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LIST OF ABBREVIATIONS

A	Albumin
A/G	Albumin globulin ratio
APRI	Animal Production Research Institute
AT	Air temperature
ADG	Average daily gain
Ba	Basophils
BW	Birth weight
°C	Celsius degree
G	Globulin
H	Hour
G	Gramm (10^{-3} Kilogram)
Hb	Hemoglobin
HS	Heat stress
Kg	Kilogram (10^3 gram)
lym	lymphocytes
mg	Milligram (10^{-3} gram)
µg	Microgram (10^{-6} gram)
mL	Milliliter (10^{-3} litter)
Mon	Monocytes
ng	Nano gram (10^{-9} gram)
Neu	Neutrophils
p/min	Pulse per minute
PR	Pulse rate
r/min	Respiration per minute
r.p.m.	Rotation per minute
RBCs	Red blood cells count ($X10^6/mm^3$)
RH	Relative humidity
RR	Respiration rate
RT	Rectal temperature
S	Shade
T₃	Triiodothyronin hormone
T₄	Tryroxine hormone

THI	Temperature-humidity index
TP	Total protein
WBCs	White blood cells count ($10^3/\text{mm}^3$)
WS	Without shade

5. SUMMARY and CONCLUSIONS

The present study was carried out in Seds Experimental Farm in Beni Swif Governorate, buffalo breeding research department, Animal Production Research Institute (APRI), Agriculture Research Center, Ministry of Agriculture, Egypt. A total of ten late pregnant buffaloes (two months before parturition) were assigned to this experiment. The animals were randomly divided into two groups each of 5 animals (pregnant buffaloes). The first group unshaded exposure solar radiation and the second group under the cement shaded which had 3 rows of straw bales on the ceiling. The aim of study was to investigate the effect of Egyptian environmental conditions on physiological and immunological responses of newborn calves when their dams exposed to heat stress from solar radiation at the end of pregnancy period. Therefore, temperature humidity index, rectal temperature (RT), respiration rates (RR), pulse rates (PR) were recorded before and after parturition for dams and thier offspring from birth to weaning. After parturition birth weight were recorded and the blood samples were collected within the first 3 days of calving, then biweekly blood samples were taken from dams and their offspring, until the end of weaning also calves weight were recorded biweekly until the end of the experimental period . The samples were used to determine hematocrit (HCT), hemoglobin (Hb), red blood cells count (RBCs), white blood cells count (WBCs), leucocytes, total protein (TP), albumin (A), globulin (G), albumin / globulin ratio (A/G ratio), total IgG, T₃ and T₄ hormones concentrations. Colostrum and milk samples were collected for protein, fat, total solid and lactose analysis. Also, total milk yield was calculated.

Results of studied physiological and immunological responses to heat stress can be summarized as following:

• **Thermo-respiratory responses:**

1. Rectal temperature, respiration rates and pulse rates were significantly higher in un-shaded dams group compared with shaded group for dry period.
2. After parturition all dams had no significant differences between two groups. Except in the first three days after parturition it was a significant difference between two groups.
3. There were no significant differences observed in RT, RR and PR between two studied groups (un-shaded and shaded) for all the offspring except their observations in the first three days after birth.

• **Hematological picture:**

1. There were significant higher values ($P < 0.05$) for hematocrit%, hemoglobin concentration and RBCs ($\times 10^6/\text{mm}^3$) in shaded dams group compared with un-shaded group during dry period. However, after parturition differences between them were decreased and became not significant during the first three days after parturition.
2. On the contrary the WBCs count was not significantly increased in response to this stress between the two dam groups and were 6.8 ± 0.23 and $6.50 \pm 0.17 \times 10^3/\text{mm}^3$, respectively during two months after parturition.
3. Calves from un-shaded dams had lower hematocrit ($29.476 \pm 0.326\%$) however calves from S group had a significantly higher value ($P < 0.05$) it was $33.5 \pm 0.92\%$. Also, the highest value in hemoglobin concentration for shaded dam's calves was 12.5 ± 0.40 g/dl during 15 weeks old meanwhile in calves for un-shaded dams was 9.84 ± 0.105 g/dl at the same age.

