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Effect of melatonin implantation on productive performance in post-partum murrah buffaloes (*Bubalus bubalis*) during summer season

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Abstract
The experiment was performed on twelve post-partum Murrah buffaloes (*Bubalus bubalis*) to observe the effect of melatonin on production trait during summer season. Six animals each were divided into control and treatment (melatonin @ 50 mg/kg body weight) group. The physiological parameters were found to be increased significantly ($p \leq 0.05$) in control than treatment group. Mean values of body weight and dry matter intake were observed non-uniform and non-significant in both groups due to negative energy balance. Further, it was concluded that melatonin maintains the negative energy balance of animals` productive performance and showed non-significant effect on milk yield, peak milk yield, milk fat and SNF % for control and treatment group.

Keywords: Buffaloes, melatonin, production traits, post-partum, summer season

1. Introduction
Exposure to extreme temperature elicits a series of extreme changes in the animal‘s biological functions that include reduction in feed intake, efficiency and utilization, hormonal secretions, enzymatic reactions and blood metabolites [10]. These changes result in impairment of production and reproduction performances [14]. Host defense mechanisms can be compromised directly because of diverse physiological and environmental factors during the transition period and are followed by a high energy demand and an increased oxygen requirement [7]. Hot and humid environment have effects on milk yield and quality as observed [8] and recorded in percentage decreased of milk fat, SNF and milk protein by 39.7, 18.9 and 16.9%, respectively. When THI value goes beyond 72, milk fat and protein content declines. There is lower milk fat and milk protein during summer season in cow [3]. These studied suggested that the melatonin has a positive effect on heat stress and productive performance in buffaloes.

2. Materials and Methods
2.1 Place of Research Work conducted
The experiment was conducted on twelve healthy post-partum Murrah buffaloes *(Bubalus bubalis)* (1st to 3rd parity) selected from Livestock Research Centre of ICAR-NDRI, Karnal. These animals were housed in a custom design animal shed and divided into control and treatment (melatonin implantation @ 18 mg/50 kg body wt.) group on basis of body weight and body condition score. All the animals were maintained under standard managemental conditions followed at ICAR-NDRI livestock farm.

2.2 Parameters taken
Body weight of post-partum buffaloes *(Bubalus bubalis)* was recorded prior to actual experiment and subsequently for 3 days using electronic weighing machine. Dry Matter Intake were recorded for 3 consecutive days and average was considered fortnightly in both the group. All the productive parameters taken in the research like milk yield, peak milk yield, SNF and fat percentage were recorded from the data record room, LRC, ICAR-NDRI.

2.3 Recording of THI
Micro climatic data, viz. dry bulb and wet bulb temperature was recorded at 7:30 AM and 2:30 PM with dry and wet bulb hygrometer (Zeal, UK) every day. The temperature humidity index was calculated as per standard method [11].

2.4 Ethical Committee

The experiment was approved by the IAEC constituted as per article no. 13 of CPCSEA rules, laid down by Government of India (Reg. No. 1705/GO/ac/CPCSEA Dt. 3/7/2013). Statistical analysis of the data was done using Two-way factor analysis of variance followed by post-hoc Tukey's test. The analysis was performed using software version (9.1) SAS Institute Inc., Cary, NC, USA Copyright© (2011).

3. Results and Discussion

Mean ± SE of THI during the experimental period have been depicted in Fig 1. The 6th, 7th and 8th fortnights showed most stressful period. The present study is in accordance of significant positive association of THI with physiological responses in growing Murrah buffaloes [9]. The impact of heat stress became more severe when relative humidity and sun exposure increased. During heat stress, animals tries to reduce their metabolic heat production by reducing feed intake, which results in decreased growth rate and production.

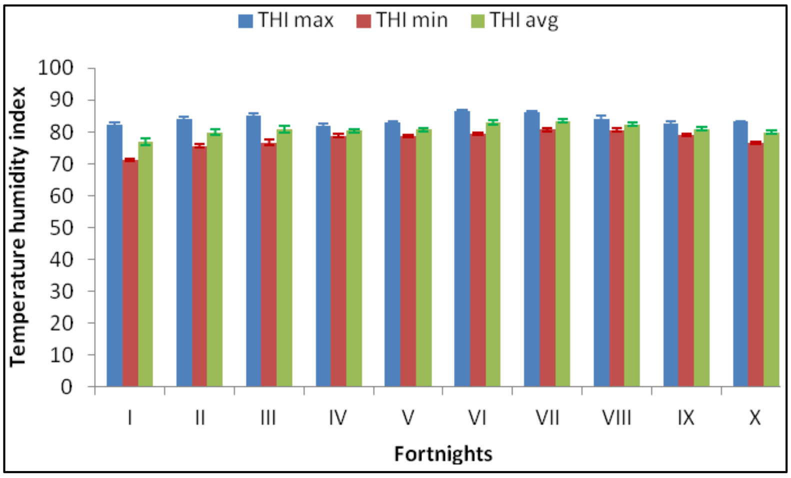

Fig 1: Fortnightly temperature humidity index (THI) during the experimental period

