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Assessment of biostimulation on growth performance and morphometric characteristics in Murrah buffalo heifers

¹Sagar Kadyan, ²Jai Prakash, ³Oshin Togla, ⁴Sushil Kumar, ⁵SK Chhikara, ⁶Man Singh and ⁴Dipin Chander Yadav

¹Ph.D. Candidate, Livestock Production Management, LUVAS, Haryana, India

²Scientist, Krishi Vigyan Kendra, Delhi, India

³Ph.D. Candidate, Quantitative Genetics and Genomics lab, AGB, NDRI, Karnal, Haryana, India

⁴Scientist, LUVAS, Haryana, India

⁵Principal Scientist, Livestock Production Management, LUVAS, Haryana, India

⁶Assistant Professor, Livestock Production Management, LUVAS, Haryana, India

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Corresponding Author: Jai Prakash

Abstract

The present study was conducted to assess the effect of Biostimulation on Growth performance (Body weight and growth rate) and Body measurements (Body length, Heart Girth, and Body Height) in Murrah Buffalo Heifers. Eighteen prepubertal heifers were randomly allocated into three groups: control (T₀, no male exposure), fenceline exposure (T₁), and fenceline plus direct male exposure (T₂). All groups exhibited a progressive increase in body weight. The average daily gain (ADG) was significantly higher ($P < 0.05$) in T₂ (550.00 ± 6.36 g/day) compared to T₀ (488.88 ± 12.85 g/day) and T₁ (503.47 ± 19.73 g/day). Similarly, Total body weight gain was significantly greater in T₂ (132.00 ± 1.53 kg) than in T₀ (117.33 ± 3.08) and T₁ (120.83 ± 4.74). Body measurements increased gradually over time but showed no significant differences among groups. The findings conclude that biostimulation enhances growth rate without significantly affecting structural body development in Murrah buffalo heifers. Thus, biostimulation may serve as a practical, non-hormonal management strategy to improve growth performance in buffalo heifers.

Keywords: Biostimulation, growth performance, body weight, average daily gain, body measurements

Introduction

Buffalo (*Bubalus bubalis*) plays a vital role in livestock production systems, contributing significantly to milk, meat, draft power, and other by-products. The productivity and profitability of buffalo farming largely depend on optimal growth and development of heifers during the pre-pubertal phase. Inadequate growth during early life not only delays physiological maturity but also negatively impacts lifetime productivity. Therefore, understanding the factors that regulate growth and development in buffalo heifers is essential for improving production efficiency. Growth parameters such as body weight gain, average daily gain (ADG), and metabolic efficiency are key determinants of future performance and lifetime productivity.

Growth in buffalo heifers is influenced by multiple factors, including nutrition, management, health, and environmental conditions. Among these, climatic stress is known to adversely affect feed intake, metabolic activity, and growth due to the inherent sensitivity of buffaloes, indicating a potential role of biostimulation in promoting somatic development (Harder and Jackson, 2003; Garratt *et al.*, 2016) [6, 4]. In cattle, exposure to bulls has been associated

with improved growth performance, reflected in higher Average Daily Gain and enhanced metabolic activity (Choudhary *et al.*, 2022) [2]. These effects are likely mediated through key metabolic hormones such as leptin and growth hormone, which regulate feed intake, energy utilization, and tissue growth (Houseknecht *et al.*, 1998; Garcia *et al.*, 2002) [8, 3]. Despite these indications, the role of biostimulation in influencing Growth parameters in buffalo heifers remains poorly understood.

Therefore, the present study was designed to evaluate the effect of biostimulation on growth performance and morphometric traits in Murrah heifers.

Materials and Methods

Location & Duration of experiment: The present investigation was carried out at the Buffalo farm of College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India. The experiment was started in the month of October, 2021 and lasted up to May, 2022. An adjustment period of one month was given to the animals before the actual start of experiment.

Experimental Animals

Experiment was approved and conducted under the established standard of the Institutional Animal Ethics Committee (IAEC). 18 Murrah heifers were selected from the Buffalo farm on the basis of Age and Body weight. 3 intact Murrah bulls within 28 to 31 months of were chosen.

