705%	34 24.460%	7 5.036%	21 15.108%	6 4.317%	94 67.626%	139 100%
TB	S	30 18.634%	6 3.727%	1 0.621%	2 1.242%	39 24.224%	22 13.665%	27 16.770%	5 3.106%	18 11.180%	4 2.484%	76 47.205%	115 71.429%
	T	10 6.211%	2 1.242%	–	–	12 7.453%	8 4.969%	12 7.453%	4 2.484%	6 3.727%	4 2.484%	34 21.118%	46 28.571%
	Σ	40 24.845%	8 4.969%	1 0.621%	2 1.242%	51 31.677%	30 18.634%	39 24.224%	9 5.590%	24 14.907%	8 4.969%	110 68.323%	161 100%
SK	F	18 11.180%	4 2.484%	–	1 0.621%	23 14.286%	17 10.559%	21 13.043%	4 2.484%	14 8.696%	7 4.348%	63 39.130%	86 53.416%
	M	22 13.665%	4 2.484%	1 0.621%	1 0.621%	28 17.391%	13 8.075%	18 11.180%	5 3.106%	10 6.211%	1 0.621%	47 29.193%	75 46.584%
	Σ	40 24.845%	8 4.969%	1 0.621%	2 1.242%	51 31.677%	30 18.634%	39 24.224%	9 5.590%	24 14.907%	8 4.969%	110 68.323%	161 100%

The comparison of birth data with some meteorological data were shown in Table 3.

