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COULD HERBAL ALOE VERA (*Aloe Barbadensis*) BE A GROWTH STIMULANT FOR TROPICAL BUFFALO CALVES?

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ABSTRACT

The present study was envisaged to explore the potential growth stimulant effect of aloe vera (*Aloe barbadensis*) as phytogenic feed additive in the ration of buffalo calves in tropics. Fifteen Murrah buffalo calves of either sex between 3 to 6 months of age were selected from the Buffalo Research Center of Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana. Based on nearness in body weight and age, fifteen calves were divided into three groups, five in each. Group T_1 served as Control (fed with Basal diet), while in T_2, calves were fed basal diet with aloe vera leaves 2 g/kg BW and in T_3 group was fed basal diet with aloe vera leaves 4 g/kg BW. Animals were fed and met the nutrient requirements in all the groups according to ICAR-2013 feeding standards. At the end of the experiment, our results revealed a significantly higher ($P<0.05$) body weight in T_3 as compared to T_1, however body weight of T_2 remained similar ($P>0.05$) with both T_1 and T_3 group. Body weight gain and Average daily gain over the experimental period were significantly higher ($P<0.05$) in T_3 followed by T_2 and was found lowest in T_1. Body length, abdominal girth and heart girth of the buffalo calves were significantly ($P<0.05$) higher in T_3 as compared to T_1 but it did not differ significantly ($P>0.05$) from T_2. However, body height (cm) of the buffalo calves at different fortnights remained statistically similar ($P>0.05$) in all Treatment groups. Therefore, aloe vera as phytogenic feed additive at 4 g/kg BW in the diet of Murrah buffalo calves has growth stimulant effects, in tropics.

Keywords: *Bubalus bubalis*, buffaloes, aloe vera, buffalo calves, body measurements, body weight, growth stimulant

INTRODUCTION

Out of total GDP in India, livestock sector represents nearly 4.2% of the country's GDP (Economic Survey, 2020 to 2021) and buffalo (*Bubalus Bubalis)* plays an important role in overall socio-economic development of rural areas by contributing 49% of total milk production in the country. Calves are the future herd of a dairy

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farm but poor growth rate and high mortality in the calves result in reduction of economic return to the farmers. Imbalance in the enteric bacterial population is a critical factor in young calves, resulting in approximately 30% mortality due to GI infections (Nehru *et al*., 2017). To overcome such enteric infections for a better growth record in young claves, antibiotics are commonly preferred choice in feeds to avoid any unwanted health complications arising out of gastrointestinal infections. But development of resistance against the used antibiotics is a huge challenge in the present world which warns the alternate of such drugs as growth promoter in feed in animal industry.

Recent studies on use of phytogenic feed additives (PFA) have emerged with promising potency in livestock industries due to their beneficial properties, including antibacterial, antifungal, and anti-inflammatory growth promotion (Taylor, 2001). Researchers have therefore been striving to identify the potential PFA as a substitute for antibiotics, one such is the efficacy of aloe vera as feed additives in livestock and poultry ration as a growth booster for enhancing the performance (Yadav *et al*., 2017).

One of the important species known for its medicinal properties, *Aloe barbadensis*, commonly known as aloe vera, is a perennial plant under Liliaceae family (Ahlawat and Khatkar, 2011). The aloe vera leaves contain more than 200 nutrients and plant bioactive compounds (Davis, 1997) especially anthraquinones, anthrones, chomones, flavonoid and tannins, polysaccharides, and saponins (Giannakoudakis *et al*., 2018). Current studies have proved its efficacy in enhancing growth in animals besides having properties to cure inflammation, diabetes, viral and fungal infection with wound healing, immunomodulatory, and antioxidant properties (Maan *et al*., 2018). Unfortunately, little work has been done on aloe vera supplementation in dairy animals, specifically on buffalo calves. So, the present investigation aimed to find the potential growth stimulatory effect of dietary supplementation of aloe vera on buffalo calves in tropics.

