



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(6): 2535-2538

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Received: 19-09-2019

Accepted: 21-10-2019

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## Effect of temporary roof modification on physiological parameters of sahiwal calves in arid regions

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**Abstract**

The study was conducted on eighteen female Sahiwal calves of 6-12 months for a period of 3 months in arid region of Rajasthan at Livestock Research Station, Kodamdesar Bikaner. The calves under experiment were divided into three treatment groups i.e. T<sub>0</sub> (Control group having asbestos sheet as roof), T<sub>1</sub> (Thatch roof which is having thatch over asbestos sheet as modification) and T<sub>2</sub> (Agro-net roof which had Agro-net over asbestos sheet as a modification). All the three groups were managed under similar system of management. The result showed that the rectal temperature and the respiration rate was significantly lower ( $P < 0.05$ ) in T<sub>1</sub> followed by T<sub>2</sub> and least in T<sub>0</sub> whereas pulse rate was non-significantly lower in calves under T<sub>2</sub> followed by T<sub>1</sub> and highest in T<sub>0</sub> groups.

**Keywords:** Agro-net, physiological, respiration rate, roof modification, sahiwal calves and thatch

**Introduction**

Housing type and environment has profound effect on the physiology of the animals and in turn manifest effect on the feeding, health condition, performance and behaviour of dairy animals. Tropical countries like India, extended periods of high ambient temperature coupled with high relative humidity compromise the ability of the dairy animals to dissipate excess body heat which results into heat stress in animals. Heat stress in dairy cow leads to various changes such as reduced feed intake and increased water intake, changed metabolic rate and maintenance requirements, increased evaporated water loss, increased respiration rate, changed blood hormone concentration, and increased body temperature which negatively affect the performance of cow (Koubkova *et al.*, 2002) [8]. Solar radiation is a major factor in heat stress by direct as well as indirect means (Shearer *et al.*, 2002) [14]. In order to prevent heat stress in animal there should have provision of shade materials as availability of shade helps to mitigate the effects of radiation, which may improve animal productivity in warm climates without additional costs (Berman and Horovitz., 2012) [2]. Proper shade reduces the severity of the heat stress compared to open sky (Singh *et al.*, 2008) [13]. The amount of reduction in radiant heat load and micro environment inside the shed depends on design and the material used for the shade (Badino., 2007) [1]. Macro and micro-climate inside the shed had pronounced effect on physiological response and growth of calf based on comfort of animals (Roy and Chatterjee., 2010) [12]. Therefore selection of roof material should be done in the manner to provide maximum comfort to animals in different agroclimatic conditions.

**Materials and methods**

The study was conducted at Livestock Research Station, Kodamdesar which is situated at an altitude of 201 meters above the mean sea level in the Thar Desert, about 32 km away from the city of Bikaner in Rajasthan. For the study eighteen female Sahiwal calves of 6-12 months of age were selected and divided into 3 groups and each group was allotted randomly to the following housing conditions/treatments: T<sub>0</sub> Control (Asbestos roof) houses having covered area with asbestos cement sheet roofing, T<sub>1</sub> (Thatch roof house) having approximately 15 cm thick layer of khimp (*Leptadenia pyrotechnia*) was put on the asbestos roof as a roof modification and T<sub>2</sub> (Agro-net roof house) in which green and black coloured knitted fabric was put on the asbestos roof as roof modification. The work was carried out for a period of three months and all animals were kept for adaptation period of one week.

The climatic conditions, feeding & management practices were same for all treatment groups. During the experimental trial physiological variables i.e. rectal temperature which was recorded by using a digital clinical thermometer in ( $^{\circ}\text{C}$ ), respiration rate that was counted from a distance by observing flank movements and expressed as count per minute and pulse rate which was measured by placing finger tip at the coccygeal artery and expressed as beats per minute were recorded on weekly basis.

**Statistical analysis:** The data for all measured variables were analyzed using one way ANOVA procedure of SPSS version 20 (SPSS for Windows, V 20.0; SPSS Inc., Chicago, IL, USA). The significant difference for the different variables was determined using Duncan Multiple Range Test of Significance.