Table 3. Comparison of birth data with some meteorological data

			Daytime Temparature ℃			Night Temparature ℃			Sensible Temparature ℃			Humudity %			Sight Distance km			Pressure Nm^{-2}			Dew point ℃		
		N	$\bar{x} \pm Sx$	Min-Max	P	$\bar{x} \pm Sx$	Min-Max	P	$\bar{x} \pm Sx$	Min-Max	P	$\bar{x} \pm Sx$	Min-Max	P	$\bar{x} \pm Sx$	Min-Max	P	$\bar{x} \pm Sx$	Min-Max	P	$\bar{x} \pm Sx$	Min-Max	P
Farm	1	17	6.62±0.43	2.00-12.00	0.731	0.00±0.51[a]	-7.00-4.00	**0.021**	0.24±0.24	-2.00-1.00	0.591	17.79±1.51	7.50-25.50	0.560	11.33±0.54	7.00-14.00	0.414	16.33±0.54	12.00-19.00	0.560	0.76±0.24	-1.00-2.00	0.591
	2	9	5.55±1.18	2.00-12.00		-3.33±1.49[b]	-7.00-3.00		0.89±0.59	-2.00-2.00		15.56±2.85	7.50-32.50		10.22±1.14	7.00-17.00		15.22±1.14	12.00-22.00		0.11±0.59	-1.00-3.00	
	3	14	6.00±0.70	2.00-12.00		-2.00±0.94[ab]	-7.00-2.00		0.40±0.41	-2.00-4.00		18.39±2.25	7.50-35.00		11.47±0.84	7.00-18.00		16.47±0.84	12.00-23.00		0.60±0.41	-1.00-5.00	
	4	17	6.71±0.40	2.00-9.00		-0.29±0.57[a]	-7.00-2.00		-0.53±0.40	-4.00-2.00		17.21±1.37	7.50-32.50		9.12±1.09	1.00-17.00		15.88±0.55	12.00-22.00		0.47±0.40	-3.00-3.00	
	5	11	7.09±0.46	3.00-8.00		0.73±0.80[a]	-7.00-2.00		0.18±0.35	-2.00-2.00		19.77±1.73	10.00-25.00		11.91±0.69	8.00-14.00		16.91±0.69	13.00-19.00		1.18±0.35	-1.00-3.00	
	6	13	6.62±0.43	3.00-8.00		0.08±0.67[a]	-7.00-2.00		0.15±0.32	-2.00-1.00		15.77±1.59	10.00-25.00		10.31±0.63	8.00-14.00		15.31±0.63	13.00-19.00		1.15±0.32	-1.00-2.00	
	7	21	6.55±0.56	1.00-12.00		0.60±0.52[a]	-5.00-4.00		-0.40±0.45	-5.00-3.00		17.00±1.47	2.50-25.00		9.80±0.89	1.00-14.00		15.80±0.59	10.00-19.00		0.60±0.45	-4.00-4.00	
	8	11	6.27±0.36	5.00-8.00		0.45±0.34[a]	-2.00-2.00		0.36±0.39	-2.00-2.00		15.68±1.69	10.00-25.00		10.27±0.68	8.00-14.00		15.27±0.68	13.00-19.00		1.36±0.39	-1.00-3.00	
	9	5	6.00±0.71	4.00-8.00		-0.60±0.52[a]	-4.00-2.00		-1.40±1.03	-5.00-1.00		15.00±2.09	10.00-20.00		10.00±0.84	8.00-12.00		15.00±0.84	13.00-17.00		-0.40±1.03	-4.00-2.00	
	10	15	7.25±0.44	4.00-12.00		0.25±0.55[a]	-4.00-2.00		-0.06±0.48	-5.00-4.00		19.84±1.71	10.00-35.00		11.31±0.97	1.00-18.00		16.94±0.69	13.00-23.00		0.94±0.48	-4.00-5.00	
	11	6	7.33±0.42	6.00-8.00		-0.17±1.22[a]	-4.00-2.00		-0.67±0.72	-4.00-1.00		20.83±2.11	12.50-25.00		12.33±0.84	9.00-14.00		17.33±0.84	14.00-19.00		0.33±0.72	-3.00-2.00	
	Σ	139	6.57±0.18	1.00-12.00		-0.29±0.24	-7.00-4.00		-0.28±0.14	-5.00-4.00		17.59±0.55	2.50-35.00		10.60±0.28	1.00-18.00		16.04±0.22	10.00-23.00		0.72±0.14	-4.00-5.00	
AG	2	49	6.08±0.35	1.00-12.00	0.118	-1.33±0.48[b]	-7.00-4.00	**0.006**	-0.75±0.25	-5.00-4.00	0.510	17.55±0.10	2.50-35.00	0.523	10.44±0.52	1.00-18.00	0.822	16.02±0.40	10.00-23.00	0.523	0.25±0.25[b]	-4.00-5.00	**0.051**
	3	40	7.07±0.28	2.00-12.00		0.43±0.33[a]	-7.00-4.00		0±0.26	-2.00-4.00		18.75±0.85	7.50-35.00		11.05±0.48	1.00-18.00		16.50±0.34	12.00-23.00		1.00±0.23[ab]	-1.00-5.00	
	4	37	6.67±0.26	2.00-12.00		0.02±0.38[a]	-7.00-3.00		-0.26±0.25	-5.00-2.00		16.96±0.93	7.50-32.50		10.56±0.43	1.00-17.00		15.78±0.37	12.00-23.00		0.74±0.25[ab]	-4.00-3.00	
	5	13	6.47±0.33	3.00-18.00		0.42±0.45[a]	-7.00-2.00		0.26±0.25	-2.00-2.00		16.71±1.38	10.00-25.00		10.68±0.55	8.00-14.00		15.68±0.55	13.00-19.00		1.26±0.25[a]	-1.00-3.00	

