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Impact Change Climate on the Milk Production in the Dairy Goats

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Research Article

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Abstract

Background: Milk production is considered one of the main pillars in building the livestock sector. When faced with one of the challenges, such as summer heat stress, which may change its course to the deterioration of milk backwards, reduce production and decrease the efficiency and quality of milk, so it was urgent to draw attention to investigated the related between environmental parameters and the milk production of hot season and milking season (spring and summer) period. The goal of recently study investigated effect heat stress on milk production in the dairy goat's data set (2017- 2018) containing 65 Saanen, 73Alpin and 22 Boer (in the age of 1-2 year).

Result: Milk analysis recorded daily maximum and minimum temperature- humidity index. Generally THI was 70.1, 82.7 in the spring and summer. General the average daily milk production was 0.7, 1.1, 0.7 for Alpine, Saanen and Boer respectively during spring and 0.9, 1.6, 0.7 for Apline, Saanen and Boer consequently during summer.

Conclusion: In small ruminant (dairy goat) change in climate as increase ambient temperature caused heat stress and negatively effect on the milk production.

Keywords: Ambient Temperature; Heat Stress; Milk Production; Goat

Abbreviations: THI: Temperature Humidity; AT: Ambient Temperature; RH: Relative Humidity.

Background

In various subtropical, tropical regions are undergoing to high relative humidity, ambient temperatures and solar radiation for long periods. Which lead to exhaustion of the physiology of the body in the disposal of excess heat and dissipation and this influence has negatively effects on the physiology of the dairy goats and daily milk yield. According to Renaudeau, et al. [1], heat stress is a significant issue for many livestock enterprises. The effect of heat stress on dairy animals have been well documented and include reduced feed intake but greater nutritional energy requirement, reduced fertility, increased respiratory and heart rates, panting activity, increased peripheral blood flow and sweating, reduced milk production, lower milk quality Stresses can cause reductions in wellbeing, physical performance (humans), growth, reproduction and lactation performance (livestock), chronic illness or ultimately death if severe and prolonged [2]. Research indicated to THI value are within 35 and 72 is not impact by milk production for all that feed intake and milk production begin to decrease in the THI value of 76 or more [1-3]. Reported that decline milk yield in the summer (10 to 40%) was more than in the winter for Holstein cows [4]. According to Bouraoui, et al. [5], that THI-milk production were negative relationship regression 0.76 where was increase THI as milk production decreases. Demonstrated that the day by day milk yield reduced from 4, 48 to 3.65kg by way of 18.2% as the elevated from<74 to 83> in summer [6]. Clarified that the milk yield in the hot environment substantially decreased as compared to the primary and 2nd thermoneutral environments which effects of hot environment on milk yield (g/day) of first thermoneutral (20°C) was 1, 8800.0, of hot surroundings (32°C) 1,611.7 and 2nd thermoneutral (20°C) 39.192 [7]. The present study was goal to investigated effect heat stress

on the milk production in the dairy goats.

Result

Ambient Temperature

The study showed that the ambient temperature THI was above 72 (82.65) during the summer season. Which is described as being in the stage of heat stress according to what has been applied through the equation mentioned in the work method, and it was calculated by converting temperatures from Fahrenheit to Celsius °F to °C, and ambient temperature THI was also higher than it was in the spring season (70.097)?

Milk Production

The general average milk production was 0.7, 1.1, 0.7 for Alpine, Saanen and Boer breed respectively in the spring and 0.9, 1.6 and 0.7 for alpine, Saanen and Boer breed respectively during summer. The change season was high significant effect on the milk production for different breeds as seen following Tables 1 & 2.

Seasons	Hours	Air temperature (°C)	Relative humidity (%)	THI
Spring	8:00- 9:00	$20.7^{A} \pm 0.2$	$73.1^{A} \pm 1.3$	70.097
	1:00- 2:00	$26.8^{B} \pm 0.3$	$46.3^{B} \pm 1.4$	
Summer	8:00- 9:00	$28.7^{A} \pm 0.1$	$73.4^{A} \pm 0.6$	82.65
	1:00- 2:00	$34.9^{B} \pm 0.1$	$46.3^{B} \pm 0.6$	

In this table show the different superscripts in the same column indicate ($p<0.05$).
Table 1: Values (SEM) climatic data and THI of each of the experimental.

Breed (Group)	Season	Spring	Summer
Alpine (T)	1	$0.7^{BC}\pm0.3$	$0.9^{BC}\pm0.2$
	2	$0.7^{BC}\pm0.2$	$0.8^{BC}\pm0.1$
	3	$0.7^{BC}\pm0.2$	$0.9^{BC}\pm0.1$
	4	$0.7^{BC}\pm0.2$	$1.1^{BC}\pm0.3$
	Mean	0.7± 0.1	$0.9^{A}\pm0.1$
Saanen (T)	1	0.6^{BC} ±0.2	$1.5^{BA}\pm0.6$
	2	1.0 BAC±0.4	$1.5^{BA}\pm0.3$
	3	1.5 A ±0.5	$1.5^{BA}\pm0.3$
	4	1.3 BA ±0.5	$2.0^{A}\pm0.4$
	Mean	1.1± 0.2	$1.6^{B}\pm0.2$
Boer (T)	1	$0.7^{BC}\pm0.1$	$0.5^{C}\pm0.2$
	2	$0.6^{BC}\pm0.2$	$0.5^{C}\pm0.2$
	3	$0.9^{BC}\pm0.4$	$0.8^{BC}\pm0.4$
	4	$0.5^{C}\pm0.2$	$1.0^{BC}\pm0.4$
	Mean	0.7 ±0.1	$0.7^{B}\pm0.2$

$p<0.01$, * $p<0.001$ ** within a row showing different superscripts are significantly different ($P<0.05$).
Table 2: Amount of milk production during two seasons.

