Research Article

Summer "Stress" and Reproduction Indicators in the Cow for Milk Production

Healthcare

Keywords: "stress" of heat, milk cow, clinical indication, oestrus, paraservis period, percentage of fertilization.

Ermal Yzeiraj	**Veterinary Station - District of Fier, Jakov Xoxa n. 9301 Fier, Albania.**
Vangjel Ceroni	**Department of Clinical Subject, Faculty of Veterinary Medicine, Tirana, Albania.**
Erinda Lika	**Department of Clinical Subject, Faculty of Veterinary Medicine, Tirana, Albania.**

Abstract

The caw breeding sector is evolving continuously in response to the rapid growth in demand for livestock products. Increased environment temperature in summer season affect the overall clinical indicators and displays negative consequences on the production and reproduction of animals. In condition of our country, the greatest impact of heat stress in summer affect in the overall clinical indicators. Animal temperature increase by 0.2 to 0.4 ° C, frequency of breathing increases by 3.2 to 4.3 acts on the respiratory minute and the average value of the pulse increases to 2.4 to 4.1 pulsacione per minute. Under the influence of heat stress in the summer season varying the reproductive indexes. The duration of the oestral cycle is increased by 1.2 to 2.2 days, the time of oestrus decreases by 2 to 5 hours, the percentage of fertilization decreases by 20%, but the average time of the first heat show is not affected (before the service period).

Introduction

Stress status is a biological phenomenon of body response to cope with the impact of changes from normal living conditions. The basic elements of animal response to stressful stresses (including "stress" from high summer temperatures) are the changes in hormone production ratios that, acting on the path of metabolic pathways, create conditions for the reestablishment of life activity, *Yadav B, et al. (2013); West, J. W. et al. (1998); Al-Haidary, A. A. et al. (1995).* Among the most active hormones in this complex biological phenomenon are adrenaline (for rapid action) and glycocorticoid hormones (for prolonged action), *Joe W. West. (1999).*

The "stress" of the heat results from the inability of the animal to remove the heat and keep the body temperature in the norm. Environmental factors, including temperature, relative humidity, etc. contribute to the "stress" of the heat in the summer season, *Al-Haidary, A. A. et al. (1995).*

Heat stress can reduce productivity, cause reproductive problems, and compromise the immune system, *Alvarez, M. B. et al. (1973).*Heat stress reduces milk production in cows up to several months later, *Larry E. (2007); Maust, L. e. Et al. (1972).*Heat stress reduces the absorption of dry matter with food, reduces rumen's movement and contraction, changes the fermentation pattern and fatty acid production ratios, affects nutrient digestibility and utilization and thus damages productivity, *Kibler,H. H. et al. (1953); West, J. W. et al. (1998); NRC. (1989); Kume, S., et al. (1987).*

The object of this article is to identify the environmental factors that contribute to changes in overall clinical and reproductive indicators in dairy cows.

Material and Methods

a. Farm Selection

For study selected a farm with 160 Holstain cows e divided in two type of Stalls. An old type of stall with closed walls and small windows and a new stall semi-enclosed or walled by the north.

b. Groups of Cows

The study were included all farm cows that were divided in 4 groups with almost equal numbers of heads. In the composition of the groups there were cows of different age and with different physiological conditions, as follows:

The first group: with 38 heads of older cows from 3 to 5 years in the study period,15 May to 15 September, the cows of this group were held during the day in a shady environment in nature. The animals entered on the stall only for milking.

The second group: 44 heads of cows were kept in the old-style stall, and used bench (without tree shades) for the rest. The animals of this group spent the night at the stall.

The third group: with 36 heads, was held at the new stall, but it also exploited the partially shady bench for a break and a walk.