Housing management

The experimental animals were housed under loose housing system having covered shed and an adjoining open paddock. There were common feeding and watering arrangement. Different treatment groups of heifers were housed in one place under

the same shed. The bulls were housed in a shed in between the sheds of two treatment groups of heifers separated through fenceline barrier wherein sufficient distance was provided allowing tactile interaction between bull and heifers. The floor of the shed was cement concrete in the covered area and brick paved in open paddock.

Feeding management

All the 3 groups of heifers were fed the similar ration as per ICAR (2013) feeding standards. All seasonal farm grown green fodder, dry roughage, Green forage were fed *ad libitum* generally between 10-12 AM.

Trials

Total of 18 Murrah heifers selected from the herd were randomly allocated to one of the following 3 treatments with 6 animals in each group. *Control (T₀): No bull contact:* The heifers in this group were not exposed to any bull contact. *Treatment 1 (T₁): Fenceline bull contact:* The heifers were exposed to the two intact bulls round the clock by housing them in a fenceline contact throughout the length of the covered area as well as open paddock of the heifer shed. *Treatment 2 (T₂): Fenceline bull contact plus direct bulls contact:* The heifers were exposed to the two intact bulls round the clock by housing them in a fenceline contact throughout the length of the covered area as well as open paddock of the heifer shed (as in T₁) along with direct introduction of an another apronized intact bull for a total duration of 6 hours daily (3 hours in morning from 07.00 to 10.00 am and again for 3 hours in evening from 4.00 to 7.00 pm) in the heifer shed. The bull used for direct contact in this groups of heifers was weekly replaced with another bull.

Parameters recorded

Recording of Growth Performance: The Body weight of the experimental animals were recorded initially at start of experiment and then at fortnightly basis till the end of the experimental period. Body weight of each animal was measured early in the morning before providing the animals any feed or water, using an electronic weighing scale. The change of body weight between key periods, was assessed by deducting the values of body weight at the first record in time from the second record in time.

Recording of Body measurements

The following body measurements were taken at monthly interval using a measuring tape (in centimetres) and measuring stand. Body length (BL): Measured as the

distance from the highest point of the shoulder to the pin bone. Heart girth (HG): Measured as the body circumference immediately behind the front shoulder at the fourth rib, posterior to the front legs. Body Height (BH): - Measured as the distance from the ground to the highest point of the withers.

Statistical analysis of data

The average of the treatment group and the control group were subjected to statistical procedures as outlined by Snedecor and Cochran (1994)^[12]. Difference of significance in variables between three groups were compared via one-way analysis of variance (ANOVA) which were carried out with SPSS computer software version 21.

Results and Discussion

Body Weight and Average Daily Gain (ADG)

The fortnightly body weight data of Murrah buffalo heifers across different treatment groups (T₀, T₁, and T₂) was recorded (supplementary file) where all groups showed a steady and consistent increase in body weight throughout the experimental period, indicating normal growth in all heifers. At the end of the study, the final body weights were also recorded and it appeared that T₂ animals were heavier, however the differences among groups were not statistically significant (P>0.05). (Table1). A clear picture was observed when Growth Rate was considered. The Average Daily Gain (ADG) was significantly higher (P<0.05) in T₂ compared to T₀ and T₁. The ADG values of T₀ and T₁ were comparable, indicating no significant difference between these two groups (Table1). Similarly, the Total Body weight gain followed the same trend. Heifers in T₂ showed a significantly higher total gain than those in T₀ and T₁, which did not differ significantly from each other (Table1).

