



Effect of weaning age on growth measurements and sero-biochemical parameters in Murrah buffalo calves

P K BHARTI¹, TRIVENI DUTT², B H M PATEL³, HARI OM PANDEY⁴, BRIJESH OJHA⁵, REENA KAMAL⁶, DEEPAK UPADHYAY⁷, MUKESH SINGH⁸ and G K GAUR⁹

ICAR-Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh 243 122 India

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ABSTRACT

The present study was conducted to compare the effect of weaning at different ages on growth measurement traits and serum biochemical parameters in Murrah buffalo calves from birth to 90 days of age. Out of 42 buffalo calves, 35 were randomly assigned in to 3 groups, viz. control (C): suckling (14); treatment T1 (T1): weaning of calves at birth (11); and treatment T2 (T2): weaning of calves at 45th day of birth (10). The mean body weight gain was significantly higher in control followed by T2 and T1. The mean initial body length of calves in control, T1 and T2 were 59.35±0.58, 56.64±0.99 and 57.20±0.91 cm, respectively. The final body length (cm) was significantly higher in control than T1 and T2. Similar trends were observed for height at wither and heart girths of calves in different groups though there were initial differences as well. The serum cortisol (nM/l) was significantly higher only at day-60th of sampling in T2 followed by T1 and control. The serum glutamic pyruvic transaminase (SGPT) was significantly higher at 45th and 60th days of sampling in T1 and T2 than control group. The weaned groups of calves had comparatively lower growth values than suckling, however, the significant differences on serum biochemical parameters were observed only at few stages of weaned buffalo calves as compared to suckling group, which indicates minor inconsistent physiological deviations. The weaning in buffalo calves at early stages affects body growth parameters with minor inconsistent changes in blood biochemical profile.

Key words: Body measurement, Buffalo calves, Cortisol, Serum enzymes, Weaning

Rearing of neonatal calves on suckling is a traditional practice mostly followed in farm conditions and small dairy farms, where calves are allowed to suckle one or two teats before and/or after milking the dams. Weaning is the separation of neonatal calves from dam and rearing them without suckling to their mother. The practice of weaning could be more beneficial to calves in terms of scientific feeding, individual care and estimating the actual milk production of dams (Rashid *et al.* 2013). Weaning calves at birth is well established in dairy cattle especially exotic and crossbred, however in buffaloes, if the similar system is practiced it may give the significant benefit to dairy producers by saving precious buffalo milk and promoting scientific feeding of calves. However, it is also presumed that weaning at birth may lead to difficulty in pail/bottle feeding due to poor learning instincts in buffalo calves, and it may also affect the growth and inflicts stress in weaned

dams (Hickey *et al.* 2003, Bharti *et al.* 2017). Weaning could also be attempted at few days later after birth, when calves are able to consume sufficient calf starter and roughage in view of better survival rate on complementary feed resources (Bharti *et al.* 2015a). Hence, as an alternative, the weaning in buffalo calves may be attempted at 45th day of age. The survivability of weaned buffalo calves after 45 days may be higher even on low intake of whole milk in slow learners. Keeping in view these facts, the present study was conducted to compare the effect of weaning age (at birth and 45th day of age) versus suckling on body measurement traits and serum biochemicals in Murrah buffalo calves.

MATERIALS AND METHODS

Location and climatic conditions: The experiment was conducted on Murrah buffalo calves at the institute farm, from birth to 90 days of age. The climatic condition of the place touches both the extremes, cold (approximately 5°C in winter) and hot (approximately 45°C in summer). The relative humidity ranges between 15 and 85%. The annual rainfall ranges from 90 to 120 cm and most of which is received from July to September.

Selection and management of calves: Newborn Murrah

Present address: ^{1,4,6,7}Scientist (pkish.1002@gmail.com, hariomvet@gmail.com, dr.reenakamal@yahoo.com, dpkvet@gmail.com), ²Joint Director Academic (triveniduttivri@gmail.com), ³Principal Scientist (mpatellpm@gmail.com), ⁵Assistant Professor (drbrijesh.ojha@gmail.com), ^{8,9}Principal Scientist (drmsingh9@gmail.com, gyanendragk@gmail.com), Livestock Production and Management Section.

buffalo calves (42) were selected at birth and randomly assigned into 3 treatment groups, viz. control (14); treatment 1 (T1), weaning of calves at birth (11); and treatment 2 (T2), weaning of calves at 45th day of birth (10). Owing to few cases of weaning failures (3 in T1 and 4 in T2) during the experimental period, the final number of calves studied were 35 out of 42 selected calves. In control (suckling), the calves were allowed to suckle from their respective dams twice a day from birth to 90 days of age, and they were given ample suckling time as per their requirement. The milk consumption of calf was estimated by taking the difference of post-suckling and pre-suckling body weights. In T1, the calves were weaned immediately after birth. Each individual calf was fed on colostrum of its own dam within 30 min of birth. The amount of colostrum was given twice daily for first 3 days of age @ 10% of body weight. From fourth day onwards till 90 days of age, the calves were reared artificially on pail feeding of whole milk. Amount of whole milk given to the calves was adjusted according to their increased body weight and age as per the recommended feeding schedule of the farm (Table 1). In T2, the calves were weaned at 45th day of age and thereafter feeding protocol was similar to that of T1. All calves were provided with good quality calf starter (CS) during day and night hours along with roughages from 16th day onwards on free choice basis. The CS was composed of crushed ingredients, viz. maize (45 parts), oat (15 parts), groundnut cake (25 part), wheat bran (12 parts), mineral mixture (2 parts) and salt (1 part). The green roughage was composed of chaffed maize/oat and berseem fodder. The dry roughage given to calves was mainly the wheat straw. The crude protein and total digestible nutrients of calf starter was 22.75 and 74.15%, respectively, on dry matter basis. The feeding schedule for weaned calves is presented in Table 1.