The fourth group: with 42 heads, stayed all the time in the new stall, without taking advantage of the bench for rest and walk.

c. Prepare Groups for Study

The animals of all groups, after the formation, were held for one month (15 May to 15 June) in environments adopted for study. All animals were fed with equal ration and supplied with water of the same source. The experiment began on June 15 and continued until September 15th. For the hot period of the year (3 months).

d. Methods

The cows were studied for 3 months at different temperature and humidity of the environment and the stalls. In each of the environment where the animals were standing, a thermohydrocarbon was placed to record the temperature and humidity of the environment.

All group animals were measured and determined by general clinical indicators, rectal temperature, respiratory densities (per minute) and heart work density in minute. Measurements for clinical indicators were performed twice a day at 9^{-oo} and at 21^{-oo}. At the same time for the groups were recorded the time of the first oestrus appearance after calving, the repetition of the estral cycle in the day, the length of the oestrus (in hours) and the percentage of fertilization.

e. Data Processing

At the end of the study period, were did data grouping for all indicators, which will be presented in the mean value and at the minimum and maximum limits.

The values gained for all the indicators were statistically processed with the ANOVA method and the relative correlation between temperature and relative humidity of the environment in different animal groups, clinical indicators and reproduction was determined by the correlation coefficients of the shift and the linear regression graphs.

Results and Discussion

The environmental parameters of humidity and temprature and clinical indicators realized in cows for the study period are shown in tab. 1.

***Table 1:** Environmental and clinical parameters in cows according to the groups in the study.*

Groups	Temp. environment (°C)	Relative Humidity (%)	Rectal Temp. (°C)	Breath/ minute	Puls/minute
First (Avrerage) **Min-Max**	16.7 ± 0.2 9.8 – 22.4	46.3 ± 0.3 14 - 50	38.6 ± 0.12 38.4 - 39.1	27.7 ± 0.11 25 - 37	72.4 ± 0.3 69 - 82
Second (Avrerage) **Min-Max**	34.2 ± 0.13 27.5 - 41.5	53.1 ± 0.32 55 - 78	38.8 ± 0.2 38.7 - 40.1	37.3 ± 0.23 27 - 52	74.6 ± 0.3 71 - 83
Third (Avrerage) **Min-Max**	32.1 ± 0.2 24.5 – 42.3	56.2 ± 0.3 55 - 65	38.7 ± 0.11 38.6 – 40.0	34.2 ± 0.2 42 - 49	73.4 ± 0.31 68 - 83
Fourth (Avrerage) **Min-Max**	33.3 ± 0.12 25.1 - 35.5	56.6 ± 0.26 55 - 67	38.7 ± 0.21 38.9 - 40.2	35.6 ± 0.23 30 - 51	74.1 ± 0.22 67 - 88

Our data clearly show that with the increase in environmental temperature, changes and clinical parameters change. Thus, at a temperature of 9.8 to 22 °C (the first group), the body temperature measured in the rectum ranges from 38.4 to 39.1 °C.In cases where the ambient temperature limits range from 27.5 °C to 41.1 °C (second group), the rectal temperature in animals ranges from 38.7 to 40.1 °C, (fig.1).

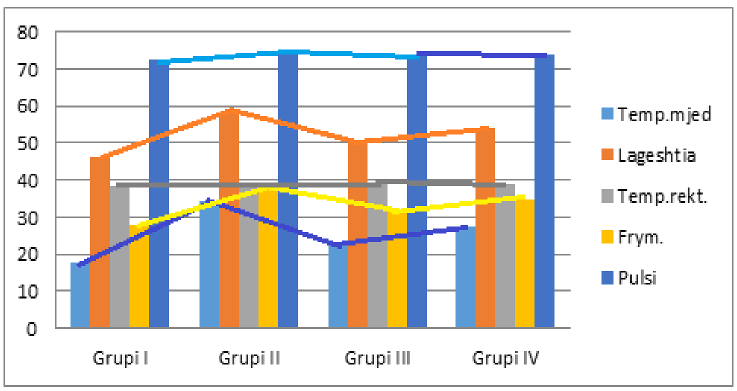

***Fig. 1:** Changes in clinical and environmental indicators in cows by groups in the study.*

This is associated with a significant increase in relative humidity of the air. The storage of cows in semi-open stalls (third and fourth groups) gives a lower body temperature fluctuation, although the Environmental temperature is more high at its minimum level.