Overall, while final body weight remained similar across groups, T₂ animals exhibited a significantly faster growth rate and higher weight gain, suggesting a positive effect of biostimulation on growth performance (Figure 1). The positive effect of biostimulation on ADG and Total weight gain might be due to the fact of activation of neuroendocrine system, particularly the hypothalamic–pituitary axis, through pheromones. This stimulation is known to improve metabolic efficiency and nutrient utilization and increase secretion of growth-related hormones. Yanagihara *et al.* (2000)^[13] reported that exogenous leptin increases basal growth hormone secretion by ovine pituitary cells, *in vitro* and *in vivo*. Harder *et al.* (2003)^[6] proposed that exposure to male pheromones stimulates luteinizing hormone (LH) secretion, leading to ovarian activation and steroidogenesis. This endocrine activation may indirectly promote somatic growth through modulation of growth hormone, metabolism, and appetite. Supporting this hypothesis, studies in other species have demonstrated enhanced growth rates in females exposed to male pheromones (Harder and Jackson, 2003; Garratt *et al.*, 2016)^[6, 4], indicating a conserved neuroendocrine mechanism. In cattle, Choudhary *et al.* (2022)^[2] reported significantly higher average daily gain in heifers exposed to bulls compared to non-exposed controls, along with elevated levels of leptin and growth hormone. These hormonal changes are indicative of improved metabolic status and growth regulation, which may explain the

enhanced body measurements observed under biostimulation.

Despite higher growth rates in T₂, the final body weights were not significantly different among groups which might be due to the shorter experimental duration that was not sufficient to show a markable difference in the final weight.

Body Measurements- Body Length - The monthly body length data were recorded where the initial body length was similar across groups. At the end of the experiment, it was observed that all heifers showed a gradual increase over time with no significant differences ($P>0.05$) among groups (Table 2). Biostimulation did not significantly influence linear body growth, although normal growth progression was observed in all groups.

Heart Girth- The data on heart girth showed a steady increase in all groups from the beginning to the end of the study. Despite slightly higher values in T₁ and T₂, the differences were not statistically significant ($P>0.05$) (Table 2). Biostimulation had no significant effect on heart girth, although a normal growth trend was evident.

Body Height - Likewise, Body height measurements also increased consistently in all groups throughout the study period. The final body height measured were comparable across the groups with no significant differences ($P>0.05$) (Table 2). This suggests that biostimulation did not significantly affect skeletal height growth in Murrah buffalo heifers.

In all the cases of morphometric traits, all groups showed a normal increasing trend, but no significant differences were observed among them. These morphometric traits are primarily related to bony frame of the body which is generally genetically regulated. These traits show gradual

gain over extended periods, which may not be evident within the shorter duration of the present study. It is likely that the effects of pheromonal treatment on these parameters would become more apparent if the experimental period were prolonged. There is a paucity of literature regarding the direct effect of biostimulation on body measurements in buffalo, making the present findings particularly relevant. However, comparisons can be drawn with studies conducted in cattle. The observations of the present study are in agreement with the findings of Koirala *et al.* (2011)^[9], who reported comparable body measurements in native cattle of Bangladesh. Although the reported heart girth (112.09±16.68 cm) in their study was lower than that observed in the present investigation, such variation may be attributed to differences in breed, genetic potential, and environmental conditions. Biostimulation impact on impact on body measurements such as body length, heart girth, and height is less evident. These traits appear to be more strongly influenced by breed characteristics, age, and baseline growth patterns rather than socio-sexual stimuli alone.

Table 1: Effect of Biostimulation on body weight and average daily gain in Murrah buffalo heifers (mean ± SE)

Parameter	T ₀	T ₁	T ₂
Initial body weight (kg)	218.33±21.91	219.00±14.66	221.00±13.90
Final body weight (kg)	335.67±21.96	339.83±15.35	353.00±14.65
Total weight gain (kg)	117.33 ^a ±3.08	120.83 ^a ±4.74	132.00 ^b ±1.53
ADG (g/day)	488.88 ^a ±12.85	503.47 ^a ±19.73	550.00 ^b ±6.36

Values with different superscripts (a, b) differ significantly ($P<0.05$)

Table 2: Effect of Biostimulation on body measurements of Murrah buffalo heifers (mean ± SE)

Parameter	Stage	T ₀	T ₁	T ₂
Body Length (cm)	Initial	77.67±3.25	78.67±1.05	76.83±1.85
	Final	86.50±2.70	87.00±2.25	87.17±1.13
	Overall Mean	83.25±3.21	83.64±1.34	84.17±1.10
Heart Girth (cm)	Initial	45.67±5.17	45.67±3.77	47.50±4.16
	Final	68.33±6.78	72.50±2.89	73.00±4.04
	Overall Mean	56.92±5.74	59.98±3.57	60.33±4.18
Body Height (cm)	Initial	108.50±2.95	109.33±1.66	110.33±1.60
	Final	121.00±2.73	121.83±1.19	122.83±1.56
	Overall Mean	115.57±2.68	116.18±1.62	117.65±1.51

