



EFFECT OF ADDING CHAMOMILE TO DIET AND WATER SPRAYING ON THE PHYSIOLOGICAL PERFORMANCE OF HOLSTEIN COW UNDER HEAT STRESS

Dr. Mohammed Ahmed Shwayel* and Raghad Hazem Hamed Al-Mafraji**

Animal Production, College of Agriculture University of Diyala, Iraq

Abstract

This experiment was conducted in Iraq at Alkhalis Dairy Cattle Station in the Diyala governorate during the months July, August and September for the period from 1/7 to 1/10/2017. The experiment aimed to reduce the effect of heat stress on the physiological performance of Holstein dairy cows by adding chamomile to the diet and spraying with water during the afternoon (3 PM). The mean of temperature-humidity index (THI) during the months of the experiment was 80.87, indicating that the cows were under the influence of heat stress. The temperature of the rectum as it reached in September 40.08°C in the treatment of control compared 38.88 and 38.95°C in treatment adding chamomile 25g / cow / day and 50g / cow / day respectively and respiration rate (in the evening) reached 41.16 breath / min in the treatment of adding chamomile 25g / cow / day compared 53.00 and 51.83 breath / min in treatment of control and adding chamomile 50g / cow / day respectively in the 2nd period (August). The heart rate during August in the evening was 42.33 Pulse / min compared with 45.00 Pulse / min in the group of dairy cows without spraying. The heat tolerance increased to 96.33 and 96.25 in the treatment of adding chamomile 25 and 50 g / cow respectively compared 90.33 in treatment of control in sixth measurement. The results showed a significant decrease in the temperature of the rectum, respiratory rate and heart rate as a result of the addition of chamomile to the diet and spray the cows with water during the afternoon, which indicates a decrease in physiological stress caused by high temperatures.

Key word: Holstein, heat stress, chamomile, Water Spraying

Introduction

Dairy cows are an important part of the livestock sector in Iraq. Dairy cows in several central and southern Iraq regions are exposed to high ambient temperatures and solar radiation for long periods. These reduce the capacity of the dairy cow to dissipate heat, resulting in heat stress. For this reason, the cow develops various physiological processes to cope with the stress.

These responses have unenthusiastic effects on the physiology and milk yield of the cow (Gaafar *et al.*, 2011; AL-Reyad *et al.*, 2016). Which requires additional measures to reduce the temperatures. Such as spraying with water during the afternoon which is one of the main strategies that can be applied to reduce the adverse impact of temperature in summer on the performance of cows as it is one of the best ways to reduce the negative impact of heat stress in many countries (Tucker *et al.*, 2005;

USDA, 2010). Considerable evidence suggests that water effectively reduces indicators of heat stress such as respiration rate and body temperature (Gaughan *et al.*, 2004; Kendall *et al.*, 2007). In order to reduce the negative impact of heat stress more, the use of other materials that can help dairy cows to resist heat stress such as chamomile (*Matricaria chamomilla L.*) is one of the important medicinal herbs. It contains a large group of therapeutically interesting (Singh *et al.*, 2011). It also contains sedative and anti-heat compounds such as salicylates, which is one of the components of aspirin. It also improves the building of damaged tissue and enhances the efficacy of immunocompromised leukocytes (Presibella *et al.*, 2006). So the experiment aimed to reduce the effect of heat stress on the production and physiological performance of Holstein dairy cows by adding chamomile to the diet and spraying with water during the afternoon.

Materials and methods

This experiment was conducted At alkhalis Dairy Cattle Station In the Diayla governorate During the months of July, August and September for the period from 1/7 to 1/10/2017. The experiment aimed to reducing Effect of heat stress on the physiological performance of Holstin dairy cows by adding chamomile to Diet and spraying with water during the afternoon. 18 Holstin dairy cows were divided into six treatment groups, T1 a control group (without adding chamomile and without spraying), T2 and T3 were added to diet 25 and 50g / cow / day chamomile, respectively and T4 Treatment of water spraying only during the afternoon and T5 and T6 represents the treatment of water spray and the addition of chamomile 25 and 50g / cow / day respectively , the cows were housed in a covered free stall barn with the remaining herd. They were fed oaccording to the production level. Ingredients and chemical compositions of diet fed to animals during the experiment are reported in table 1. Addition hay and alfalfa hay, who was present when the availability of green fodder scarves, the water was always available to the animals.

