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Effect of spraying water on the body of Holstein cows during dry period before calving under heat stress conditions in milk production and components.

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ABSTRACT

Aim of the current experiment is to reduce heat stress on pregnant imported Holstein cows in central Iraq during the months of August and September. used 12 multiparas Holstein dry (pregnant) cows raised At the Great Khalis cattle station in Hibhib sub-district in Diyala governorate and their ages were between third and fourth lactation similar in production and the pregnant cows were divided randomly into three treatments, each treatment containing 4 dry pregnant cows, treatment C cows without spraying (control treatment), treatment R1 Sprinkle the body with water 14 days before calving daily at 1 pm, treatment R2 Cows are sprayed a month before calving daily at 1 pm. The results of the statistical analysis showed that there were no significant differences between the treatments in the daily milk production, but an arithmetic increase was observed in the average daily milk production for the fifth, sixth and seventh month after birth for the treatment of spraying a month before calving, which recorded 18.25, 18.50 and 15.00 kg/cow/day Compared with the control treatment, which recorded a decrease in milk production 14.00, 15.00 and 12.50 kg/cow/day respectively, as well as no significant differences between treatments in total milk production during the Experiment, but a Arithmetically increase was noted in the treatment spraying one month before calving which amounted to 944.28 kg/cow compared to the control treatment which recorded 812.32 kg/cow, As for the components of milk no significant differences were observed among the treatments after two months of birth, but differences were noted among the treatments after 4 months of birth, as the spraying treatment a month before calving recorded a significant increase in lactose and non-fat solids, which recorded 4.32 and 7.93 % compared with the control treatment of Without spray, which recorded 3.82 and 7.00%, respectively, and after 6 months of birth, the percentage of non – fat solids : protein, lactose and ash in the spray treatment a month before calving recorded a significant increase, as it was 2.77, 4.22 and 0.60% compared with the control treatment, which recorded 2.50, 3.77 and 0.52%, respectively. We conclude from this experiment that spraying cows before month calving improves the milk components significantly as well as the production but in an arithmetically way.

Keywords: spray water , dry period, Holstein cow , heat stress

INTRODUCTION

Stress is a reflexive reaction that results in the animal's inability to adapt to its environment which leads to many negative effects, starting from the stresses facing the animal, causing a decrease in its production leading to death 1, and heat stress is the most Harmful as it affects animal production. 2,3, which is represented by a set of environmental factors represented in temperature, relative

humidity, air movement and solar radiation that cause the effective temperature of the environment to be higher than the comfort zone of cows 4. Studies have shown that cows exposed to heat stress during prenatally reduce postpartum milk production and composition 5,6,7, and an economic study indicated that stress caused economic losses in the United States estimated at $810 million annually [8]. Exposing dry cows to heat stress before calving reduced udder growth after calving [9], and showed lower secretory activity and lower productivity after calving [10], and thus producing less milk from 3 - 4.1 kg/cow/day compared with cows that were not exposed to heat stress during the prenatal period [11,12]. The bad environmental conditions during the summer negatively affected the composition of cow's milk, as the milk contained a much lower percentage of fats, proteins, lactose and minerals [13].Use of water spray before calving during the dry period would reduce the negative effects of heat stress and improve performance after birth and reduce heat pressure on the growth of the mammary gland and milk production in the future, as some improvement was observed in milk production with cooling during the last three weeks before birth [14]. Studies have shown that spraying cows during the dry period is important for optimal udder growth, which affects milk production later, it was noted that heat stress delays the cellular renewal of the udder which leads to a decrease in the proliferation of epithelial cells later in the dry period when there is a way to cool the body [9,15].The aim of the current study is to mitigate the negative impact of heat stress on pregnant imported Holstein cows in central Iraq.