## Results and Discussion

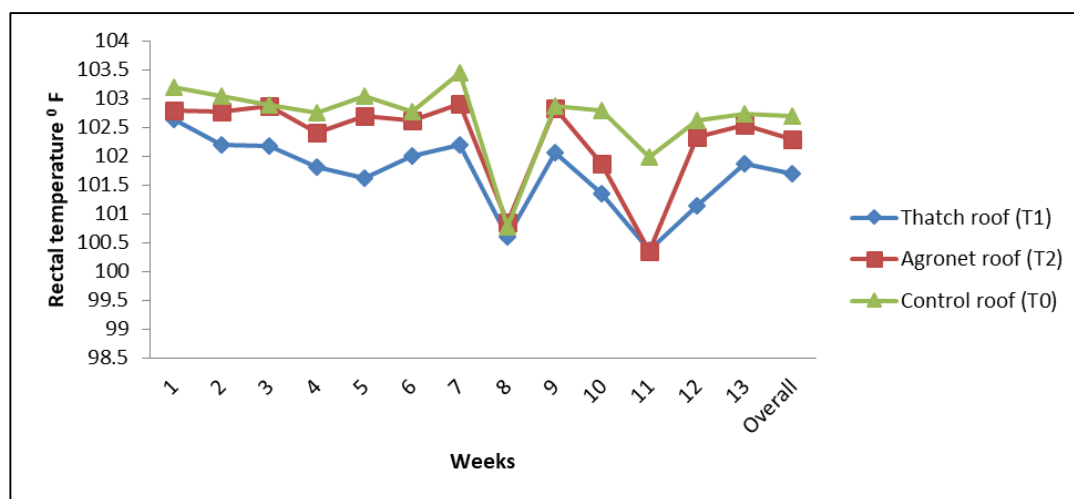
**Rectal temperature ( $^{\circ}\text{C}$ ):** The data for the rectal temperature which was recorded on weekly basis in different groups are depicted in Table 1 and Fig.1 and the result shows that the overall rectal temperature is significantly lower ( $P<0.05$ ) in  $T_1$  followed by  $T_2$  as compared to  $T_0$  which is having highest rectal temperature. This might be due to the fact that the heat load inside the shed is highest in  $T_0$  followed by  $T_2$  and  $T_1$  as thatch and agro-net had low thermal conductivity due to

which they act as heat insulator hence reduce heat load on the calves. Similar findings were reported by Prasanpanich *et al.*, (2002) [11], Khongdee *et al.*, (2010) [6], Khongdee *et al.*, (2013) [7] and Patil *et al.*, (2014) [10]. However Gurdevet *et al.*, (2007) [5] studied about physiological indices in buffaloes exposed to sun and reported a non-significant difference in rectal temperature in exposed and non-exposed animals.

**Table 1:** Mean $\pm$ SE of Rectal temperature ( $^{\circ}\text{F}$ ) of Sahiwal calves in different groups

Weeks	Control roof ( $T_0$ )	Thatch roof ( $T_1$ )	Agro-net roof ( $T_2$ )
1	103.19 $\pm$ 0.26	102.64 $\pm$ 0.30	102.80 $\pm$ 0.39
2	103.05 $\pm$ 0.39	102.19 $\pm$ 0.22	102.77 $\pm$ 0.40
3	102.89 $\pm$ 0.39	102.17 $\pm$ 0.30	102.87 $\pm$ 0.61
4	102.75 $\pm$ 0.60	101.80 $\pm$ 0.42	102.40 $\pm$ 0.55
5	103.05 $\pm$ 0.51	101.62 $\pm$ 0.29	102.69 $\pm$ 0.42
6	102.77 $\pm$ 0.38	102.00 $\pm$ 0.41	102.62 $\pm$ 0.26
7	103.44 $\pm$ 0.32 <sup>b</sup>	102.20 $\pm$ 0.21 <sup>a</sup>	102.90 $\pm$ 0.29 <sup>a</sup>
8	100.77 $\pm$ 0.55	100.60 $\pm$ 0.49	100.84 $\pm$ 0.49
9	102.87 $\pm$ 0.30	102.05 $\pm$ 0.31	102.82 $\pm$ 0.30
10	102.80 $\pm$ 0.33	101.35 $\pm$ 0.58	101.87 $\pm$ 0.19
11	101.99 $\pm$ 0.46 <sup>b</sup>	100.37 $\pm$ 0.46 <sup>a</sup>	100.34 $\pm$ 0.24 <sup>a</sup>
12	102.62 $\pm$ 0.45	101.14 $\pm$ 0.45	102.32 $\pm$ 0.60
13	102.74 $\pm$ 0.44	101.87 $\pm$ 0.27	102.55 $\pm$ 0.28
Overall	102.69 $\pm$ 0.10 <sup>b</sup>	101.69 $\pm$ 0.19 <sup>a</sup>	102.29 $\pm$ 0.08 <sup>a</sup>

Means bearing different superscript in a row differ significantly ( $P<0.05$ ).



