Effect of Micro-Environment on Physiological Responses of Kids*

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Kid rearing in intensive management is related to high mortality and poor growth because of improper micro environment. A direct environmental consequence is the stimulation of neuro-endocrine system, resulting in the loss of or conservation of heat to maintain the body temperature within the narrow optimal range for biological activity. Cardinal physiological responses of kids are influenced by micro-environment within the animal shelter. Hence, a suitable and viable shelter needs to be developed to rear goats under intensive management.

Materials and Methods

The three different types of shelter structures were constructed with different materials to provide micro environments to 3 groups. Group 1 was in concrete shelter (concrete floor, roof, wall), Group 2 was in kuccha floor, thatched roofed with wire fencing type of shelter and Group 3 was in raised slotted floor (height 1.65ft) made up of a wooden planks (gap between two slots was 2.5cm), with thatch roof and wire fencing. Space was provided according to ISI standard, such as 5.44 sqft (covered area) and 10.89 sqft (open area) for each kid (4-16 months aged).

Thirty female crossbred (Alpine x Beetal) kids, around 4 months old were allotted randomly into 3 groups (housing). The average body weights of these groups were similar.

All kids were fed similar fodder and concentrate as per feeding schedule followed at NDRI farm. Other general management was similar to the one being practiced at farm.

The cardinal physiological reactions were recorded for all kids at 8.00 A.M. and 3.00

P.M. at fortnightly intervals for one year. Body temperature (or rectal temperature) pulse rate and respiration rate were recorded at above timings.

Micro-environmental parameters like maximum, minimum, average daily temperature, dry and wet bulb temperature, relative humidity (RH) were recorded. The THI (McDowell, 1992) was worked out with the help of dry bulb and wet bulb temperature which was recorded daily at 9.00 A.M. and 3.00 P.M.

The 2 way analysis of variance (Snedecor and Cochran 1994) was applied for the analysis of experimental data. The paired t-test was applied to find out the difference between morning and evening RH and THI. The correlation coefficients between various micro-environmental parameters and cardinal physiological reactions were obtained according to Steel and Torrie (2001).

Results and Discussion

The results of different months and seasons were classified as Summer (April - June), Rainy (July - August), Autumn (September - October), Winter (November - January) and Spring (February - March). Months were serially numbered 1 to 12 from January to December.

The lowest BT (Body temperature) (M) & (E) was found at 11th month of spring season in all groups. The highest BT (M) & (E) were found during 4th to 5th month period. Higher value of body temperature indicated that kids suffer from physiological stress. The kids of group-1 was in maximum stress condition followed by kids of group-2 and least stress was at kids of group-3

in all seasons. This might be due to the reason that higher climatic temperature in the concrete shelter which was somewhat closed type had higher temperature as compared to thatched shelter which was open type. The body temperature during evening time was higher as compared to morning time in all three groups and all months. It might be due to higher environmental temperature during evening time, which increases body temperature of kids. The ANOVA revealed that shelter group, month, season, time had significant ($P < 0.01$) effect on body temperature. The paired-t test indicated that there was significant ($P < 0.01$) difference between BT during morning and evening times in all groups, months and seasons. Das *et al.* (1991) observed that mean monthly rectal temperature was lowest in January and highest in April. Kabuga (2005) reported that ambient temperature influenced physiological reaction of animal.

The lowest PR (Pulse rate) (M) & (E) were found at 11th month in all groups. The higher PR (M) & (E) were found during 4th to 5th months in all groups. The highest stress was on kids who were in group-1 but less stress was on kids who were in group-2 and least stress was in group-3 during all periods and seasons. It might be due to higher condensation of moisture (present in air) by concrete shelter. The concrete roof and concrete floor condensed the moisture and held it in that micro-environment leading to high RH. On the other hand, thatched shelter had superior protective power against moisture, which resulted in less moisture in that micro-environment. The ANOVA indicated that shelter group, month, season, time had significant ($P < 0.01$) influence on pulse rate. The pulse rate was higher during evening as compared to morning time during all seasons and shelters. It might be due to higher THI which increased the pulse rate of kids. From "t-values" it could be noted that there was a significant ($P < 0.01$) variation between morning PR and evening PR in three shelters and all seasons. Bhakat *et al.* (2004) found minimum variation of pulse rate for those animals that were kept under thatch roofed open type shelter.