No significant differences ($P>0.05$) were observed among treatment groups for all parameters

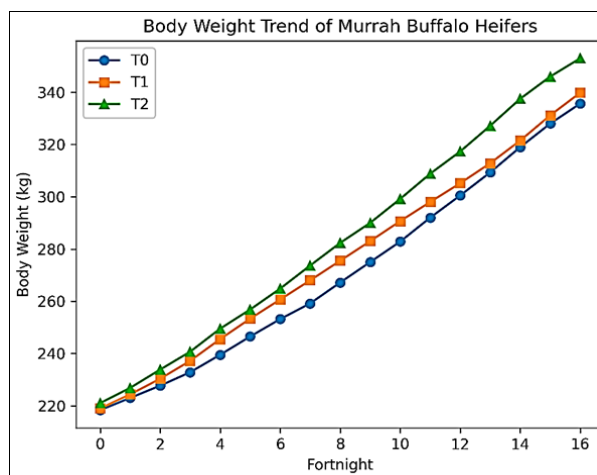


Fig 1: Effect of biostimulation on body weight (kg) of Murrah buffalo heifers over the experimental period. T₂ shows a steeper growth trend compared to T₀ and T₁, indicating improved growth rate

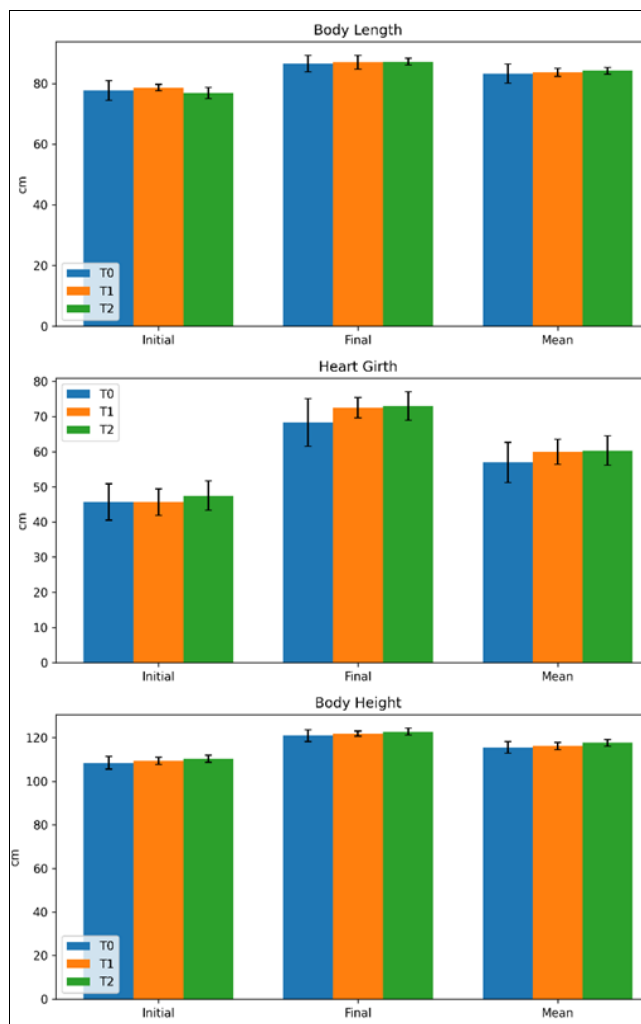


Fig 2: Effect of biostimulation on body measurements of Murrah buffalo heifers: (A) body length, (B) heart girth, and (C) body height (mean $\pm$ SE). No significant differences were observed among treatment groups ($P>0.05$)

Conclusion

Biostimulation significantly improved growth rate (ADG and total weight gain) without affecting the structural body measurements, indicating its role in enhancing growth efficiency rather than altering body conformation.

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