MATERIALS AND METHODS

Fifteen Murrah buffalo calves of either sex between 3 to 6 months of age were selected from the Buffalo Research Center of Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana. Based on nearness in body weight and age, fifteen calves were divided into three groups, five in each. Group T_1 served as Control (fed with Basal diet), while in T_2, calves were fed basal diet with aloe vera leaves 2 g/kg BW and in T_3 group was fed basal diet with aloe vera leaves 4 g/kg BW. The preliminary adjustment period of seven days was given and all the buffalo calves were dewormed before the start of the experiment. The investigation was conducted for duration of 90 days, from February to April, 2021.

The aloe vera fresh leaves were purchased from Medicinal and Aromatic Plant Section, Department of Plant Breeding, College of Agriculture, CCS HAU, Hisar, Haryana. Procured fresh aloe vera leaves were subjected to thorough washing to remove dirt and to avoid any loss of active ingredients like enzymes, hormones and vitamins, washed leaves were minced in the mixer (electric operated) to prepare the crude extract. Further, the extract prepared is fed after thorough mixing with concentrate. Procurement and processing of aloe vera were done on daily basis.

All the experimental buffalo calves were fed as per the requirements specified by the ICAR

(2013). The quantity of different feeds given to each group was adjusted at fortnightly intervals depending on change in body weight of calves. As per routine practice and recommendation, weighed quantity of seasonal green fodder (berseem), wheat straw and concentrate mixture were offered to the calves under study. The animals were given fresh drinking water during the experiment on *adlib.* basis. Basal diets of calves were prepared after analyzing the proximate composition (AOAC, 2013) of the feed ingredients along with fresh aloe vera, in triplicate (Table 1).

To analyze the growth curve during the course of experiment, initial body weight was recorded at the start of the experiment, followed by fortnight recordings. All data were taken in the morning hours prior to feeding and watering to the experimental calves. Similarly body measurements i.e. body length (distance from point of shoulder to the point of pin bone), body height (from ground level to the point of withers), heart girth (circumference of the body over the chest of the animal just behind point of elbow) and abdominal girth (circumference of the body over the flank of the animal just in front of udder) were measured at the start of the experiment and subsequently at fortnightly intervals**.** Change in body weight and body measurements parameters were calculated using standard mathematical formula.

The means of data obtained from the studies were compared by one way analysis of variance (ANOVA) as per the methods described by Snedecor and Cochran (1994) by using "SPSS" software (version-20). The mean differences among different treatments were separated by Duncan's (1955) multiple range tests. Consequently, a level of significant ($P<0.05$) was used as the criterion for statistical significance.

RESULTS AND DISCUSSIONS

The average body weight of buffalo calves at fortnightly interval has been presented in Table 2 and showed an increasing trend in all the three treatment groups throughout the experiment. At the beginning of the experiment, body weight of all the Treatment groups i.e. T_1, T_2, T_3 were 72.20±2.65 kg, 73.40±2.62 kg and 72.80±2.06 kg respectively, were similar ($P>0.05$). However, the last reading of the experiment (VI fortnight) was suggestive of the role of aloe vera supplementation (4 g/kg body weight) with a significant effect ($P<0.05$) on average body weight in T_3 Treatment group, compared to the Control group. Final body weight after a period of 90 days feeding trial were 108.60±2.93 kg (T_1), 114.80±2.78 kg (T_2) and 118.00±2.38 kg (T_3) kg and body weight in T_3 group was found significantly higher ($P<0.05$) from T_1 group, however it did not differ significantly ($P>0.05$) from T_2 group, though average weight of T_3 was found higher than T_2 group.

Total weight gain (kg) and daily weight gain (kg) over the 90 days of experiment have been presented in Table 3. The overall total weight gain (kg) and daily weight gain (kg) were significantly different ($P<0.05$) among all the treatment groups and observed highest in T_3 (44.40±0.70, 0.502±0.08) followed by T_2 (41.40±0.60, 0.460±0.07) and was found lowest in T_1 (36.40±0.68, 0.404±0.08).