The graph data shows that the average ambient temperature value is higher in the second and fourth and lower group in the first and third groups.

Respiratory densities appear to be significantly affected by environmental fluctuations and air humidity. Animal stasis in the shade significantly reduces breathing rate, but does not stabilize at normal limits, keeping the cows in stall affects the increase in breathing density.Heartbeat is almost never affected by the change in ambient temperature.

In tab. 2, are reflected the data obtained from the monitoring of reproduction indicators by the groups of cows in the study. After the data grouping and processing, are shown that the oestral cycle intervals are prolonged by the increase of temperature and relative humidity of the air. They fluctuate from 21.2 average days at ambient temperature 9.8 - 22.4 ^{o}C, at 22.6 average days at 27.5 - 41.5 ^{o}C.

Exceptions to this rule make the second group where temperature and humidity are at higher levels, repeating the oestral cycle occurs every 21.7 days. Such an occurrence is also reported by other authors, *Yadav B, et al. (2013); West, J. W. et al. (1998); Al-Haidary, A. et al. (1995).*

Table 2*: Reproduction indicators in cows, by groups in the study.*

Groups of cows	**Paraservisperioda (day)**	**Oestral Cycle (day)**	**Oestrus stretch (h)**	**Fertilization %**
First (Avrerage) **Min-Max**	42.2 ± 0.12 41 - 55	26.2 ± 0.1 21 - 27	13.6 ± 0.2 13.4– 14.4	61.3 ± 0.2 40 - 80
Second (Avrerage) **Min-Max**	42.4 ± 0.2 42 - 57	22.4 ± 0.2 19 - 26	9.1 ± 0.3 8.2 - 10.2	33.6 ± 0.3 10 - 51
Third (Avrerage) **Min-Max**	43.6 ± 0.13 42 - 58	23.2 ± 0.1 21 - 27	12.2 ± 0.12 11.6 – 14.2	38.7 ± 0.4 34 - 55
Fourth (Avrerage) **Min-Max**	42.4 ± 0.14 39 - 55	26.4 ± 0.12 21 - 26	13.4 ± 0.21 12.5 – 15.1	39.4 ± 0.2 22 - 52

Extension of the oestral cycle is significantly influenced by the temperature and humidity of the environment. In the first group the oestral cycle lasted 13.4 - 14.4 hours, while in the second it lasted 8.2-10.2 hours, (fig. 2).

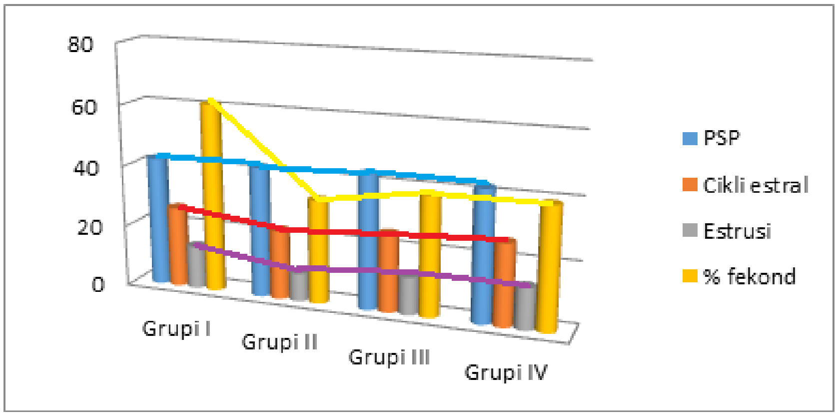

Fig. 2: *Changes in reproduction indicators in cows depending on the environmental conditions*

Keeping cows in the shade in the stalls affects thedecrease extension of the oestral cycle of the cows (the third and fourth group). As other authors claim, at high environmet temperatures, and when cows are maintained in the stalls, oestrus is quite and difficult to detect.