			Daytime Temparature ℃			Night Temparature ℃			Sensible Temparature ℃			Humudity %			Sight Distance km			Pressure Nm^{-2}			Dew point ℃		
		N	**x̄ ± Sx**	Min-Max	P	**x̄ ± Sx**	Min-Max	P	**x̄ ± Sx**	Min-Max	P	**x̄ ± Sx**	Min-Max	P	**x̄ ± Sx**	Min-Max	P	**x̄ ± Sx**	Min-Max	P	**x̄ ± Sx**	Min-Max	P
	Σ	139	6.57±0.16	1.00-12.00		-0.26±0.22	-7.00-4.00		-0.29±0.13	-5.00-4.00		17.61±0.50	2.50-35.00		10.67±0.25	1.00-18.00		16.04±0.20	10.00-23.00		0.71±0.13	-4.00-5.00	
HG	Hornless	37	6.68±0.30	1.00-12.00	0.555	0.23±0.37	-7.00-4.00	0.343	-0.02±0.26	-5.00-2.00	0.535	16.65±0.94	2.50-32.50	0.317	9.98±0.50	1.00-17.00	0.195	15.66±0.38	10.00-22.00	0.317	0.98±0.26	-4.00-3.00	0.535
	Short-horned	4	5.33±0.33	5.00-6.00		-1.67±0.88	-3.00-0.00		-0.33±0.88	-2.00-1.00		15.00±3.82	10.00-22.50		10.00±1.53	8.00-13.00		15.00±1.53	13.00-18.00		0.67±0.88	-1.00-2.00	
	Long-horned	98	6.59±0.17	1.00-12.00		-0.34±0.28	-7.00-4.00		-0.34±0.15	-5.00-4.00		18.19±0.63	2.50-35.00		11.00±3.11	1.00-18.00		16.28±0.25	10.00-23.00		0.66±0.15	-4.00-5.00	
	Σ	139	6.59±0.17	1.00-12.00		-0.21±0.222	-7.00-4.00		-0.25±0.13	-5.00-4.00		17.70±0.52	2.50-35.00		10.69±0.21	1.00-18.00		16.08±0.21	10.00-23.00		0.75±0.13	-4.00-5.00	
EG	Earless	16	5.73±0.42	3.00-8.00	0.114	-1.33±0.71	-7.00-2.00	0.154	-0.40±0.41	-2.00-3.00	0.596	16.00±1.40	10.00-25.00	0.234	10.40±0.56	8.00-14.00	0.235	15.40±0.56	13.00-19.00	0.234	0.60±0.41	-1.00-4.00	0.596
	Short-eared	24	6.23±0.43	2.00-12.00		-0.58±0.62	-7.00-3.00		-0.50±0.26	-2.00-2.00		16.35±1.30	7.50-32.50		9.77±0.73	1.00-17.00		15.54±0.52	12.00-22.00		0.50±0.26	-1.00-3.00	
	Long-eared	99	6.78±0.19	1.00-12.00		0.03±0.24	-7.00-4.00		-0.17±0.15	-5.00-4.00		18.22±0.61	2.50-35.00		10.94±0.30	1.00-18.00		16.29±0.24	10.00-23.00		0.83±0.15	-4.00-5.00	
	Σ	139	6.59±0.17	1.00-12.00		-0.21±0.22	-7.00-4.00		-0.25±0.13	-5.00-4.00		17.69±0.52	2.50-35.00		10.69±0.26	1.00-18.00		16.08±0.21	10.00-23.00		0.75±0.13	-4.00-5.00	
TB	S	115	6.56±0.20	1.00-12.00	0.297	-0.33±0.26	-7.00-4.00	0.129	-0.27±0.15	-5.00-4.00	0.745	17.56±0.61	2.50-35.00	0.674	10.51±0.32	1.00-18.00	0.062	16.03±0.24	10.00-23.00	0.674	0.73±0.15	-4.00-5.00	0.745
	T	46	6.59±0.27	3.00-12.00		-0.05±0.38	-7.00-4.00		-0.32±0.26	-5.00-200		17.73±0.88	10.00-25.00		16.03±0.24	8.00-14.00		16.10±0.35	13.00-19.00		0.68±0.26	-4.00-3.00	
	Σ	161	6.57±0.16	1.00-12.00		-0.25±0.21	-7.00-4.00		-0.29±0.13	-5.00-4.00		17.61±0.50	2.50-35.00		10.67±0.25	1.00-18.00		16.04±0.20	10.00-23.00		0.71±0.13	-4.00-5.00	
SK	F	86	6.41±0.19	1.00-12.00	0.276	-0.30±0.27	-7.00-2.00	0.816	-0.19±0.17	-5.00-4.00	0.409	17.30±0.66	2.50-35.00	0.508	10.57±0.33	1.00-18.00	0.668	15.92±0.26	10.00-23.00	0.509	0.81±0.17	-4.00-5.00	0.409
	M	75	6.76±0.27	1.00-12.00		-0.20±0.35	-7.00-4.00		-0.40±0.20	-5.00-4.00		17.97±0.77	2.50-35.00		10.79±0.39	1.00-18.00		16.19±0.31	10.00-23.00		0.60±0.20	-4.00-5.00	
	Σ	161	6.57±0.16	1.00-12.00		-0.25±0.22	-7.00-4.00		-0.29±0.13	-5.00-4.00		17.61±6.39	2.50-35.00		10.67±0.25	1.00-18.00		16.04±0.20	10.00-23.00		0.71±0.13	-4.00-5.00	