The results of present study are in agreement with the findings of Yadav *et al.* (2017a) who found a significant effect ($P<0.05$) of aloe vera supplementation 2 g and 4g per body weight on the average body weight, overall average daily weight gain in the crossbred cattle calves. However, our study is not corroborated with the findings of Alibabaei *et al.* (2016) who did not find any significant difference ($P<0.01$) in weekly weight gain

in newborn HF calves during a feeding trial with a daily 15 ml aloe vera gel supplementation in feed, compared to control groups. In the same line of our results, Bhati *et al.* (2017) also found significantly higher (P<0.01) daily weight gain and higher final body weight on aloe vera supplementation 3% of total diet in *Rathi* calves. Ghane *et al.* (2010) also observed substantial increase in body weight gain of *Holstein Friesian* calves on dietary supplementation of aloe vera, however it was not significant. Aloe vera supplementation had also a significant effect on higher body weight with higher ADG in the lambs (Ahmed *et al*., 2017). Qiao *et al.* (2013) also observed a significant increase (P<0.05) in average daily gain of body weight in piglets, when supplemented with 0.1% of aloe vera polysaccharide in the diet, compared to control. Higher dry matter intake (Bhati *et al*., 2017), better nutrient utilization efficiency, antimicrobial property (Alemdar and Agaoglu, 2009) and antiparasitic activity (Maphosa and Masika, 2012) might be the reasons for better growth rate in case of aloe vera supplemented group of buffalo calves. Maintenance of a healthy villi and its growth could be a possible reason due to aloe vera in the feed which might be responsible for higher weight gain by facilitating better absorption of digested nutrients due to increased surface area of villi in aloe vera supplemented groups (Sujatha *et al*., 2017).

The average value of body measurements (body height, body length, abdominal girth and heart girth) of experimental buffalo calves under different groups are presented in Table 4 and fortnightly body measurements are depicted in Figure 1 to 4. At the start of experiment, average value of all the body measurements for all treatment groups were similar (P>0.05). At the end of experiment, final body height was 95.30±1.35 cm (T_1), 97.86±0.84 cm (T_2) and 98.62±1.04 (T_3) cm and remained statistically similar (P>0.05) with each other. At the end of experiment, we could get a higher (P<0.05) average body length (cm), average abdominal girth (cm) and average heart girth (cm) of the buffalo calves in T_3 group as compared to T_1 group but remained similar (P>0.05) compared to T_2 group. On the basis of average body measurements at fortnightly interval, buffalo calves of Treatment group T_3 remained always above, followed by T_2 and T_1 group (Figure 1 to 4).

During experiment

Our results are in agreement with the findings of the Yadav *et al.* (2017a). Yadav *et al.* (2017a) found that the dietary supplementation of aloe vera in crossbred calf has significant positive effect (P<0.05) on body length and heart girth of calves but it did not have significant effect on the body height. Supporting to our result, significant increase (P<0.01) in tibia bone length was also noticed due to the effect of dietary supplementation of aloe vera in rat pups (Majid *et al*., 2018). The aloe vera is rich in calcium ions which speed up the growth of bones (Majid *et al*., 2018) and this might be the reason for increase in body measurements and a possible cause for higher body weight of buffalo calves fed with higher level of aloe vera in our 90 days feeding trial.

CONCLUSION

From our experiment, we conclude that supplementing the diet of Murrah buffalo calves with aloe vera 4 g per kg body weight significantly enhances their growth performance in tropics.

Table 1. Proximate composition (%) of feed ingredients on dry matter basis fed to experimental buffalo calves.

Ingredients	DM	CP	CF	EE	Ash	OM	NFE
Wheat straw	90.00	3.0	35.46	1.02	12.97	87.03	47.55
Berseem	23.00	18.6	27.30	1.9	10.4	89.60	41.80
Maize	88.08	8.60	2.80	3.56	1.75	98.25	83.29
Ground nut cake(GNC)	91.47	40.70	9.15	7.68	7.80	92.20	34.67
Mustard cake	91.46	35.62	8.33	6.25	8.83	91.17	40.97
Wheat	88.61	10.89	3.77	2.15	2.23	97.77	80.96
Soyabean meal	88.60	45.00	8.00	1.75	8.64	91.36	36.61
Barley	88.60	11.00	4.99	2.51	2.50	97.50	79.00
Aloe vera	2.42	9.5	18.5	2.53	19.5	80.5	49.97

Table 2. Body weight (Kg) of the experimental buffalo calves (Mean ± SE) at fortnightly interval.