Fertilization is higher in optimal environment temperature (first group) and reached at 40-80% limits. In the near boundaries is also the third group, for the cows that are manteined in the stall and bench. In this group, the fertilization reached at 34-55%.The fertilization indicator was lower in the other two groups. This proves once again that interventions to improve the fertizilation in cows should be taken in consoridatin the environmental conditions.

Of interest are the correlative correlations between the average indicators of temperature and relative humidity of the air with clinical parameters and reproduction in cows.

From the data obtained, it appears that the impact of environmental conditions on cow reproduction processes begins to be established when the environmental temperature exceeds 31oC boundaries. The study found that to occur these cows should stay in such environments one preliminary adoption and at least for a period of 8 to 10 days.

The most noticeable influence on the reproduction parameters on cows from the environment temperature was evidenced in the duration of the oestrus, in the shortening of the oestral period, in the silent forms of oestrus, and in reducing the percentage of fertilization, (tab.3).

Related results are also reported by other researchers. According to,*Chose et al. (2007),* under the influence of heat stress, the duration and intensity of estrus on the cows decreases. Equiteoestrus until anestrus, frequent ovulation failure, prolongation of the maturing period of follicles and decrease of oocyte and fertilization quality in the end is reflected by the increase in the index of copulation, *West, J. W. et al. (1998); NRC. (1989),* are the most frequent signs of cows breeding in high temperature environments. The correlation between the indicators in the study is presented in tab. 3.

Tabela 3: *Correlation coefficients between environmental, clinical and reproductive indicators in cows of study groups.*

	Relative Humidity (%)	Rectal Temp. (°C)	Breath/ minute	Puls/minute	Oestral cycle	Oestrus extrusion	Fertiliz.
Temp. environment, °C	0.56	**0.71**	**0.7**	0.57	0.33	-0.3	0.03
Relat Humidity (%)	0	**0.71**	**0.74**	**0.78**	0.14	0.41	**0.64**
Rectal Temp. (°C)			**0.81**	**0.72**	0.43	-0.06	0.56
Breath/ minute				**0.63**	0.18	-0.11	0.3
Puls/minute					0.15	0.49	0.53
Oestral cycle						-0.41	0.43
Oestrus extrusion							0.48

From the data (tab. 3), it appears that the influence of environmental factors has strong corelation with clinical parameters and between them there are strong correlation relationships.Correlative relationships between environmental parameters and reproduction parametersare weak and sometimes have a negative character (fig. 3, 4, 5).

The exception to this rule is the relative humidity of the air over the extrusion length and on the fertilization, however, this relation remains weak.

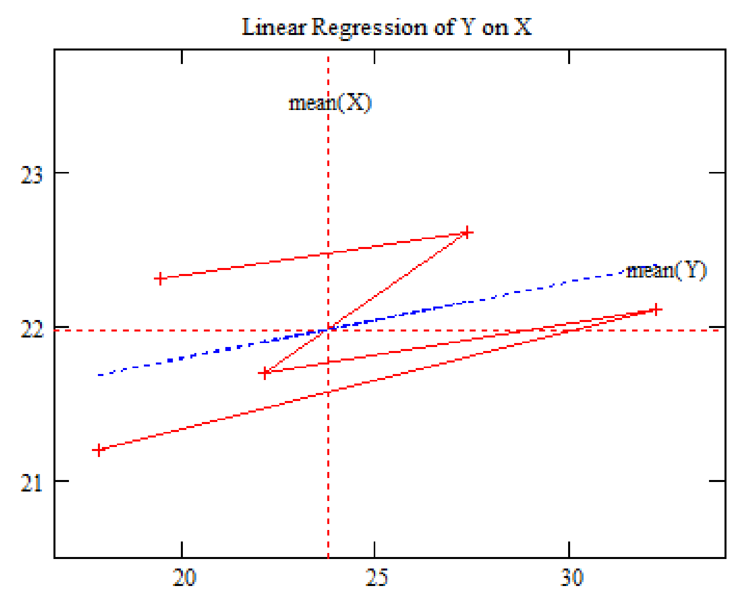

Fig. 3: *Relationships between the environmental temperature and the period of the oestral cycle in the cows. (r = 0.435)*