Discussion

Ambient Temperature

According to the formula developed by Abdel Samee, et al. [8], who stated that THI values below 72 are not stressful, while THI ranging between 72 and 78 are stressfully realized that the homoeothermic capability of goats begins to come to terms when THI override 80% Avendano Reyes, et al. [9] reported that the THI is a good indicator of stressful

thermal climatic conditions and extreme distress and animal are unable to preserve thermoregulatory mechanisms and normal body temperature. THI at values more than 78 and THI values 75-78 stressful and THI values of 70 or less are considered comfortable. According to Abdel Samee, et al. [8] demonstrated that THI values was 80.7 in the hot-humid summer and THI values are consider stressful and this values was lower as compared to the THI values in the present study [9-12]. Therefor there was a weak correlation between insolation conditions and daily milk yield at r=0.2, between Relative humidity and daily milk yield at r=+0.4, and between relative humidity and milk fat at r=+0.2. Between daily milk yeild, milk fat, milk protein wind strength, and made up r=–0.2 to 0.4. Between daily milk yeild, milk fat, milk protein, and air temperature made up r = □0.2 to 0.5 ($p < 0.05$).

Milk Production

That's was similar to Peana, et al. [11] achieved that during winter, daily milk yield was negatively affected by wind chill index and the persistency of wind chill index at values fewer or equal. During spring, milk yield declines at average and maximum THI higher than 65 and 68, respectively, and as hours of consequently at mild discomfort level and discomfort level increased. Wind speed equal to or higher than 2.5m/s in winter and 4 m/s in spring and maximum wind speed equal to or up of 8 m/s in both seasons were detrimental to milk yield. Average wind amount between 1.5 and 4 m/s had beneficial responded during spring. Radiation up of 24 MJ/m2 was detrimental to milk yield during spring, where rain had a negative responded only in winter. Milk yield decrease was as high as 19% for T max, 17% for Tavg and 15% for minimum wind chill index in winter and 19% for T max, and 17% for both T min and maximum THI during spring [6], the effect immediately (0 day and 1 day) to all unfavorable conditions in winter. And the timing of effect was more variable during spring, and shown that all these reasons return to many effect of factors (different seasonal meteorological conditions, pasture production, different management, supplementation as observed in the two seasons) [12]. That milk yield in goat decreased as THI value increased. Also for each 1 unit increment of THI there is a decrease of 1% in milk yield.

Conclusion

In small ruminant (dairy goat) change in climate as increase ambient temperature caused heat stress and negatively effect on the milk production.

Methods

This study carried out at dairy goat research farm of agricultural faculty of Cukurova university, Adana (36-59 N.35 18E, Turkey All the goats were clinically healthy and physical normalities. The all goats undergo to the similar management conditions and mentored closely over the period of study. All animals kept in separate parts of the pen. Roughage and concentrate feeds are adequately supplied every day (TMR 1-2kg, 40% roughage +60% concentrate. Water was providing for supply fresh water available represented as adequate, houses were well, ventilated was adequate, cleaning hygienic management and was regularly. The experiment was during spring (March and summer (15 July to 15 August. Average temperature, relative humidity and wind speed in morning 22.6°C, 73.7%, 9.6 km s-. S-1) respectively. As for, the average temperature, RH, wind speed recorded in the afternoon, they were 26.2°C, 45.%, 14.1 km-s-1 mid-summer .in the morning time, average temperature was (29. °C, humidity (71.1%). wind (7.6 km s-1). And 35.1°C, 45.7% and (17.55 km. s-1) in afternoon, respectively. Data analyzed by using standard least-squares model (JMP, SAS Institute Inc., Cary, NC. ANOVA disclosed a significance difference in least-square mean; the differences were tested using Duncan s Multiple Range test (SAS).

The temperature humidity index (THI) as indicator of adverse climatic conditions was calculated from dry bulb temperature (db, °F) and relative humidity (RH% /100) by the following formula [8].

$$THI = db - (0.55 - 0.55\,RH)(db - 58)$$

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	3	0.7 ^{BC}±0.2	0.9 ^{BC}±0.1
	4	0.7 ^{BC}±0.2	1.1 ^{BC}±0.3
	Mean	0.7± 0.1	0.9 ^{A}±0.1
Saanen (T)	1	0.6 ^{BC} ±0.2	1.5 ^{BA}±0.6
	2	1.0 BAC±0.4	1.5 ^{BA}±0.3
	3	1.5 A ±0.5	1.5 ^{BA}±0.3
	4	1.3 BA ±0.5	2.0 ^{A}±0.4
	Mean	1.1± 0.2	1.6 ^{B}±0.2
Boer (T)	1	0.7 ^{BC}±0.1	0.5 ^{C}±0.2
	2	0.6 ^{BC}±0.2	0.5 ^{C}±0.2
	3	0.9 ^{BC}±0.4	0.8 ^{BC}±0.4
	4	0.5 ^{C}±0.2	1.0 ^{BC}±0.4
	Mean	0.7 ±0.1	0.7 ^{B}±0.2

p<0.01, * p<0.001 ** within a row showing different superscripts are significantly different (P<0.05).
Table 2: Amount of milk production during two seasons.

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Availability of Data and Materials

All datasets supporting our findings are available from the corresponding author on reasonable.

Ethics Approval and Consent to Participate

This study was approved by the Institute of Research Farm of Cukurova University Informed consent was obtained from Institute of Research Farm of Çukurova University and department of zoology to collect samples from the goats. Basically it is part of Author s PhD thesis

This consent form was dated and signed by the researchers indicating that "I have read and explained this consent form to the participant before receiving the participant's consent, and the participant had knowledge of its contents and appeared to understand it".

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests.

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