a, ab, b Differences between the values involving different letters in the same column were found to be statistically significant at P<0.05

Also, 7 different weather events were presented here. The farms average daytime temperature ($P>0.05$), night temperature ($P<0.05$), sensible temperature ($P>0.05$), humidity ($P>0.05$), sight distance ($P>0.05$), pressure ($P>0.05$), dew point ($P>0.05$) were 6 6.57±0.18 ℃, -0.29±0.24 ℃, -0.28±0.14 ℃, 17.59±0.55 %, 10.60±0.28 km, 16.04±0.22 Nm^{-2}, 0.72±0.14 ℃, respectively. Also, as can be seen in Table 3, different level of statistical significances were between Farm-NT and AG-DP ($P<0.05$); AG-NT ($P<0.01$). However, no statistical significance could be determined outside these two levels of statistical significance.

4. DISCUSSION

Jose et al. (2016b) reported that productivity and reproductive performance characteristics were affected by environmental factors and the *reproducibility* level was low as a result of a study they conducted in Pelibuey sheep. The level of repeatability in meteorological studies, as it is known, is low. In this case, a method source (Sadıkhov et al., 1995) of Tubitak-National Meeorology Institute is available. The advantage of this study is that the level of exposure from other environmental factors other than meteorological data is low, whereas the level of repeatability is relatively high. Li et al. (2012) used a pasture model (APSIM-AgPasture) and farm system model (Farmax) in a study on sheep and beef farming in which they talked about the profound effects of weather change on pasture production and pastoral farm. Measurement uncertainty is less and easier to determine in studies with these and similar computer modeling programs.

According to the results of a study that Tracey and Flemming (2007) did on the goats; While the helicopter was just above the goats, the goats showed alert behavior. The distance moved decreased sharply when the helicopter was further than 150 m away. However the goats often fled to a distance of up to 1.5 km in response to helicopter over-flights, confused. Helicopter flights did not also cause mothers to abandon their young, nor adversely affect their immediate or long-term welfare. In this study, given that the animals' response to audible stimuli was not just movement, these "could the animals have responded to audible weather events such as R and SNW in relation to birth?" brought the question to mind. Another important point in this study is 2, 3, 4, 5 years old goats had similar behavior that they had not given birth on R and SNW weathers.