MATERIALS AND METHODS

The experiment was carried out in the Great Khalis Cows Station in the Hibhab District - Khalis District in Diyala Governorate, which is 5 km away from the city, during the period from 1/8/2021 - 1/4/2022 using 12 Holstein cows from dry (pregnant) cows raised in the station. Their ages were between 7-5 years, and pregnant cows were divided into three treatments, each treatment containing 4 multiparous pregnant cows, as the treatments were C = non-sprayed cows (comparison treatment), R1 = water sprayed cows 14 days before calving and daily at 1 pm, R2 = water sprayed cows a month before calving and daily at 1 pm. And the cows were placed in semi-misleading pens that contain feeders for the cow to eat from, and they have an iron clip designed so that the cow's head enters the trough to eat the fodder. The barn floor is a concrete cast, and vaccinations are given by specialized veterinarians at the station through periodic follow-up and monitoring of cows and conducting periodic checks to ensure that they are free of diseases especially mastitis. Pregnant non-milk-producing (dry period) cows were fed a mixture of concentrated fodder consisting of feed materials available at the station. The fodder is provided daily in the morning and evening, where the percentage of concentrated feed for pregnant cows was 8-6 kg / day and hay (dry rough forage), either green grass or jet it is not given to cows that have two weeks left in their calving, and after birth, bran fodder is provided because it contains phosphorous, which provides an opportunity for a balance between phosphorous and calcium in the fodder because the fodder contains calcium and adding bran is an attempt to balance this ratio between them. Pregnant i cows were sprayed daily during the months of August and September, it was sprayed at 1 pm at a time when temperatures are high and the entire body of the cow is sprayed with water (full body washing) As the cows are entered through a corridor designed for spraying through tubes containing small holes with a strong thrust similar to a shower, the cows pass through which the whole body is washed from top to

bottom. This room is called the sprayer. The air temperature was measured with an electronic thermometer of German origin that measures temperature and humidity at the same time. In the location of dry cows in the barn, the reading was recorded at 3 am and 3 pm daily for the duration of the experiment, and on the basis of it the Temperature-Humidity Index (THI) was calculated according to the method of Mader [17]. One of the studied characteristics is milk production, as the cows are milked twice a day at 4 am and 4 pm, using automated milking machines. The cows' parking space to allow greater freedom and flexibility for the milker where he can easily see the cow's udder, and after the cow's milking is completed the amount of milk produced is recorded with an electronic scale, and this process is carried out for each cow daily (morning and evening) throughout the days of the experiment .milk using an analyzer milk components of the milk analyzer, as 100 ml of the milk sample was placed in a sealed bottle for each cow and transferred to the apparatus in the Abu Ghraib dairy factory in Baghdad for the purpose of conducting the examination The milk was cooled and placed in a refrigerator at an appropriate temperature for the purpose of the examination the next day. The milk was cooled and placed in a refrigerator at an appropriate temperature for the purpose of the examination the next day Short on the device screen as percentages of each component of milk, which includes fat, protein, lactose, total solids and milk density.

Statistical analysis

CRD was used to analyze the results using SPSS [18] and the significant differences between the means were compared with Duncan [19] multi-range test.

And using the following mathematical model:

$$Yij = \mu + Ti + eij$$

Where:

Yij = the value of the view j of the treatment i

μ= the general average of the trait studied.

Ti= the effect of treatment i.(spraying with water).

Eij= random error that is normally distributed.

Statistical analysis

Experimental data were analyzed according to Completely Randomized Design and the significant differences among means were detected using Duncan's Multiple Range Test at probability of 0.05 [22] . The linear model:

$$\mathbf{Yij = \mu + \tau_i + \varepsilon_{ij}}$$

RESULTS

Tables 1.Showed there were no Significant differences between the treatments in milk production, but arithmetically increasing were made in the fifth, sixth and seventh month for spray treatment month before calving, which recorded 18.25, 18.50 and 15.00 kg/cow/day Compared with the control treatment which recorded decrease in milk production 14.00, 15.00 and 12.50 kg/cow/day, while the spray treatment 14 days before it recorded 15.00, 16.00 and 12.00 kg/cow/day.

Table 1. Effect of spraying pregnant (dry) cows with water on the body before calving during the heat stress period of August and September in daily milk production (kg/cow/day) for the months after birth (mean ± standard error)

Treatments	first month	second month	third month	Fourth month	fifth month	sixth month	seventh month
Without Spray (control treatment) C	15.25±2.05	17.50±1.32	14.25± 0.25	15.50±3.57	14.00±0.70	15.00±1.41	**12.50±0.95**
Spray14days Before calving R1	16.75±1.75	19.00±4.56	16.50±3.70	16.00±3.18	15.00±2.51	16.00±3.39	**12.00±0.07**
SprayaMonthBeforecalving R2	14.50±2.32	19.50±2.10	16.50±1.65	18.00± 2.12	18.25±3.09	18.50±3.88	**15.00±3.02**
significant level	N.S	N.S	N.S	N.S	N.S	N.S	**N.S**

N.S = indicates that there are no significant differences between the coefficients in a vertical way

And it is noted in Table 2 showed that there were no Significant differences between the treatments in total milk production, but there was arithmetically increase in the spraying treatment one month before calving, which amounted to 944.28 kg/cow compared with the control treatment which recorded 812.32 kg/cow, and the spray treatment before 14 day of calving recorded 961.11 kg/cow.