Fortnights	Treatments		
	T_1	T_2	T_3
Initial	72.20±2.65	73.40±2.62	72.80±2.06
I	77.60±2.66	79.00±2.49	78.40±2.14
II	83.40±2.62	85.40±2.54	85.40±2.14
III	89.40±2.56	92.40±2.50	92.60±2.29
IV	95.80±2.78	99.60±2.68	101.00±2.63
V	102.40±3.14	107.40±2.93	109.60±2.77
VI	108.60±2.93^{b}	114.80±2.78^{ab}	118.00±2.38^{a}

^{a,b} Mean values with different superscripts in a row differ significantly at $P<0.05$.

Table 3. Changes in body weight of experimental buffalo calves (Mean ± SE) during the experiment.

Parameters	Treatments		
	T1	T2	T3
Initial body weight (kg)	72.20±2.65	73.40±2.62	72.80±2.06
Final body weight (Kg)	108.60±2.93^{b}	114.80±2.78^{ab}	118.00±2.38^{a}
Total body weight gain (Kg)	36.40±0.68^{c}	41.40±0.60^{b}	44.40±0.7^{a}
Body weight Gain/day (Kg)	0.404±0.08^{c}	0.460±0.07^{b}	0.502±0.08^{a}

^{a,b,c} Means values with different superscripts in a row differ significantly P<0.05.

Table 4. Body measurements of buffalo calves (Mean±SE) at the beginning and end of trial.

Parameters		Treatments		
		T_1	T_2	T_3
Body Height (cm)	Initial	86.00±1.10	86.60±1.08	86.40±0.81
	Final	95.30±1.35	97.86±0.84	98.62±1.04
Body Length (cm)	Initial	84.00±1.14	85.00±1.70	84.80±1.83
	Final	95.08±1.34^{b}	99.28±1.83^{ab}	101.70±1.58^{a}
Abdominal Girth (cm)	Initial	111.80±2.13	114.40±1.29	114.40±1.03
	Final	123.88±2.08^{b}	129.82±1.30^{a}	132.36±1.74^{a}
Heart Girth (cm)	Initial	97.80±1.02	99.20±0.86	98.70±0.80
	Final	109.50±1.60^{b}	114.82±1.13^{a}	117.34±1.23^{a}

^{a,b} Mean values with different superscripts in a row differ significantly P<0.05.

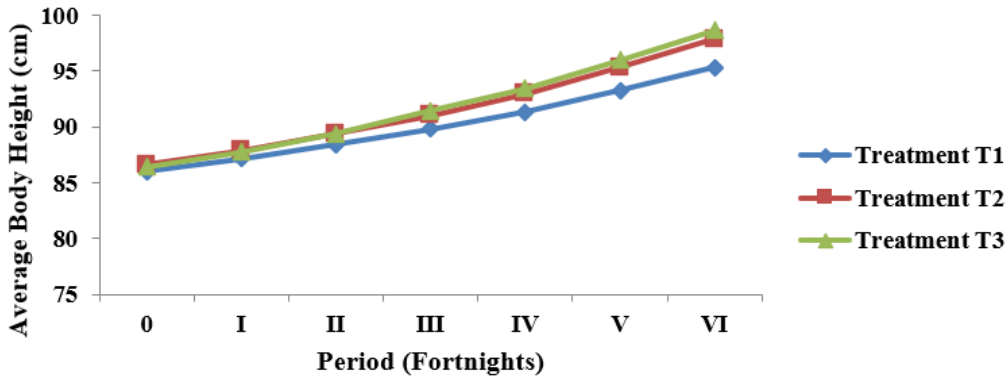

Figure 1. Body height measurement curve (at fortnightly interval) of buffalo calves during experiment.