Rectal temperature was measured using a medical digital thermometer (accuracy to 1°C). Heart rate was counted using a medical stethoscope and Respiration rate was measured by counting the flank movements of the individual cows for one minute : period of uninterrupted breathing and reported as the number of inspirations per minute. The following measurements were performed weekly in 5 AM and 3 PM during the experimental periods and heat tolerance was measured according to Rhoad (1944). Temperature and relative humidity were daily recorded by using a thermo hygrometer. Temperature-Humidity Index (THI) values were also determined during the experimental period using the following equation, as described by Mader *et al.*, (2006). Factorial Experiments (3×2) according to Randomized Complete Blocks Design were used in the analysis of experiment data to Study the effect of the treatments studied in different qualities and compared the differences between the test averages (Duncan, 1955) polynomial and use the program (SPSS, 1998) in the statistical analysis.

Table 1: Chemical and Chamomile compositions of diet.

Compositions	Chemical * %	Chamomile %
Dry matter	98.14	99.18
moisture	1.86	0.82
Crud Protein	15.29	12.50
Crud Fber	6.16	4.33
Fat	6.20	6.14
Ash	4.33	4.20

* according to AOAC (1975)

Results and discussion

The average ambient temperature (°C), relative humidity (%) and temperature humidity index (THI) are shown in table 2. The THI of July, August and September were 80.20, 81.55 and 80.87, respectively and that indicating higher heat stress on dairy cows during this months. These high THI values indicate that most dairy herds are exposed to the negative effects of heat stress and that effects on the physiology performance of the cow.

Table 2: The averag of Ambient temperature (°C) and relative humidity (%) during the experiment period

Months	Average relative Temperature °C	Average humidity %	THI *
July	39.17	12.17	80.20
August	37.17	14.87	81.55
September	33.76	15.90	80.87
Mean	36.73	14.31	80.87

*Temperature-Humidity Index according to Mader *et al.*, (2006).

Effect of adding chamomile to Diet and Water Spraying on the Rectal temperature of Holstein Diary cow are shown in table 2 and There is no significant effect of water spray and addition of chamomile on morning and evening Rectal temperature during the July and August. During the September, the addition of chamomile resulted in a significant decrease in the temperature of the rectum as it reached 40.08°C in the treatment of control compared 38.88 and 38.95°C in Treatment Add chamomile 25g / cow / day and 50g / cow / day respectively. As for the effect of the interaction between the water spraying and chamomile the rectal temperature in the evening was 40.70°C T1 and decreased (P<0.01) to 38.66, 38.50, 39.46, 39.10 and 39.40°C in T2, T3, T4, T5 and T6, respectively.

The results in table 4 showed there is no significant effect of treatment with adding chamomile to Diet and Water Spraying on the Respiration rate of Holstein Diary cow during July, and September and showed there was a significant different (p < 0.05) at the addition of chamomile resulted in a significant decrease in the Respiration rate (in August at the evening) as it reached 41.16 breath / min in the treatment of Add chamomile 25g / cow / day compared 53.00 and 51.83 breath / min in treatment of control and Add chamomile 50g / cow / day respectively and there is no significant effect of interaction between the water spraying and chamomile in Respiration rate. The heart rate (table 5) in August during the morning was 56.83 and 58.00 Pulse / min in the control treatment and the addition of chamomile (50g / cow daily) respectively and decreased (P<0.01) significantly to 47.00

Table 3: Effect of adding chamomile to Diet and Water Spraying on the Rectal temperature of Holstein Dairy cow (mean±SE).