Table 2: Effect of spraying pregnant (dry) cows with water on the body before calving during the heat stress period of August and September in Total milk production (kg/cow/day) for the 7th months after birth (mean ± standard error)

Treatments	Total Milk Production
Without Spray (control treatment) C	812.32±63.95
Spray 14 days before calving R1	961.11±245.81
Spray a Month before calving R2	944.28±151.26
significant level	N.S

N.S = indicates that there are no significant differences between the coefficients in a vertical way.

As for the components of milk, the results of the statistical analysis after two months of birth showed that there were no significant differences in the treatments for percentage of milk fat after two months of birth and after 4 months of birth no significant effect was observed but an increase was noted in the spray treatment 14 days before birth where it recorded 5.08% and The spraying treatment before one month recorded 4.62% compared to the treatment without spraying which recorded 4.52%, and it was not recorded after 6 months of birth any significant effect.

As for the protein in the milk of cows subjected to heat stress, it is noticed from the statistical analysis after two months of birth that there was no significant effect of the two treatments of spraying 14 days before and spraying a month before birth, where the percentage

amounted to 2.90 % and 2.82%, respectively compared to the control treatment, which amounted to 2.62%, no significant differences were recorded after 4 months of birth. There was also arithmetically increase in the spraying treatment a month before which recorded 2.82% compared to the treatment without spraying which recorded 2.52%, while in the treatment of spraying 14 days before, it was recorded 2.67%, and it was noted that there was a significant effect after 6 months of birth for the treatment. Spraying a month ago which recorded 2.77%, and the treatment of spraying 14 days before and recorded 2.62%, compared with the treatment without spraying which recorded 2.50%.

It was noted that the percentage of lactose sugar in milk there were no significant differences among the treatments after two months of birth as it was recorded in the two treatments of spraying 14 days before birth and spraying one month before birth 4.52% and 4.30% respectively, and the control treatment was 4.02%, and it was recorded after 4 months of birth that there was a significant effect for the spray treatment a month before it recorded 4.32% compared to the control treatment which scored 3.82%, and the spray treatment before 14 days recorded 4.05%, as well as 6 months after birth it was noted that there was a significant effect on the percentage of lactose sugar where the spray treatment recorded 4.22% before a month compared to the control treatment It amounted to 3.77%.

The results showed that two months after birth, there were no significant differences among the treatments in the percentage of ash in the milk, as the two treatments of spraying 14 days before birth and spraying a month before birth after two months of birth were 0.60% and 0.66% respectively and the ratio in the control treatment was 0.55%. There were no significant differences between the treatments for the percentage of ash in milk after 4months of birth and after 6 months of birth There was a significant increase for the spraying treatment a month before which recorded 0.60% compared with the non-spraying treatment which recorded 0.52% .

As for the non-fat solids in the milk of Holstein cows subjected to heat stress, the results showed that two months after birth, there were no significant differences among the treatments, and after 4 months of birth a significant increase in the percentage of non-fat solids was observed in the spray treatment one month before calving, which amounted to 7.93% Compared with the control treatment which recorded 7.00%, and the spraying treatment was recorded before 14 days, 7.47%, but after 6 months of birth no significant differences were also observed among the treatments. As for the density of milk it is noticed from the statistical analysis after two and four months of birth that there are no significant differences among the treatments for the studied trait, as well as after 6 months of birth .

