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Study the effect of feed additives on growth performance of Sahiwal growing female calves during summer season in arid region of Rajasthan

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Abstract
Nutritional supplements have been used to mitigate heat stress in cattle. The present investigation was conducted at the Livestock Research Station, Kodamdesar, College of Veterinary and Animal Sciences, Rajasthan University of Veterinary and Animal Sciences to evaluate the value of nutritional intervention on mitigation of heat stress (HS) in cattle for a period of 90 days during the months of June to August, 2019. The aim of the study was to determine the effect of feed additives on growth performance of growing Sahiwal female calves during summer season in arid region of Rajasthan. Eighteen Sahiwal growing female calves having ages between 6-15 months were procured, such that the calves were the best representation of the population. Calves were housed in a well-ventilated and protected shed and were allocated to three different groups, each group consisting of six calves. To study the effect of feed additives on performance of Sahiwal growing female calves during summer season, the selected female calves were divided into three groups viz., group 1 (G-1), group 2 (G-2) and group 3 (G-3). Group 1 (G-1) calves received basal diet and the calves of group 2 (G-2) and group 3 (G-3) were fed the basal diet additionally supplemented with feed additives. Total body weight gain (kg), were significantly higher for the calves receiving probiotics along with encapsulated niacin as supplementation followed by calves receiving only probiotics as feed supplementation as compared to calves receiving only basal diet. Based on the above it can be summarized that probiotics (Saccharomyces cerevisiae SC-47, *Saccharomyces boulardii*, *Lactobacillus acidophilus*, *Propionibacterium freudenreichii* and sea weed powder) and encapsulated niacin can be effectively used as feed additives for improving growth rate and alleviating heat stress in Sahiwal calves under the arid conditions of Rajasthan.

Keywords: Sahiwal, probiotics, encapsulated niacin, heat stress, growth performance

Introduction
According to the climate change studies conducted for the Indian sub-continent, there will be an overall increase in the temperature by 1-4 °C towards the 2050s. An increase in the frequency of extreme weather events like a heatwave, cold wave, droughts, floods, cyclones is another very significant aspect of climate change (Rao *et al*., 2016) [8]. However, different regions will get affected by climate change differently. The climatic parameters will be also altered with a further increase in temperature, which will affect the growth and production of domestic livestock. Climate change, in particular global warming, will affect the health and welfare of farm animals, both directly and indirectly (IPCC, 2007) [4]. Environmental factors, such as temperature and light, exert significant effects on the production, health and immunity of animals. Heat stress in tropical countries is a problem of great concern among farmers and livestock producers as it causes great economic loss in terms of both production and reproduction traits of animals. Heat stress in dairy cows is caused by a combination of environmental factors (temperature, relative humidity, solar radiation and air movement) (Ghosh *et al*., 2017) [3]. Heat stress occurs in animals when there is an imbalance between heat production within the body and its dissipation. Heat stress is the sum of external forces to a homoeothermic animal that acts to shift body temperature from the resting state. Heat stress reduces feed intake, milk yield, growth rate and reproductive performance (Patel *et al*., 2017) [6] which lead to major economic losses to the dairy farmers.
There are several strategies to alleviate heat stress to maintain or increase productivity in cattle. One strategy used to minimize the effects of heat stress is to modify the environment in which cows are kept by providing shade to reduce solar radiation or using sprinklers to increase evaporative cooling. Manipulation of certain diet ingredients is another strategy that may be useful (Knapp and Grummer, 1991) [5].

The nutritive value of feed and fodder has a significant bearing on the productivity of cows. Changes in diet in the form of nutritional modifications could help cows to maintain homeostasis or prevent nutrient deficiencies resulting from excessive heat load. These modifications in the diet are needed especially in hot weather and arid regions to maintain nutrient intake, increase dietary nutrient density, or to reestablish homeostasis.

A feed additive is an ingredient or combination of ingredients added to the feed, in appropriate quantities to promote growth lower feed consumption, improving feed efficiency and can be used specifically for protection against all kinds of harmful environmental stress.

The feed additives chosen for investigation for this study were probiotics and niacin. Probiotics are live microorganisms which, when administered in adequate amounts, confer a health benefit on the host. Probiotics can be defined as a whole food-based supplement of live microorganisms, which benefits the host animal by improving its intestinal microbial balance. Currently, the use of probiotics additives has been developed as alternatives to antibiotics to improve animal health and productivity (Allen *et al*., 2013) [1]. Niacin is a highly effective; lipid regulating drug associated with several metabolically induced side effects such as prostaglandin (PG) mediated flushing and hepatic toxicity. Purwar *et al*., 2017 [7] also found that The body weight, DMI/100kg BW and gain in height were numerically higher in the treatment group as compared to control group but it didn't show any significant difference. Average daily gain (ADG) and heart girth gain (HGG) were significantly ($P<0.05$) higher in the treatment group as compared to control group by supplementation of protected fat (2.5% of DMI), yeast (10 g/animal/day), niacin (6 g/animal/day), zinc (40 mg/kg DMI), and chromium (1.5 mg/kg DMI). Considering the above factors, to study the potential of a mixture of feed additives to mitigate heat stress effects and enhance growth in Sahiwal growing calves in terms of the level of climatic protection and body weight gain of the animal in the arid region of Rajasthan

