

Effect of different housing conditions on the milk production and some physiological characteristics of Holstein Friesian cows

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Eastern region of Turkey has too harsh climatic conditions during winter and early spring seasons. Temperature drops around 20-30°C and it snows too much. Because of the cold and snowy weather conditions, the cattle producers have misconception that cattle have to be housed in hot barn to obtain maximum yield. Therefore, all air-inlets and air-outlets are closed tightly to raise the temperature of the barn (Yanar *et al.* 2000). As a consequence of this application, the temperature, relative humidity and hazardous gases such as carbon dioxide, ammonia increase considerably.

Optimum temperature of the barn's air for European dairy cattle should be between 10° and 18°C while the ideal range for the relative humidity is between 60 and 70% (Özhan *et al.* 2001). Yaman (1987) indicated that rectal temperature began to elevate, and feed intake, milk production tend to lower in Holstein Friesian cattle when the barn's air temperature attained to 21°C degree. Perera *et al.* (1986) also reported that an increase of the 1°C in the air temperature of the barn resulted in 0.17°C increase in rectal temperature and 1.74 number/min in respiratory rate.

The study was undertaken to investigate the influence of the 2 different housing conditions on the milk production and physiological traits of Holstein Friesian cattle raised in harsh climatic conditions of eastern region of Turkey.

fall season were used in this research. The barn's air temperature and relative humidity were controlled by an electronic system containing basically hydrostat and thermostat developed by the Department of Agricultural Mechanisation in College of Agriculture. The cows were first housed in a barn having temperature of 13°C and humidity of 65% with low levels of CO₂ and NH₃ (adequate housing condition) for 14 days. Milk production parameters such as milk yield, milk fat percentage, dry matter percentage, and physiological traits for example rectal temperature, respiratory rate and pulse rate were determined in the morning and evening at seventh and fourteenth days of the experiment. Later, the cows were exposed for 14 days to temperature of 21°C at relative humidity of 85% (inadequate housing condition). The both housing conditions were tested within this time period to minimise the influence of the stage of the lactation on the milk production characteristics, since daily milk yield of the dairy cattle was fairly constant within 1 month period.

The cows were fed concentrate feed (1.5 kg/head) before the milking in the morning and evening. Wet sugar beet pulp (8 kg/head) and dry hay *ad lib.* were offered daily to the animals.

Carbon dioxide and ammonia levels of the barn's

Table 1. Means for temperature, relative humidity, carbon dioxide and ammonia values of the both housing conditions

Replications	Adequate housing conditions				Inadequate housing conditions			
	Temperature (°C)	Humidity (%)	CO ₂ (ppm)	NH ₃ (ppm)	Temperature (°C)	Humidity (%)	CO ₂ (ppm)	NH ₃ (ppm)
1	13.4	67.4	2742	19	21.6	82.5	5707	36
2	11.4	71.2	2833	19	20.3	81.3	4750	31
Average	12.4	69.3	2788	19	21.0	81.9	5229	34

Holstein Friesian cows (10) in second parity and calved in
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atmosphere were measured by using a carbon dioxide analyser and the dragger device. The temperature and relative humidity of the barn were recorded continuously by using a thermohygrograph. Rectal temperature was taken from rectum

Table 2. Means with standard errors for some physiological characteristics of Holstein Friesian cows

	n	Rectal temperature (°C)			Respiratory rate (number/min.)			Pulse rate (number/min.)		
		Morning X ± S _x	Evening X ± S _x	Average X ± S _x	Morning X ± S _x	Evening X ± S _x	Average X ± S _x	Morning X ± S _x	Evening X ± S _x	Average X ± S _x
<i>Housing conditions</i>		**	NS	NS	**	**	**	*	NS	NS
Adequate ¹	10	38.56±0.08	38.76±0.07	38.66±0.06	22.75±0.38	28.85±0.99	25.80±0.56	67.70±0.96	64.00±1.23	65.85±1.05
Inadequate ²	10	38.78±0.02	38.74±0.04	38.76±0.02	30.05±0.96	42.10±2.54	33.87±1.45	65.95±1.30	63.90±1.06	64.92±1.10
<i>Days of measurement</i>		NS	NS	NS	*	NS	**	NS	NS	OS
7th day	10	38.71±0.06	38.73±0.06	38.72±0.05	29.40±0.58	34.55±1.18	25.80±0.56	67.35±0.77	64.10±1.35	65.72±1.01
14th day	10	38.63±0.04	38.77±0.06	38.70±0.04	27.40±0.67	36.40±2.06	33.87±1.45	66.30±1.48	63.80±0.89	65.05±1.13

NS, Nonsignificance; *, P<0.05; **, P<0.01; ¹Adequate housing = temperature of 13°C and relative humidity of 65%; ²Inadequate housing = temperature of 21°C and relative humidity of 85%.

by a thermometer, and pulse rate was determined by using a stethoscope.