4. There were higher significant values of RBCs ($\text{X}10^6/\text{mm}^3$) in calves from shaded group compared with calves from un-shaded dams (5.9 ± 0.05 and $4.4 \pm 0.036 \text{ X}10^6/\text{mm}^3$, respectively). Meanwhile there were no significant differences in WBCs count in both groups.
- **Leukocyte types:**
 1. Dams from WS group had higher significant differences ($P < 0.05$) compared with S group of neutrophils and less value of lymphocytes. And there were significant differences for eosinophils and monocytes between them however, no significant differences for basophils percentages between shaded and un-shaded dams groups.
 2. The Leukocyte types percentages (%) showed high value of neutrophils and less value of lymphocytes in offspring from un-shaded group than those from shaded group. And there were significant differences ($P < 0.05$) for eosinophils and monocytes however; no significant differences for basophils percentages between shaded and un-shaded offspring groups.
 - **Total protein (TP), Albumin (A), Globulin (G) concentrations and A/G ratio**
 1. The value of total protein, globulin concentrations and albumin/globulin ratio were higher in S group than WS group. However, there were no differences in albumin between both groups.
 2. Calves from dams in group un-shaded had lower ($P < 0.05$) plasma total protein, globulin and albumin/globulin ratio from birth to 15 weeks of age compared with those in shaded group. Meanwhile, there were no significant differences in albumin between both groups.

- **Immunoglobulin (IgG) concentration:**
 1. The mean total immunoglobulin concentration (IgG) in group WS and group S buffaloes was 521.7 ± 4.95 and 614.7 ± 13.02 mg/dL, respectively.
 2. Calves exposed to solar radiation heat stress in utero had a decrease ($P < 0.05$) total IgG concentration in their plasma and decreased during the first 15 weeks of age compared with those for shaded group.
- **Thyroid hormones (Triiodothyronine hormone (T_3) and thyroxin hormone (T_4))**
 1. The mean values for T_3 and T_4 hormones were 126.9 ± 6.26 vs 412.6 ± 13.01 and 11.4 ± 1.14 vs 17.90 ± 0.56 ng/ml in experimental dam groups WS and S groups respectively.
 2. S Group calves had a higher level of T_3 and T_4 concentrations (232.4 ± 20.65 and 12.9 ± 0.67 ng/ml respectively) compared with WS group 123.5 ± 9.83 , 8.7 ± 0.52 ng/ml, respectively.
- **Growth performance**
 - ★ **Birth weight (BW)**

The highest value of (BW) was for shaded group calves at birth (43.0 ± 8.3 kg) while in un-shaded group was 39.0 ± 1.4 kg. Also the calves of group WS had a lower weaning weight (90.2 ± 7.4 Kg) compared with those for group S (102.4 ± 4.5 Kg).
 - ★ **Average daily weight gain:**

The results showed significant differences of daily gain in calves for shaded group than calves for un-shaded group.
- **Colostrum and milk compositions:**
 1. Shaded Group had a higher value of total protein, fat and total solid in their colostrum (13.46 ± 0.088 , 9.59 ± 0.067 and 26.67 ± 0.278 %) respectively. Meanwhile, they were 9.9 ± 0.15 , 7.12 ± 0.083 and 22.36 ± 0.278 % ($P < 0.01$) respectively for un-

shaded group. However, there were no significant differences for lactose and ash percentages between both groups they were (0.844 ± 0.04 , 1.224 ± 0.242 and 0.932 ± 0.034 , 1.06 ± 0.025 %) for un-shaded and shaded group respectively.

2. The results obtained showed no significant differences between both un-shaded and shaded groups for milk compositions. But shaded group had slightly higher values in total protein, fat, lactose and total solid (4.36 ± 0.067 , 6.9 ± 0.067 , 5.264 and 17.376 ± 0.159 % respectively) compared with un-shaded group (3.92 ± 0.017 , 5.9 ± 0.073 , 4.35 ± 0.051 and 15.012 ± 0.107 % respectively).

- **Total milk yield (TMY):**

There was a significant difference ($P < 0.05$) between two groups in total milk yield. It was higher in shaded group compared with un-shaded group they were 1092.75 and 1340.25 Kg/ 235 day.

Conclusion and Recommendations

The results of this study can be concluded as:

- (1) Exposing buffalo dams to the solar radiation, negatively affected on their physiological responses, immunity, colostrum and milk composition and total milk yield. Also, it was affected on physiological and immunological responses of their newborn calves.
- (2) Heat stress during dry periods caused decreasing in blood components for them and their offspring. Also, in decreasing calf birth weight and compromised the passive IgG transfer from colostrum.
- (3) Utero heat stressed were negatively affecting of birth and its weaning weight of offspring. And calves can express tolerance to environmental conditions from their dams (increasing of lymphocyte

and monocyte counts of calves were considered as indicators for immunological activity against the bad environmental conditions).

(4) We can improve the immunity for newborn calves by good management during last two month before parturition of their dams.