Treatment	Rectal temperature (°C)					
	July		August		September	
	3 PM	5AM	3 PM	5AM	3 PM	5AM
	Effect of water spraying					
Water without spray	38.28±0.03	39.57±0.17	38.22±0.04	39.57±0.17	38.36±0.2	39.28±0.38
Water spray	38.30±0.05	39.37±0.13	38.34±0.03	39.37±0.13	38.45±0.02	39.32±0.14
	Effect of chamomile					
0 g/cow	38.23±0.06	39.33±0.21	38.30±0.06	39.56±0.25	38.41±0.04	40.08±0.36 ^A
25 g/cow	38.36±0.04	39.33±0.21	38.28±0.04	39.60±0.16	38.41±0.05	38.88±0.18 ^B
50 g/cow	38.28±0.04	39.53±0.21	38.26±0.06	39.40±0.14	38.40±0.02	38.95±0.24 ^B
	Water spraying X chamomile					
T1	38.30±0.11	39.33±0.33	38.26±0.12	39.53±0.48	38.40±0.05	40.70±0.41 ^A
T2	38.33±0.03	39.33±0.33	38.23±0.08	39.60±0.25	38.33±0.06	38.66±0.32 ^B
T3	38.23±0.03	40.00±0.00	38.16±0.06	39.60±0.25	38.36±0.03	38.50±0.11 ^B
T4	38.16±0.03	39.33±0.33	38.33±0.08	39.60±0.30	38.43±0.06	39.46±0.33 ^B
T5	38.40±0.10	39.33±0.33	38.33±0.03	39.60±0.26	38.50±0.05	39.10±0.15 ^B
T6	38.33±0.08	39.06±0.06	38.36±0.08	39.20±0.05	38.43±0.03	39.40±0.30 ^B

- The period is 30 days.

- T1 a control group (without adding chamomile and without spraying), T2 and T3 were added to diet 25 and 50g / cow / day chamomile, respectively and T4 Treatment of water spraying only during the afternoon and T5 and T6 represents the treatment of water spray and the addition of chamomile 25 and 50g / cow / day respectively.

- Means with differen Capitalt letters significantly different at P<0.01.

Table 4: Effect of adding chamomile to Diet and Water Spraying on the Respiration rate of Holstein Dairy cow (mean±SE)

Treatment	Respiration rate (breath / min)					
	July		August		September	
	3 PM	5AM	3 PM	5AM	3 PM	5AM
	Effect of water spraying					
Without water spray	33.33±0.52	47.00±2.52	31.22±1.27	48.88±2.05	34.66±0.62	48.44±0.92
water spray	33.00±0.74	48.77±0.96	32.00±0.86	48.44±1.84	35.66±0.72	50.55±0.72
	Effect of chamomile					
0 g/cow	32.83±1.04	50.66±0.33	32.16±1.07	53.00±0.81 ^A	34.83±0.65	50.33±0.66
25 g/cow	33.00±0.85	46.66±2.57	29.16±0.54	41.16±0.54 ^B	35.33±0.33	49.00±0.89
50 g/cow	33.66±0.33	46.33±2.99	33.50±1.54	51.83±0.65 ^A	35.33±1.33	49.16±1.60
	Water spraying X chamomile					
T1	32.33±1.45	50.33±0.33	32.33±2.18	54.00±1.00	35.33±1.33	51.00±1.00
T2	33.66±0.66	46.66±5.23	29.00±1.00	41.00±1.00	35.33±0.33	48.33±0.88
T3	34.00±0.00	44.00±6.24	32.33±3.17	51.66±880	33.33±1.20	46.00±1.52
T4	33.33±1.76	51.00±0.57	32.00±1.00	52.00±1.15	34.33±0.33	49.66±0.88
T5	32.33±1.66	46.66±2.40	29.33±0.66	41.33±0.66	35.33±0.66	49.66±1.66
T6	33.33±0.66	48.66±0.66	34.66±0.66	52.00±1.15	37.33±1.85	52.33±0.66

- T1 a control group (without adding chamomile and without spraying) , T2 and T3 were added to diet 25 and 50 g / cow / day chamomile, respectively and T4 Treatment of water spraying only during the afternoon and T5 and T6 represents the treatment of water spray and the addition of chamomile 25 and 50 g / cow / day respectively.