The differences due to two different housing conditions and days of the measurement were statistically analysed by two-way ANOVA with repeated measure designs.

Average temperature, relative humidity, CO₂ and NH₃ values belonging to different barns' air conditions are presented in Table 1. Average carbondioxide and ammonia levels in adequate housing condition was within normal values for the cows. However, these values measured from the inadequate barn's air were higher than that of harmful levels for dairy cattle as indicated by Akcan (1986).

Data with regard to physiological measurements are given in Table 2. Unsuitable housing conditions resulted in significantly (P<0.01) higher rectal temperature determined in the morning. Thatcher (1974) and Yaman (1987) also reported that rectal temperature initiates to elevate after the temperature of 21°C of the barn's air. The finding is in accordance with results of Shinde and Taneja (1986).

The influence of the housing conditions on the respiratory rate was statistically significant (P<0.01), and average

respiratory rate of the cows kept in the inadequate barn was 8.07 number/min. higher than that of cattle housed in the suitable housing condition (Table 2). The result could be attributed to the high CO₂ and NH₃ concentrations of the improper barn's atmosphere. This result was also in agreement with findings of the Kishonti and Adam (1987) and Venugopal *et al.* (1987) who noted that the respiratory rate raised with increase in the temperature and relative humidity. The average respiratory rates determined after 7 and 14 days' exposure was also significantly different.

The pulse rate determined in the morning was significantly (P<0.05) influenced by the housing conditions. Inadequate barn's conditions resulted in a decrease for the pulse rate, and the result was in accordance with findings of Singh and Battacharya (1990).

High temperature and relative humidity had significantly (P<0.05) adverse effect on the daily total milk yield (Table 3). The daily milk yield of Holstein Friesian cows housed under unsuitable barn's air was 0.460 kg less than that of the cows kept in proper housing condition. The result was in agreement with the findings of Johnson (1991). On the other

Table 3. Means with standard errors for some milk characteristics of Holstein Friesian cows.

	n	Milk yield (kg)			Milk fat percentage (%)			Dry matter percentage (%)		
		Morning X ± S _x	Evening X ± S _x	Total daily X ± S _x	Morning X ± S _x	Evening X ± S _x	Average X ± S _x	Morning X ± S _x	Evening X ± S _x	Average X ± S _x
<i>Housing conditions</i>		NS	NS	*	NS	NS	NS	*	*	**
Adequate ¹	10	6.06±0.39	5.45±0.40	11.52±0.76	3.01±0.13	3.72±0.11	3.37±0.06	11.24±0.23	12.09±0.14	11.67±0.15
Inadequate ²	10	5.94±0.36	5.27±0.35	11.06±0.68	3.22±0.10	3.61±0.09	3.42±0.07	11.02±0.22	11.89±0.15	11.46±0.17
<i>Days of measurement</i>		*	NS	**	NS	NS	NS	NS	NS	NS
7th day	10	6.36±0.43	5.43±0.35	11.85±0.75	3.23±0.09	3.63±0.08	3.44±0.68	11.37±0.18	11.91±0.17	11.64±0.15
14th day	10	5.64±0.35	5.28±0.40	10.72±0.69	3.00±0.14	3.69±0.11	3.35±0.06	10.90±0.31	12.08±0.12	11.49±0.18

NS: nonsignificance; *, P<0.05; **, P<0.01; ¹adequate housing = temperature of 13°C and humidity of 65%; ²Inadequate housing = temperature of 21°C and relative humidity of 85%.

hand, milk fat percentage was not significantly affected by the housing conditions.

Dry matter content of the milk produced in ideal barn was significantly higher than that of milk from the cows housed in the barn with high temperature. The result is in agreement with findings of Yamagishi *et al.* (1987) and Shijimaya *et al.* (1986) who reported that cows kept in colder environments tended to produce milk with higher dry matter percentage compared to those housed in the warmer barns.

The results of the study revealed that the inadequate barn's air conditions had significantly adverse influences on the rectal temperature, respiratory rate, pulse rate, daily milk yield and dry matter of the milk of Holstein Friesian cows. The milk production performance of Holstein Friesian cows raised under the environmental conditions of Eastern region of Turkey could be increased considerably by improving the housing conditions.

SUMMARY

The influence of the 2 different housing conditions called adequate (temperature of 13°C and humidity of 65% with low levels of CO₂ and NH₃) and inadequate (temperature of 21°C and relative humidity of 85% with high levels of CO₂ and NH₃) on the milk production and physiological traits of Holstein Friesian cattle were investigated. The effects of the housing conditions were significant for rectal temperature, respiratory rate and pulse rate determined in the morning. The total daily milk yield of the cows housed in the inadequate conditions of the barn was 0.460 kg lower, and the difference was statistically significant (P<0.05). The averages for dry matter percentage were also significantly affected by the housing conditions. However, the barn's air conditions did not have significant influence on the milk fat percentage.

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