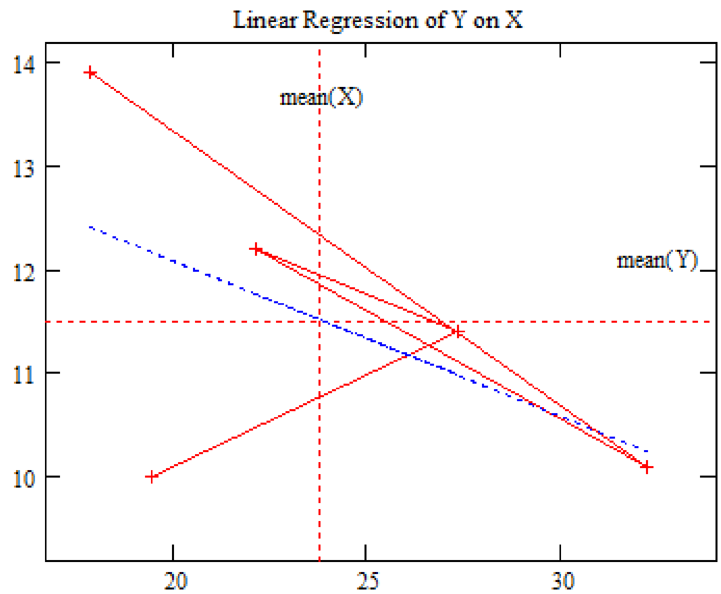

Fig. 4: *Relationships between the environmental temperature and duration of the ocular cycle in cows. (r = - 0.549)*

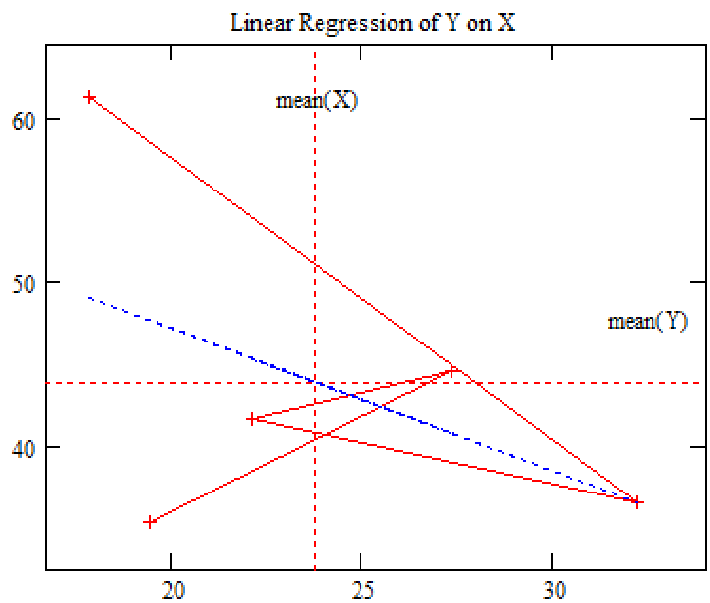

Fig. 5: *Relationship between environmental temperature and percentage of fertilization in cows. (r = - 0.413)*

Our data is also approaching the data of many other authors, *Berman, A. (2005),* who claim that the impact of environmental factors is primarily in the metabolic processes, biosynthesis and the release of various hormones in order to maintain the state of homeostasis in the body. Primary hormones include insulin, glucagon, adrenaline, and less other hormones.