Materials and Methods

The present investigation was conducted at the Livestock Research Station, Kodamdesar, College of Veterinary and Animal Sciences, Rajasthan University of Veterinary and Animal Sciences, which is situated about 32 km away from the city of Bikaner in Rajasthan. All the facilities required for carrying out the research work were available at the College of Veterinary and Animal Sciences, Bikaner and Livestock Research Station, Kodamdesar. All the cattle in the experimental groups were reared under similar climatic conditions. Eighteen Sahiwal growing female calves having ages between 6-15 months were procured from the Livestock Research Station, Kodamdesar. The animals were received in a staggered manner and were allocated to three different groups, each group consisting of six calves. The grouping was done on the basis of treatments given and the calves which were selected represented the cattle population as much as possible.

The study was conducted during the months of June to August. The investigation lasted for a period of 90 days. During this period, observations on various parameters were taken and the data was recorded. All cows were free from physiological, anatomical and infectious diseases. Calves were housed in a well-ventilated and protected shed and allowed to acclimatize for a period of seven days prior to experimental feeding.

To study the effect of feed additives on the performance of Sahiwal growing female calves during the summer season, the selected female calves were divided into three groups viz., group 1 (G-1), group 2 (G-2) and group 3 (G-3). Group 1 (G-1) calves received a basal diet and the calves of group 2 (G-2) and group 3 (G-3) were fed the basal diet additionally supplemented with feed additives.

The calves were fed two times a day in the morning at 9.00 a.m and in the evening at 3.00 p.m. For conduction of the experiment, the animals were individually fed, with available green fodder Jower (*Sorghum vulgare*) and dry Wheat straw (*Triticum aestivum*) fodder ad libitum along with required quantity of concentrate is in form of Saras Cattle feed pellets. (Basal diet). The probiotic containing *Saccharomyces cerevisiae* and bacteria, *Saccharomyces boulardii* and *Lactobacillus acidophilus* was used for feeding the experimental female calves. Both the feed additives, probiotics, and encapsulated niacin was mixed with concentrate mixture.

Growth parameters

The growth of experimental calves was studied with respect to body weight and body weight gain.

Body Weight (BW)

The experimental calves were weighed at fortnightly intervals on two consecutive days in the morning hours before offering feed and water to the animals. The mean value of the two measurements was taken as the actual body weight.

Body weight gain (BWG) served as an indicator of the rate of growth. The rate of growth of the experimental female calves was calculated using the following formula:

Body Weight Gain (kg)
= Body weight at the end of the experiment (kg)
− Body weight at the beginning of the experiment

Results and Discussion

The present study was undertaken to explore the possibility of using probiotic cultures (Saccharomyces cerevisiae SC-47, *Saccharomyces boulardii*, *Lactobacillus acidophilus*, *Propionibacterium freudenreichii* and seaweed powder), encapsulated niacin or a combination of both as feed additives to improve growth performance.

Body weight

The observations pertaining to body weight which was recorded on fortnightly interval have been presented in Table 1 and figure 1. The mean body weights at the start of the experiment were 94.66±8.75 kg, 94.9±8.73 kg, and 94.77±7.02 kg for the groups G-1, G-2, and G-3, respectively. At the end of the experiment, the mean values of body weight for groups G-1, G-2, and G-3 were 120.8±8.71 kg, 123.87±9.07 kg, and 124.75±7.88 kg respectively.

Table 1: Fortnightly body weight (kg/d) in female Sahiwal calves

Fortnight	G1	G2	G3
0	94.66±8.75	94.9±8.73	94.77±7.02
1	97.76±8.81	97.9±8.72	97.78±7.16
2	101.27±8.76	102.21±8.83	101.95±7.4
3	105.28±8.76	107.08±8.79	107.09±7.32
4	109.8±8.76	112.03±9.04	112.54±7.33
5	114.91±8.76	117.8±9.20	118.51±7.51
6	120.8±8.71	123.87±9.20	124.75±7.88