- Means with differen Capitalt letters significantly different at P<0.01

Pulse / min in the treatment of chamomile 25 g / cow daily as for the heart rate during the evening was 59.16, 49.33 and 59.83 Pulse / min in the control treatment and add chamomile 25 and 50g / cow / day respectively. As for the effect of the interaction between the water spraying and chamomile the heart rate in the evening

was 60.00, 60.33, 58.33 and 59.33 Pulse / min in T1, T3, T4 and T6 and decreased (P<0.01) to 48.66 and 50.00 in T2 and T6 respectively The spraying of cows with water reduced (P<0.05) heart rate during the evening to 42.33 Pulse / min compared with 45.00 Pulse / min in the group of dairy cows without spraying in September. Table 6

Table 5: Effect of adding chamomile to Diet and Water Spraying on the heart rate of Holstein Dairy cow (mean±SE)

Treatment	Heart rate (Pulse/ min)					
	July		August		September	
	3 PM	5AM	3 PM	5AM	3 PM	5AM
	Effect of water spraying					
without water spray	42.22±0.74	48.44±0.80	54.22±2.04	56.33±1.97	41.66±0.84	45.00±0.91 ^a
water spray	40.77±0.81	47.88±0.53	53.66±1.64	55.88±1.58	39.44±0.29	42.33±0.33 ^b
	Effect of chamomile					
0 g/cow	40.50±1.05	48.33±0.88	56.83±0.87 ^A	59.16±0.74 ^A	40.66±0.71	44.00±1.23
25 g/cow	42.50±0.99	48.00±1.12	47.00±0.81 ^B	49.33±0.66 ^B	40.16±1.01	43.00±0.77
50 g/cow	41.50±0.84	48.16±0.47	58.00±0.77 ^A	59.83±0.74 ^A	40.83±1.04	44.00±1.03
	Water spraying X chamomile					
T1	42.66±0.33	48.00±1.73	57.66±1.45	60.00±1.15 ^A	42.00±0.57	45.66±2.18
T2	43.00±1.52	49.00±2.08	46.33±0.88	48.66±0.66 ^B	41.33±1.85	44.33±0.66
T3	41.00±1.73	48.33±0.33	58.66±0.66	60.33±0.88 ^A	41.66±2.18	45.00±2.08
T4	38.33±0.88	48.66±0.88	56.00±1.00	58.33±0.88 ^A	39.33±0.66	42.33±0.33
T5	42.00±1.52	47.00±1.00	47.66±1.45	50.00±1.15 ^B	39.00±0.57	41.66±0.88
T6	42.00±0.57	48.00±1.00	57.33±1.45	59.33±1.33 ^A	40.00±0.00	43.00±0.00

- T1 a control group (without adding chamomile and without spraying) , T2 and T3 were added to diet 25 and 50 g / cow / day chamomile, respectively and T4 Treatment of water spraying only during the afternoon and T5 and T6 represents the treatment of water spray and the addition of chamomile 25 and 50 g / cow / day respectively.

- Means with differen Capitalt letters significantly different at P<0.01

Table 6: Effect of adding chamomile to Diet and Water Spraying on the heat toleranc of Holstein Dairy cow (mean±SE)