**Fig 1:** Rectal temperature ( $^{\circ}\text{F}$ ) of Sahiwal calves in different groups

**Respiration rate per minute:** Results in Table 2 and in Fig. 2 shows that the respiration rate is significantly lower ( $P<0.05$ ) in  $T_1$  and  $T_2$  as compared to  $T_0$  group. Also respiration rate in  $T_2$  is slightly higher than  $T_1$  but non-significantly. The reason may be due to more heat stress to animals under asbestos sheet alone in control roof house as

compared to thatch and agro-net roof modification which reduces the heat load on calves. Similar findings were also reported by Eigenberg *et al.*, (2005) [4] and Patil *et al.*, (2014) [10]. In contrary to above result, Singh *et al.*, (2008) [13] reported that the respiration rate was not influenced by providing shed (asbestos, agro-net and tree).

**Table 2:** Mean $\pm$ SE of Respiration rate per minute of Sahiwal calves in different groups

Weeks	Control roof ( $T_0$ )	Thatch roof ( $T_1$ )	Agro-net roof ( $T_2$ )
1	40.84 $\pm$ 3.72	33.00 $\pm$ 2.20	36.84 $\pm$ 3.56
2	35.84 $\pm$ 2.31	33.34 $\pm$ 2.29	33.00 $\pm$ 2.93
3	33.00 $\pm$ 2.63	36.34 $\pm$ 2.71	36.84 $\pm$ 2.67
4	34.84 $\pm$ 0.98	36.17 $\pm$ 2.19	35.34 $\pm$ 2.10
5	33.84 $\pm$ 1.01	34.67 $\pm$ 2.61	29.34 $\pm$ 0.88
6	35.00 $\pm$ 1.21 <sup>b</sup>	33.50 $\pm$ 1.83 <sup>ab</sup>	29.67 $\pm$ 1.33 <sup>a</sup>
7	36.67 $\pm$ 1.20 <sup>b</sup>	28.84 $\pm$ 1.13 <sup>a</sup>	31.00 $\pm$ 0.89 <sup>a</sup>
8	36.17 $\pm$ 1.97	32.34 $\pm$ 1.90	32.67 $\pm$ 1.47
9	38.00 $\pm$ 2.30 <sup>b</sup>	30.67 $\pm$ 1.90 <sup>a</sup>	31.67 $\pm$ 2.12 <sup>ab</sup>
10	35.34 $\pm$ 2.04 <sup>b</sup>	29.84 $\pm$ 0.94 <sup>a</sup>	30.17 $\pm$ 1.27 <sup>a</sup>

11	33.50±0.92 <sup>b</sup>	28.67±0.98 <sup>a</sup>	30.50±0.76 <sup>a</sup>
12	36.00±1.63 <sup>b</sup>	26.84±1.37 <sup>a</sup>	29.17±2.62 <sup>a</sup>
13	33.84±2.33	28.84±1.44	32.67±2.12
Overall	35.61±0.50 <sup>b</sup>	31.77±1.297 <sup>a</sup>	32.22±1.29 <sup>a</sup>

Means bearing different superscript in a row differ significantly ( $P < 0.05$ ).

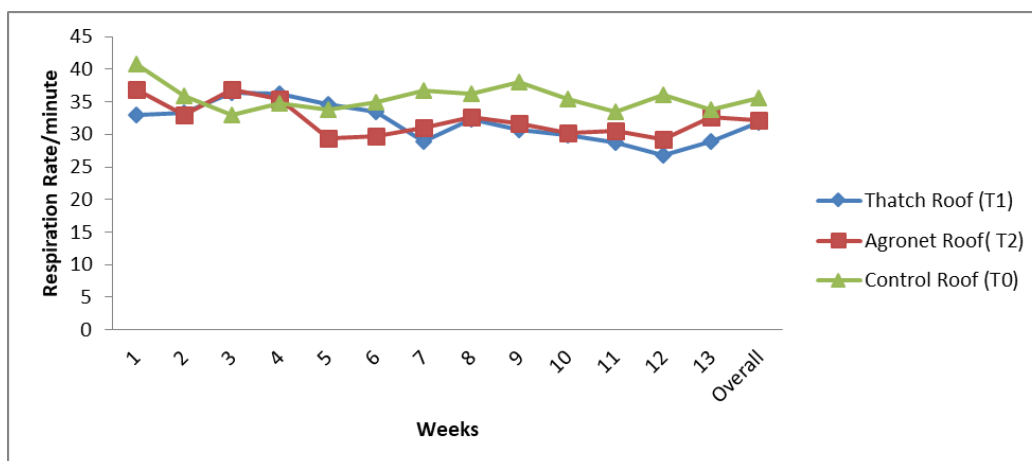


Fig 2: Respiration rate per minute of Sahiwal calves in different groups

**Pulse rate per minute:** Table 3 and Fig. 3 depicts that the overall pulse rate is non-significantly higher in calves under control roof as compare to other two groups may be because of the micro climate under control roof is not suitable for the calves due to more penetration of solar radiations which is