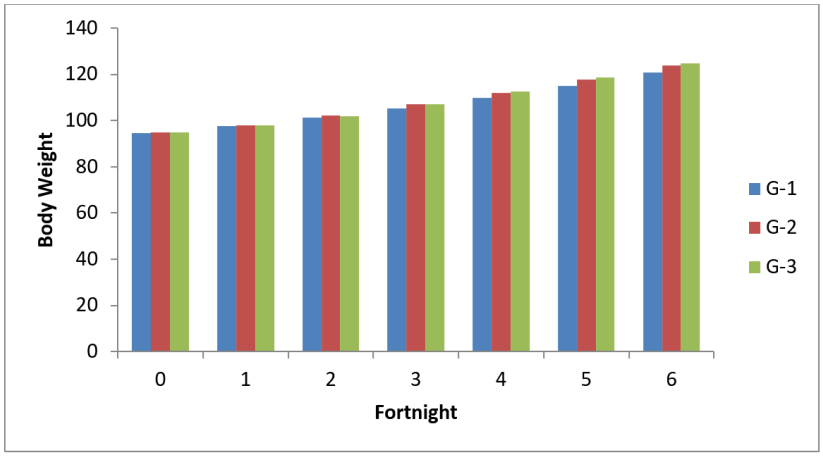

Fig 1: Variation of body weight in the experimental groups with fortnight

Total body weight gain (kg)

The observations with respect to total body weight gain (kg) fortnightly for the three groups have been presented in Table 2 and figure 2. The result shows that the overall total body weight gain (kg) was significantly higher in treatment groups G-2 (28.97±0.694) and G-3 (29.99±1.131) as compared to control group G-1 (26.14±0.226) however it was non-significantly higher in G-3 as compared to G-2 treatment groups. This might be due to the fact that the body wt. gain in G-2 and G-3 treatment groups is higher as they are additionally supplemented with feed additives whereas in control group only basal diet is fed, but when we compare the body weight gain in treatment groups G-3 and G-2 then the value is non-significantly higher in G-3 as it is fed with combination of probiotics and encapsulated niacin whereas in G-2 it is only probiotics.

Table 2: Fortnightly total body weight gain (kg) in female Sahiwal calves

Fortnight	G1	G2	G3
1	3.1±0.058	3±0.037	3.02±0.203
2	3.52±0.056	4.31±0.244	4.18±0.441
3	4.01±0.009	4.87±0.387	5.14±0.119
4	4.53±0.145	4.95±0.435	5.45±0.262
5	5.12±0.106	5.77±0.648	5.98±0.396
6	5.89±0.155	6.08±0.178	6.25±0.58
Total gain	26.14±0.226[a]	28.97±0.694[b]	29.99±1.131[b]

Mean having different superscript in a row differ significantly ($P<0.05$).

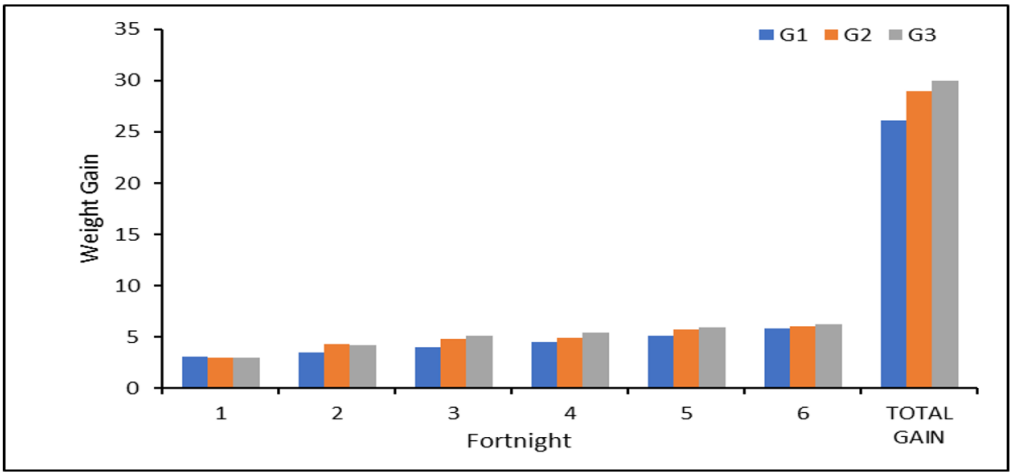

Fig 2: Total body weight gain in the experimental groups with fortnight

The total body weight gain (kg) was significantly higher ($P<0.05$) in G-3 and G-2 as compare to G-1 and in between G-2 and G-3 it was non-significantly lower in G-2 as compared to G-3 group. Significantly having higher values for groups supplemented with feed additives (probiotics only and probiotics plus encapsulated niacin).

Similar types of observations were recorded by other researchers. Saijpaul *et al.* (2007) [9] supplemented crossbred calves with probiotic (Bioboost) containing *L. sporogens* and Iive yeast and demonstrated increased body weight gain in supplemented group over control but the results did not vary significantly. Barajas *et al*. (2005) [2] demonstrated that chromium methionine addiction tended (p=0.06) to increase calves body weight by 2.5 percent (251.38 vs. 257.75 kg).

Conclusion

The present investigation clearly indicates that the calves receiving diet supplemented with feed additives showed better performance with respect to growth parameters like body weight, total body weight gain. The present study shows that supplementation with the above feed additives could serve as a heat stress abatement strategy in growing sahiwal calves during extreme conditions in summer months.

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