Mean ± SE of B wt of control and treatment groups have been presented in Table 1. The mean values of body weight were non-significantly higher in treatment than the control group. The present experiment is in agreement and did not follow any uniform trend neither increasing nor decreasing, this may be due to negative energy balance and may be due to decreased dry matter intake (DMI) [4].

The mean ± SE of DMI in control and treatment groups are presented in Table 1. The mean values of DMI of postpartum buffaloes for treatment were non-significantly higher than the control group. Both groups of animals were having decreasing trend, from initiation of the study to fifth week after that it observed to be increased. This may be due to the animals were expected to heat load, physical stress at calving, metabolic stress, associated with increased nutritional demands for lactogenesis and negative energy balance. The study is in agreement with [1] who reported that under chronic stressful conditions animals lowered food intake. During early postpartum stage there is a decrease in serum NEFA levels which reflect high NEFA extraction by the mammary gland for milk fat synthesis[2], associated in wide endocrine changes and improvement in DMI and hence in energy balance[15].

Table 1: Mean (± S.E.) body weight and dry matter intake of control and treatment group of post-partum Murrah buffaloes during summer season

Weeks	Body Weight (kg/d)		Dry Matter Intake (kg/d)	
	Control	Treatment	Control	Treatment
I	558.64±27.58	559.05±24.20	13.97^{A}±0.69	14.03^{A}±0.62
II	556.35±27.18	558.58±24.90	13.68^{A}±0.75	13.88^{A}±0.62
III	553.64±27.27	556.37±24.73	13.67^{A}±0.71	13.79^{A}±0.62
IV	550.45±26.37	555.98±24.51	13.65^{A}±0.64	13.84^{A}±0.68
V	554.02±25.42	556.15±25.10	9.97^{B}±0.46	10.07^{B}±0.52
VI	551.69±24.02	558.82±24.95	10.04^{B}±0.46	10.18^{B}±0.52
VII	565.08±23.94	562.54±25.14	10.15^{B}±0.50	10.32^{B}±0.46
VIII	568.77±23.68	573.05±28.22	14.25^{A}±0.59	14.46^{A}±0.69
Mean ± S.E.	557.33±8.44	560.12±8.27	12.42±0.33	12.57±0.33

Values with different superscripts A-B within a column differ significantly
The values of mean ± SE are observations on six animals

Mean value for milk yield in control was lower than the treatment group and have been presented in Table 2. The present study is in accordance that higher milk production in cooled group relative to non-cooled group (stressed) may be the reason for their higher circulating prolactin levels in early lactation [1]. Melatonin administered in dairy cattle during late pregnancy had no effect on milk production [6]. Changes in Photoperiod to cattle including concentrations of melatonin [5] showed limited effects of changes on the reproductive performance [12], but the same changes does not occur for milk yield.

Table 2: Mean (± S.E.) milk yield, milk fat and SNF of control and treatment group of postpartum Murrah buffaloes during summer season

Days Postpartum	Milk Yield (kg/d)		Milk Fat (%)		SNF (%)	
	Control	Treatment	Control	Treatment	Control	Treatment
15	8.98±0.21	9.49±0.14	10.09±0.34	9.76±0.47	10.2±0.54	10.18±0.48
30	9.54±0.29	10.04±0.13	9.94±0.28	9.38±0.51	10.49±0.57	11.37±0.71
45	10.13±0.25	10.29±0.13	9.87±0.43	9.23±0.35	9.87±0.43	10.21±0.36
60	10.54±0.26	10.74±0.17	9.61±0.37	9.87±0.29	10.25±0.24	9.72±0.34
75	10.55±0.25	10.58±0.17	9.56±0.51	9.43±0.42	10.31±0.28	10.24±0.38
90	10.87±0.24	11.02±0.20	9.42±0.64	8.74±0.22	10.34±0.34	9.86±0.42
105	11.13±0.22	11.18±0.15	8.97±0.29	9.02±0.84	10.19±0.29	9.73±0.46
120	11.07±0.18	11.17±0.15	9.18±0.15	8.97±0.88	10.07±0.35	10.74±0.51
Mean ± S.E.	10.35±0.13	10.56±0.10	9.58±0.16	9.30±0.14	10.22±0.12	10.26±0.22

The values of mean ± SE are observations on six animals

Mean value of milk fat percent for control was non-significantly higher than the treatment group, whereas, SNF percent observed to be non-significantly higher in treatment as compared to the control group and presented in Table 2. The present finding for milk fat and SNF is in the agreement who reported that volatile fatty acids content and propionate proportion positively correlated with milk yield (MY), and proportion of acetate and butyrate positively correlated with milk fat [12]. Non-significant difference in milk composition such as fat, SNF and total solids between heat stressed and protected Nili-Ravi buffaloes [13].