Table 3. Effect of spraying pregnant (dry) cows with water on the body before calving during the heat stress period of August and September in milk components for 2 months after birth (mean ± standard error)

Treatments	**Fat%**	**protein%**	**%Lactose**	**Ash%**	**Solids -Non-fat %**	**Milk Density g/cm3**
Without Spray (control treatment) C	5.17± 0.55	2.62± 0.09	4.02± 0.13	0.55 ± 0.02	7.42 ± 0.23	**1.022± 0.000**
Spray 14 days Be-fore calving R1	5.35±0.66	2.90± 0.17	4.52±0.24	0.60 ± 0.04	8.09 ± 0.41	**1.025 ± 0.001**

Spray a Month Be-fore calving R2	5.70 ± 0.67	2.82± 0.14	4.30±0.21	0.66 ± 0.04	7.86 ±0.50	**1.024± 0.002**
significant level	N.S	N.S	N.S	N.S	N.S	**N.S**

N.S = There are no significant differences among the vertical treatme

Table 4. Effect of spraying pregnant (dry) cows with water on the body before calving during the heat stress period of August and September in milk components for 4 months after birth (mean ± standard error)

Treatments	**Fat%**	**Protein%**	**Lactose%**	**Ash%**	**Solids -Non-fat %**	**Milk Density g/cm3**
Without Spray (control treatment) C	4.52±0.67	2.52±0.04	3.82±0.08 B	0.52±0.02	7.00±0.11 B	**1.023±0.000**
Spray 14 days Before calving R1	5.08±0.75	2.67±0.07	4.05±0.09 AB	0.55±0.02	7.47±0.16 AB	**1.024±0.000**
Spray a Month Before calving R2	4.62±0.70	2.82±0.14	4.32±0.21 A	0.57±0.02	7.93±0.37 A	**1.026±0.002**
significant level	N.S	N.S	*	N.S	*	**N.S**

N.S = There are no significant differences between the vertical treatments

*The different letters within the same column indicate that there are significant differences among the treatments at the level of significance ($p < 0.05$).

Table 5 . Effect of spraying pregnant (dry) cows with water on the body before calving during the heat stress period of August and September in milk components for 6 months after birth (mean ± standard error)

Treatments	**%Fat**	**Protein%**	**Lactose%**	**Ash%**	**Solids -Non-fat %**	**Milk Density g/cm3**
Without Spray (control treatment) C	5.35±0.09	2.50± 0.09 B	3.77± 0.13 B	0.52± 0.02 B	7.14±0.21	**1.022±0.000**
Spray 14 days Before calving R1	5.45±0.63	2.62± 0.08 AB	3.95± 0.11 AB	0.55±0.02 AB	7.25 ± 0.23	**1.022± 0.001**
Spray a Month Before calving R2	5.55±1.02	2.77±0.06 A	4.22± 0.08 A	0.60±0.00A	7.73±0.14	**1.024±0.001**
significant level	N.S	*	*	*	N.S	**N.S**

N.S =There are no significant differences between the vertical treatments

*The different letters within the same column indicate that there are significant differences between the treatments at the level of significance ($p < 0.05$).

DISCUSSION

It was agreed in this study with previous studies on, but the differences in this experiment were arithmetic, as previous studies indicated that when spraying with water on the body of cows during the period of heat stress as a means of cooling in the dry period one month before birth, the production of birth milk improved by 1.4 kg / Day after birth [14,19]. Another study indicated that cows that did not experience heat stress before calving produced more milk after parturition [20]. A study indicated [9] that the milk production of sprayed cows was 33.9 kg / cow / day compared to cows that were not exposed to body spray, which recorded 28.9 kg / cow / day.

The absence of statistically significant differences between treatments in milk production for cows may be due to the high standard error in each treatment due to the small number of replicates for each treatment, which led to the absence of statistically significant differences between the treatments.

Researchers [21,6] reported that the exposure of dry cows to prenatal spraying increased some components of milk, with a protein content of 3.01% after parturition compared to dry, unsprayed cows, which scored 2.87% after parturition, and that the use of spray It resulted in a 4.92% higher lactose compared to 4.67% control cows [22]. Perhaps the reason for the improvement of some milk components from the reason for the high percentages of some milk components in cows whose bodies were sprayed with water a month before giving birth may be due to the fact that the spraying reduced the negative effect of heat stress on milk. cows during that period [16] and increased the activity and growth of udder secretory cells [15], which was reflected in the improvement of some milk components .

CONCLUSIONS

It is clear from the previous experience that spraying water on pregnant Holstein cows imported month before calving in heat stress has a positive role in improving and increasing some components of milk which are protein, lactose and ash, and it also has a role in increasing milk production but arithmetically

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