The lowest RR (respiratory rate) during morning and evening were found during 10th to 11th month. But higher values were found during 4th to 5th month during rainy season. Higher value of respiration rate indicated that kids suffered from physiological stress. The kids of group-1 were in maximum stress condition. But comparatively less stress was found in kids of group-2 and least stress in kids at group-3 during all periods. This might be due to less RH and temperature under thatched shelter as compared to concrete shelter. The ANOVA revealed that shelter group, month, season and time had significant ($P < 0.01$) effect on RR. It was higher during evening as compared to morning time. It is due to higher THI during evening as compared to morning time during all seasons under three shelters. The paired t-test indicated that there was significant ($P < 0.01$) difference between RR during morning and evening time Bhakat and Nagpaul (2005) reported less stress on kids kept under thatched shelter as compared to kids kept under concrete shelter.

The scrutiny of micro-environmental data of all months revealed that the highest average temperature and highest maximum temperature were recorded during 2nd month and lowest was at 11th month. The highest minimum temperature was found during 4th month and the lowest values were observed during 10th month. The ANOVA revealed that shelter, season, and month had significant ($P < 0.01$) effect on maximum, minimum and average temperature. Kaushish *et al.* (1985) reported that average temperature; RH and THI of goat house were 24.2°C, 32.7%, 58.8°C and 39.9°C, 55.9% and 60.3 in the morning and evening, respectively.

The highest RH (Relative Humidity) (M) was during 10th month and the lowest RH (E) was in 1st month. The ANOVA indicated that shelter, month, and season had significant ($P < 0.01$) effect on RH (M) and RH (E). In any particular period, RH (M) was higher than RH (E). This might be due to more condensation of moisture present in air in early morning. As the day progressed, moisture became less. The "t-values" re-

vealed significant ($P < 0.01$) variation between RH (M) and RH (E) during all periods, shelters and seasons.

The lowest and highest THI (Temperature, Humidity Index) (M) was during 9th and 4th month, respectively. Since THI (M) was below 80.00 under thatched roofed shelters in all seasons kids under this shelter had least stress compared to concrete shelter where THI was above 80.00 in summer and rainy seasons. The highest THI (E) was observed in the 1st month under concrete shelter and in 2nd month under thatched shelter during summer season. The lowest values were found during 11th month in spring season. The less THI (E) values were obtained under thatched shelter as compared to concrete shelter in all seasons. The ANOVA revealed that shelter, season and month significantly ($P < 0.01$) affected THI (M) and THI (E). During all period evening THI was higher than morning THI. From "t-values" it could be noted that there was a significant ($P < 0.01$) variation between morning THI and evening THI during all months and seasons. Ghosh and Pan (1994) reported that THI (E) was 82.06 ± 2.58 and 68.80 ± 0.58 during hot-humid and cold-humid season.

The correlation coefficient between micro-environment of shelter and physiological reactions of kids revealed that BT (Body temperature) (M) was positively and significantly ($P < 0.01$) correlated with maximum and minimum temperature, THI (M), but negatively correlated with RH (M) in all three shelter groups. The BT (E) was positively and significantly ($P < 0.01$) correlated with maximum and minimum temperature, RH (E) and THI (E) under all groups of shelter. In the present study, pulse rate and respiration rate were (M and E) positively and significantly ($P < 0.01$) correlated with maximum and minimum temperature and THI (M and E), RH (M and E) in three groups of shelter. It was observed that correlation coefficient between BT and PR; BT and RR; PR and RR during morning and evening time were positively and significantly ($P < 0.01$) correlated. The study concludes that crossbred female kids are in least stress in the micro-environment of shelter constructed with

raised-slotted floor with thatched roof during most of months and seasons of a year.

Summary

An experiment was carried out on thirty crossbred female goat kids maintained in three different types of shelters and investigated cardinal physiological reactions of kids in relation to micro-environment of shelter for one year covering all seasons. The BT, PR and RR of kids were significantly ($P < 0.01$) influenced by shelter group, month and season. The paired-t test indicated that there was significant ($P < 0.01$) difference between morning and evening BT, PR and RR in all groups, months and seasons. The ANOVA revealed that shelter, season and month had significant ($P < 0.01$) effect on maximum, minimum, average temperature, RH and THI. There was a significant ($P < 0.01$) variation between morning and evening values of RH and THI during all months, shelters and seasons. Over all in a year, the kids under concrete shelter were in maximum stress condition followed by thatched roof tough floored shelter and least stress was in raised slotted floor with thatched roof shelter.

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