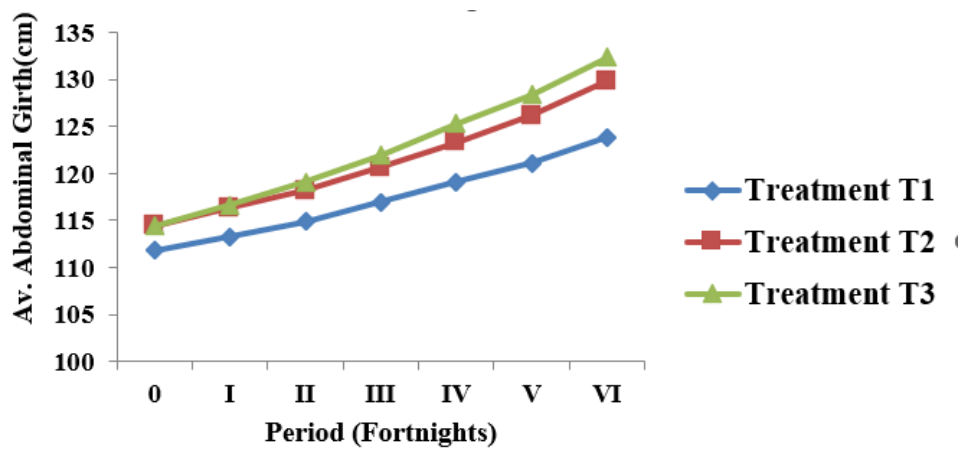

Figure 2. Body length measurement curve (at fortnightly interval) of buffalo calves during experiment.

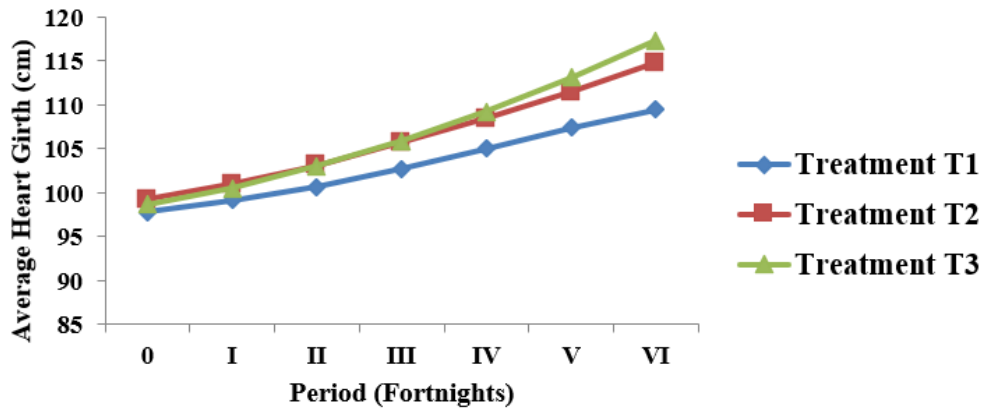

Figure 3. Abdominal girth measurement curve (at fortnightly interval) of buffalo calves during experiment.

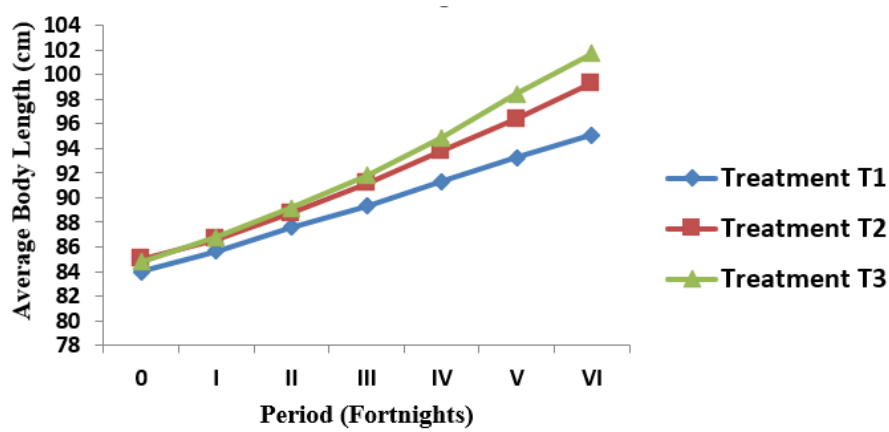

Figure 4. Heart girth measurement curve (at fortnightly interval) of buffalo calves during experiment.

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