responsible for heat stress in calves which are reared under control roof. Similar finding was also reported by Patil *et al.*, (2008) [9] who observed that pulse rate was higher in tin roof shed as compare to thatch roof, as pulse rate rises with the rise in temperature of shed in Osmanabadi weaned kids.

Table 3: Mean±SE of Pulse rate per minute of Sahiwal calves in different groups

Weeks	Control roof (T <sub>0</sub> )	Thatch roof (T <sub>1</sub> )	Agro-net roof (T <sub>2</sub> )
1	62.67±3.80	63.67±2.60	62.00±2.43
2	67.00±1.61	64.34±1.49	66.50±1.80
3	60.84±3.24	66.5±2.090	56.17±4.32
4	65.34±2.21	67.67±2.77	64.34±3.70
5	61.50±3.93	66.00±2.67	61.17±2.84
6	65.50±2.39	62.84±2.70	60.67±1.49
7	65.84±2.16	59.84±2.65	57.67±4.57
8	65.00±3.67	62.34±3.14	65.17±1.51
9	63.67±2.30	61.84±2.84	62.84±2.63
10	64.50±2.71	63.50±2.06	62.50±2.26
11	64.34±1.96	59.00±1.26	63.00±1.52
12	59.17±2.04	57.00±2.36	61.00±3.79
13	59.34±3.00	56.67±2.95	59.17±4.85
Overall	63.44±1.14	62.40±1.52	61.71±1.07

Non –significant

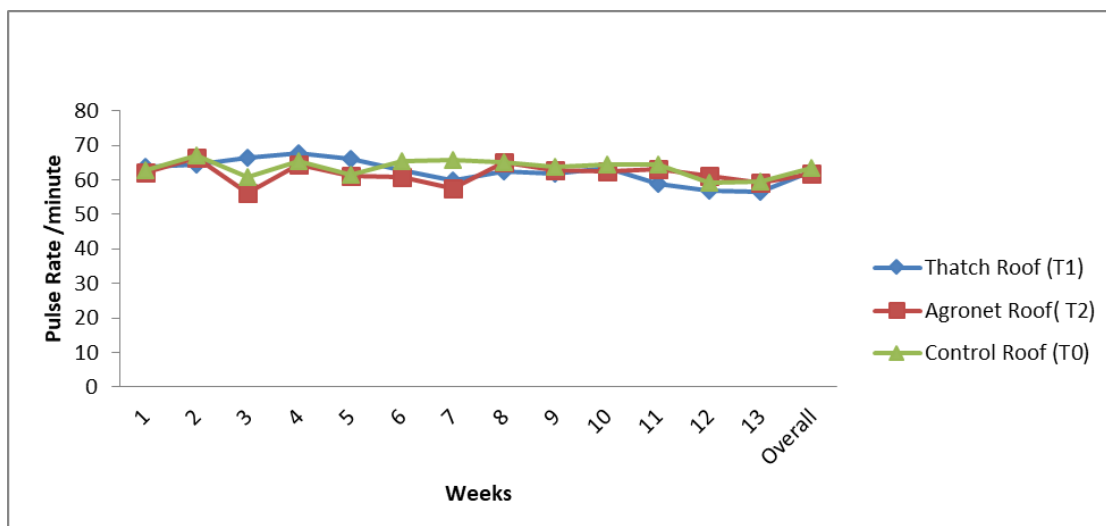


Fig 3: Pulse rate beat per minute of Sahiwal calves in different groups

## Conclusion

Therefore, it can summarily be concluded that in arid regions heat has a major effect on physiology of animal which leads to affect various physiological parameters as a reaction towards various stressors. Modifications such as thatch and agro-net on asbestos sheet roof had shown significant effect on physiological parameters like rectal temperature, respiration rates as thatch and agro-net over asbestos sheet act as a thermo insulator in treatment groups as compare to control group which was having roof of only asbestos sheet.

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