Treatment	heat toleranc					
	First measurement	Second measurement	Third measurement	Forth measurement	Fifth measurement	Sixth measurement
	Effect of water spraying					
without water spray	2.02±94.50	0.47±94.77	0.39±94.33	1.16±93.77	0.45±94.44	0.94±93.55
water spray	0.77±94.11	0.51±94.72	1.03±93.83	0.58±93.94	0.96±93.61	0.80±95.27
	Effect of chamomile					
0 g/cow	1.39±95.00	1.18±93.33	1.59±93.50	0.52±94.66	0.38±93.66	^B 1.88±90.33
25 g/cow	1.10±94.33	0.79±94.83	0.87±93.41	1.16±94.16	0.80±95.16	^A 1.15±96.33
50 g/cow	0.94±93.91	0.76±93.91	0.74±94.66	1.09±93.41	0.20±95.41	^A 1.29±96.25
	Water spraying X chamomile					
T1	2.51±94.50	0.60±93.16	3.34±93.66	0.60±94.16	0.28±93.00	^B 1.92±87.16
T2	1.48±94.33	0.60±95.33	1.52±93.50	0.28±95.00	0.44±95.83	^A 2.08±97.66
T3	0.16±91.83	0.72±94.83	1.58±94.16	1.01±93.83	0.28±95.50	^A 0.72±98.66
T4	1.75±95.50	2.56±93.50	1.20±93.33	0.88±95.16	0.44±94.33	^A 2.00±93.50
T5	1.96±94.33	1.58±94.33	1.20±93.33	2.45±93.33	1.60±94.50	^A 0.76±95.00
T6	0.28±96.00	1.25±93.00	0.16±95.16	2.17±93.00	0.33±95.33	^A 1.42±93.83

- T1 a control group (without adding chamomile and without spraying) , T2 and T3 were added to diet 25 and 50 g / cow / day chamomile, respectively and T4 Treatment of water spraying only during the afternoon and T5 and T6 represents the treatment of water spray and the addition of chamomile 25 and 50 g / cow / day respectively.

- Means with differen Capitalt letters significantly different at P<0.01

showed there is no significant effect of treatment with adding chamomile to Diet and Water Spraying and the interaction between the chamomile and water spray on the heat tolerance through the experiment except the sixth measurement which was at the end of the experiment, There was a significant effect in the treatment of

chamomile. The heat tolerance increased to 96.33 and 96.25 in the treatment of Add chamomile 25 and 50g / cow respectively compared 90.33 in treatment of control as for the effect of the interaction between the water spraying and chamomile, the heat tolerance during the sixth measurement in the T1 was 87.16 and increased

significantly ($P < 0.01$) to 97.66, 98.66, 93.50, 95.00 and 93.83 in the T2, T3, T4, T5 and T6 respectively.

The reason for the decrease in the temperature of the rectum, heat tolerance, the rate of breathing and pulse in the cows when sprinkled with water during the afternoon and treated with chamomile in the periods of experience is due to the cooling of blood in the blood vessels near the surface of the body, which will turn to the various organs and then return this blood to the surface of the body overloaded to get rid of them and thus feel comfortable and cold due to increased heat loss by evaporation (Chanchai *et al.*, 2010). This result is consistent with Kendall *et al.*, (2007) and Legrand *et al.*, (2011) and Chamomile contains a large group of therapeutically interesting and active compound classes. Sesquiterpenes, flavonoids, coumarins and polyacetylenes are considered the most important constituents (Singh *et al.*, 2011). Flavonoids such as quercetin, patuletin, luteolin and apigenin are also active in chamomile. Lead to important biological roles as it works to increase the effectiveness of the immune system, which reduces the risk of some diseases and prolong the effectiveness of vitamin C and have the role of anti-inflammatory agents (Cook and Samman (1996): Craig (1999)). These compounds act as highly effective antioxidants by protecting a number of important representative substances such as protein and red blood cells from various oxidative stress factors by free radicals and inhibition of cell membrane fat oxidation (Vaya *et al.*, 1997). It also contains sedative and anti-heat compounds such as Salicylates, which is one of the components of Aspirin. Alpha-pisbolol, a component of chamomile, has a similar effect to salicylic acid (Tyler, 1993).

Conclusions

From the above we conclude that spraying with water and treatment with chamomile reduced the effects of heat stress on the physiological performance in Holstein dairy cows. Especially in the end of experiment.

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