The sexogenic hormone secretion decreases significantly in the conditions of high metabolic energy needs, *Fox, D.G. et al (1998); Kume, S. Et al. (1987).*

The optimum environmental temperature for dairy cows to provide normal productive and reproductive life activity is influenced by the animal's physiological condition and the moisture conditions in the outdoor environment. The cows in lactacion like optimum ambient temperature ranges from 5 to 15 ^{o}C. High environmental temperatures have an impact on cows' productive and reproductive abilities. At ambient temperatures affect air humidity, especially its increase. Cows better cope with increased ambient temperatures in dry air conditions. Temperatures 30 ^{o}C with low air humidity level is better tolerated than the temperature of 20 ^{o}C but with a high level of air humidity, *Yadav B, et al. (2013); West, J. W. et al. (1998); Al-Haidary, A. et al. (1995).* The cows can withstand low temperatures at -37 ° C, but temperatures above 23 ^{o}C can cause "stress" when combined with high humidity, low air or sun movement direct, *Yadav B, et al. (2013)*.

Conclusions

1. Clinical and reproductive indicators vary depending on the relative temperature and relative humidity of the environmental air.

2. The correlation shows that there is a strong correlation between environmental indicators and clinical parameters, while reproductive parameters generally have weak correlation.

3. Relative air humidity has stronger correlations with both clinical and reproduction parameters.

4. The effects of environmental parameter varation on clinical and reproductive indicators are the result of metabolic and first-order metabolic disorders as the energy balance changes and inhibits the synthesis of anabolic hormones and promotes the synthesis of catabolic hormones.

References

Al-Haidary, A. A., D. E. Spiers, G. E. Rottinghaus, and G. B. Garner. (1995). Effect of administration of ergovaline on the thermoregulatory functions of beef calves under heat stress. J. Anim. Sci. 73(Suppl. 1):132.

Alvarez, M. B., and H. D. Johnson. (1973). Environmental heat exposure on cattle plasma catecholamine and glucocorticoids. J. Dairy Sci. 56:189−194.

Berman, A. (2005). Estimates of heat stress relief needs for Holstein dairy cows. J. Anim. Sci. 83:1377-1384.

Chose L. E. (2007); Heat stress in dairy cattle. ppt.

Fox, D.G. and T.P. Tylutki. (1998). Accounting for the effects of environment on the nutrientrequirements of dairy cattle. J. Dairy Sci. 81:3085-3095.

Joe W. West. (1999). Nutritional Strategies for Managing the Heat-Stressed Dairy Cow1. J. anim. Sci.77:21-35.

Kibler, H. H., and S. Brody. (1953). Influence of humidity on heat exchange and body temperature regulation in Jersey, Holstein, Brahman and Brown Swiss cattle. Missouri Agric. Exp. Sta. Bull. No. 522. Columbia.

Kume, S., M. Kurihara, S. Takahashi, M. Shibata, and T. Aii. (1987). Effect of hot environmental temperature on major mineral balance in lactating cows. Jpn. J. Zootech. Sci. 58:764−770.

Larry E. (2007). Climate Change Impacts on Dairy Cattle. Department of Animal ScienceCornell University, Ithaca, NY 14853

Maust, L. E., R. E. McDowell, and N. W. Hooven. (1972). Effect of summer weather on performance of Holstein cows in three stages of lactation. J. Dairy Sci. 55:1133−1139.

NRC. (1989). Nutrient Requirements of Dairy Cattle. 6th rev. ed.Natl. Acad. Sci., Washington, DC.

West, J. W., G. M. Hill, P. Mandebvu, J. M. Fernandez, and B. G. Mullinix. (1998). Effects of dietary fiber on intake, milk yield, and digestion by lactating dairy cows during cool or hot, humid weather. J. Dairy Sci. (In press).

Yadav B, Singh G, Verma AK, Dutta N and Sejian V. (2013). Impact of heat stress on rumen functions.Veterinary World,6 (12): 992-996.