The 2016 precipitation average of Van province reported by Selçuk et al. (20016) was 33.8 kg/m^2, 46.8 kg/m^2 and 55.8 kg/m^2 respectively in February, March and April, respectively. In this study, births in February looked like a bell curve, and this month was the month that

expressed the birth calendar in the healthiest way. When focusing on the relationship between absolute audible pressure and audible pressure level, slow wind levels were calculated as 20dB (Anonymous, 2018a). In this case, it was possible for the pregnant goats in the study to hear the sound of the rain, even if they could not hear the sound of the wind blowing. Wind direction has been reported to have little effect on sound propagation as long as the wind speed is at 10 mph (=16,093 km/sa) or less, which is considered fairly slow (Anonymous, 2022b).

The same rain rates can form different acoustic spectrums depending on different drop distributions. This can become much more complicated, even simply by adding the wind that produces its own sound and also affects the intensity of the rain (Medwin et al., 1990). On the other hand, it is true that a storm can have a very high frequency with torrential rain, given that it can be 120 dB. Although the geography where the study was carried out was not a place of strong winds, it was likely that the wind blowing would be perceived by animals.

A similar study was carried out by Demir (2006) on a total of 323 pregnant sheep raised in 8 enterprises in the same location during the lambing season, which took place between February 7 and April 9, 2015. In this study, 73,336% of the total lambs were in the 51,613% where silent weather events were observed. This situation is similar to this study on goats. During the birth season, 76,667% of the silent weather events were observed and 67,626% of the births occurred in silent weather events on these dates. This study has similar results in this perspective with the study conducted on sheep by Demir (2016).

5. CONCLUSIONS

It is thought that the study was carried out in accordance with the purpose, since the farms are far enough from the nearest settlements. Air traffic was an important factor in sound. However, this risk has disappeared because the airport is far enough away. In this study, it was observed that there is no significant difference between farms. It is thought that their conditions support goats to be similarly affected by environmental events and to act on herd instinct.

In the first 13 days of continuous births, it can be seen that the bell curve appears, which is the general feature of the birth chart of small ruminants. This is very important for the healthy execution of a study. Although this study was carried out on a small number of animals, similar results from a large number of enterprises are considered important for animal behavior. Furthermore, from the findings, it is observed that the age of animals is closely related to the weather. As a result, a large number of and more detailed studies are needed to connect the timetable of birth of goats to the weather.

REFERENCES

Akkuşçi, A. (2021). Kuzulama sezonunda mevcut hava durumu ve solar radyasyon düzeylerinin koyunların doğum verileri ile ilişkisi. *Yüksek Lisans Tezi*, Van Yüzüncü Yıl Üniversitesi, Fen Bilimleri Enstitüsü.

Algers, B., Ekesbo, I., Stromberg, S. (1978). The impact of continuous noise on animal health. *Acta Veterinaria Scandinavica*, *67*,1-26.

Anonymous 2018a. https://www.softdb.com/effect-of-wind-and-temperature-gradients-on-sound-waves/. The last access: 15.06.2022

Anonymous 2021. https://www.tarimorman.gov.tr/HAYGEM/Belgeler/Hayvanc%C4%B1l%C4%B1k/K%C3%BC%C3%A7%C3%BCkba%C5%9F%20Hayvanc%C4%B1l%C4%B1k/Ke%C3%A7i%20Yeti%C5%9Ftiricili%C4%9Fi/2020%20YILI/Keci_Yetistiriciligi.pdf The last access: 12.03.2020

Anonymous 2022a. https://www.calculator.net/heat-index-calculator.html The last access: 15.02.2022

Anonymous 2022b. https://www.abdengineering.com/blog/weather-affects-noise-study/ The last access: 27.01.2022

Arehart, L.A., Ames, D.R. (1972). Performance of early-weaned lambs as affected by audible type and intensity. *Journal of Animal Science*, *35*, 481-485.

Ames, D.R., Arehart, L.A. (1972). Physiological response of lambs to auditory stimuli. *Journal of Animal Science*, *34*, 994-998.

Berglung, B., Lindvall, T., Schwela, D. H. (1999). Guidelines for community noise. *The World Health Organization*, Geneva, Switzerland. p 159.