4. Conclusions

Melatonin implantation reduced plasma level of cortisol significantly in treatment group of animals. During heat stress, ameliorative action of melatonin helped in conservation of energy which resulted in an increase in growth performance and dry matter intake, which could be otherwise used in dissipation of heat. Melatonin maintains the negative energy balance of animals` productive performance and was concluded that there was no significant effect in treatment on milk yield, peak milk yield, milk fat and SNF % for control and treatment group.

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6. References

1. Aarif O, Aggarwal A. Evaporative cooling in late gestation Murrah buffaloes potentiates immunity around transition period and overcomes reproductive disorders. Theriogenolgy. 2015;84:1197-1205. DOI: 10.1016/j.theriogenology.2015.06.019
2. Bell AW. Regulation of organic nutrient metabolism during transition from late pregnancy to early lactation. J Anim Sci. 1995;73:2804-2819. DOI: 10.2527/1995.7392804x
3. Bouraoui R, Lahmar M, Majdoub A, Djemali M, Belyea R. The relationship of temperature humidity index with milk production of dairy cows in a Mediterranean climate. Anim Res. 2002;51(6):479-491.
4. Chandra G, Aggarwal A, Singh AK, Kumar M. TNF-α level and metabolic status in α-tocopherol acetate supplemented high body condition periparturient crossbred cows during summer and winter season. Ind J Anim Sci. 2012;82:999-1003.
5. Dahl GE, Tao S, Thompson IM. Lactation Biology Symposium: Effect on photoperiod on mammary gland development and lactation. J Anim Sci. 2012;90:755-760. DOI:10.18805/IJAR.B-5011.
6. Garcia-Ispierto I, Hassan AA, Lopez-Gatius F. Melatonin Treatment at Dry-off Improves Reproductive Performance Postpartum in High-producing Dairy Cows under Heat Stress Conditions. Reprod Domestic Ani. 2012;48(4):577-583. DOI: 10.1111/rda.12128
7. Gitto E, Reiter RJ, Cordaro SP, La Rosa M, Chiurazzi P, Trimarchi G, *et al*. Oxidative and inflammatory parameters in respiratory distress syndrome of preterm newborns: beneficial effects of melatonin. Am J Perinatology. 2004;21(4):209-216. DOI: 10.1055/s-2004-828610.
8. Kadzere CT, Murphy MR, Silanikove N, Maltz E. Heat stress in lactating dairy cows: A review. Livestock Prod Sci. 2002;77(1):59-91.
9. Kumar P, Singh SV. Growth rate, feed intake, physiological responses and hormonal profile of Murrah buffaloes implanted melatonin during summer season. Ind J Anim Sci. 2021;91(5):386-390.
10. Kumar P, Singh SV. Expression Pattern of Genes Related to Heat Shock Proteins, Apoptosis, Antioxidants and Interleukins in Growing Female Murrah Buffaloes Implanted with Melatonin during Summer Season. Ind J Anim Res; c2023. DOI:10.18805/IJAR.B-5011.
11. Mc Dowell RE. Improvement of livestock production in warm climates. W.H. Freeman and company, San Francisco, CA; c1972.
12. Sawal RK, Kurar CK. Milk yield and its fat content as affected by dietary factors: A review. AJAS 1998;11(3):217-233.
13. Singh G, Kamboj ML, Patil NV. Effect of thermal protective measures during hot humid season on productive and reproductive performance of Nili-Ravi buffaloes. Ind Buffalo J. 2005;3:101-04.
14. Tao S, Bubolz JW, Do Amaral BC, Thompson IM, Hayen MJ, Johnson SE, *et al*. Effect of heat stress during the dry period on mammary gland development. J Dairy Sci. 2011;94:5976-5986. DOI: 10.3168/jds.2011-4329
15. Vandehaar MJ, Yousif G, Sharma BK, Herdt TH, Emery RS, Allen MS, *et al*. Effect of energy and protein density of prepartum diets on fat and protein metabolism of dairy cattle in the periparturient period. J Dairy Sci. 1999;82:1282-1295. DOI: 10.3168/jds.S0022-0302(99)75351-8