Castelhano-Carlos, M.J., Baumans, V. (2009). The impact of light, noise, cage cleaning and in-house transport on welfare and stress of laboratory rats. *Laboratory Animals*, *43*, 311–327

Delpietro, H. A. (1989). Case reports on defensive behaviour in equine and bovine sub-jects in response to vocalization of the common vampire bat (*Desmodus rotundus)*. *Applied Animal Behaviour Science*, *22*, 377-380.

Demir, A.O. (2016). Hava durumunun koyunların doğum performansı üzerine etkileri. Bursa Tarım Kongresi, Türkiye, S: 18-25.

Heffner, R.S., Heffner, H.E. (1990). Hearing in domestic pigs (*Sus scrofa*) and goats (*Capra hircus*). *Hearing research*, *48*, 231-240.

Jose, C., Manuel, A., Pereira, F., De Mira, A., Morita, L., Antonio, E., Titto, L. (2016a). Thermoregulatory response in Hair sheep and Shorn Wool sheep cristiane gonc. *Small Ruminant Research*, *144*, 341–345.

Jose, E.T.C, Magaña-Monforte, J.G., Segura-Correa, J.C. (2016b). Environmental effects on productive and reproductive performance of Pelibuey ewes in Southeastern México. *Journal of Applied Animal Research*, *44*(1), 508-512.

Koser Eliçin, M. (2008). White goat sex change of tyroid hormones. *Doktora tezi*, Ankara Üniversitesi, Fen Bilimleri Enstitüsü, Ankara.

Li, F.Y., Vibart, R., Dynes, R.A., Vogeler I., Brown, M. (2012). Effects of weather variability on sheep and beef farming in northern Southland, New Zealand: A modelling analysis. *Proceedings of the New Zealand Grassland Association, 74*, 77-84.

Manuja, B.K. Manuja, A., Aich, P. (2012). Stress and its impact on farm animals. Frontiers in Bioscience E4, 1759-1767.

Medwin, H., Kurgan, A., Nystuen, J.A. (1990). Impact and bubble audible from raindrops at normal and oblique incidence. *Journal of Acoustical Society of America*, *88*(1), 413-418.

Sadıkhov, E, Kangı, R, Uğur, S. (1995). Ölçüm Belirsizliği. Ulusal Meteoroloji Enstitüsü. 95-014. https://www.ume.tubitak.gov.tr/sites/images/ume/ume-95-014.pdf The last access: 15.02.2022

Selçuk L., Sağlam Selçuk, A., Kasapoğlu, D. (2016). Coğrafi bilgi sistemleri (CBS) tabanlı çok kriterli karar analizi (Çkka) kullanılarak, Van ili merkez ilçelerinin kentsel taşkın duyarlılık değerlendirmesi, Van/Türkiye. *Yerbilimleri/Earth Sciences*, *37*(1), 1-18.

Talling, J. C., Lines, J. A., Wathes, C. M., Waran, N. K. (1998). The acoustic environment of the domestic pig. *Journal of Agricultural Engineering Research*, *71*, 1-12.

Tracey, J.P., Flemming, J.S. (2007). Behavioural responses of feral goats (*Capra hircus*) to helicopters. Appl. Anim. *Behav. Sci*., *108*, 114-128.

Weeks, C.A. Brown, S.N. Lane, S. Heasman, L. Benson, T., Warrirs, P.D. (2009). Noise levels in lairages for cattle, sheep and pigs in abattoirs in England and Wales. *Veterinary Record*, *165*, 308-314.

Demir, A.Ö. (2022). Norduz Keçilerinin Doğumu ile Hava Verileri Arasındaki İlişkiler. *Şırnak Üniversitesi Fen Bilimleri Dergisi*, *3*(1): 33-48.

Demir, A.Ö. (2022). Relationships Between Weather Data and Birth of Norduz Goats. *Sirnak University Journal of Sciences*, *3*(1): 33-48.