Housing and management of experimental animals: The calves were housed individually in well ventilated, clean and dry *pakka* pens for 18 h daily (from 3:00 PM to 9:00 AM) and they were let loose for remaining 6 h during the day time (9:00 AM to 3:00 PM) for socialization and expression of playing behaviour. They had free access to fresh, clean and wholesome water in open paddock. During winter, proper bedding material was provided to protect the calves from the cold.

Parameters recorded: The body weight (kg) of each individual calf was recorded at fortnightly interval using digital weighing balance. The growth measurement traits like body length (BL, distance between points of shoulder to point of pin bone), height at wither (HW, from ground

level to highest point above the shoulder) and heart girth (HG, the circumference of the body just behind the shoulder blade) were recorded simultaneously when animals were on plain ground using measuring tape. The blood samples were collected from buffalo calves by jugular veni-puncture using 18/20 gauze sterilized needle in morning hours after milk feeding at every 15 days interval from birth to 3 months of age, i.e. on 0, 15, 30, 45, 60, 75 and 90 days. Every possible measure was taken into care to avoid unnecessary stress to the calves during blood sampling. Blood samples were collected into 15 ml centrifuge tubes and allowed to clot. The serum was separated after centrifugation of clotted sample at 3,000 revolutions/min (rpm) for 7 min. Separated serum samples were further analyzed for estimation of cortisol, serum glutamic pyruvic transaminase (SGPT), serum glutamic oxalo-acetic transaminase (SGOT), total protein (TP), tri-iodo thyronine (T₃), and tetra-iodo thyronine (T₄). The serum enzymes were detected using commercial kits and cortisol and thyroid hormones (T₃ and T₄) using radioimmunity assay (Novatec RIA kits).

Analytical procedures: The standard statistical analytical procedures (Snedecor and Cochran, 1994) were adopted for analysis of the generated data using Statistical Analysis System (SAS) 9.2 version software. The oneway analysis of variance (ANOVA) was used to see the level of significance for various parameters and Tukey's test was applied to compare the difference between the groups.

RESULTS AND DISCUSSION

Body weights and weight gain: The mean birth weight (kg) of calves in control, T1 and T2 were 34.58±0.84 kg, 32.66±1.22 kg and 33.32±0.59 kg, respectively, which were statistically nonsignificant from each other. The final body weight (90th day) of calves in control, T1 and T2 were 79.71±2.42 kg, 69.51±1.93 kg and 73.59±1.11 kg, respectively. The final body weight in control was significantly (P<0.01) higher than both the weaned groups (T1 and T2). Among weaned groups, T2 showed better result, which might be due to milk suckling by calves for first 45 days of life. The total body weight gain was significantly (P<0.05) higher in control (45.12±2.21 kg) than T1 (36.85±1.95 kg) however, it was not significantly different from T2 (41.29±1.22 kg). The body weight gain in T1 and T2 was not significantly different from each other. The average daily gain in control, T1 and T2 was 0.501, 0.409 and 0.458 kg, respectively. The trends of average daily gain among the groups was similar to total weight gain. The lowest growth in T1 might be due to low milk intake by calves as initially some of the calves had shown difficulty

Table 1. Feeding schedule of calves

Age of calf	Colostrum	Whole milk	Calf starter	Green fodder
0-3 days	1/10 th of body weight	Nil	Nil	Nil
4-56 days	Nil	1/10 th of body weight	<i>Ad lib.</i> from 16 th day onwards.	
57-64 days	Nil	1/20 th of body weight	<i>Ad lib.</i>	<i>Ad lib.</i>
65-90 days	Nil	1/40 th of body weight	<i>Ad lib.</i>	<i>Ad lib.</i>

Table 2. Mean±SE of body measurements of buffalo calves (cm)

Fortnights	Body length (cm)			Height at wither (cm)			Heart girth (cm)		
	Control	Treatment 1	Treatment 2	Control	Treatment 1	Treatment 2	Control	Treatment 1	Treatment 2
At birth	59.35±0.58 ^a	56.64±0.99 ^b	57.20±0.91 ^{ab}	71.85±0.74 ^A	67.63±0.85 ^B	68.60±0.85 ^B	79.57±0.93 ^a	75.00±0.75 ^b	76.20±1.17 ^b
I	62.07±0.68 ^a	59.27±1.04 ^b	59.80±0.99 ^{ab}	75.78±1.14 ^a	71.00±1.00 ^b	71.80±0.80 ^b	82.92±0.84 ^a	78.36±0.94 ^b	80.10±1.43 ^{ab}
II	65.28±0.82	62.45±0.96	64.30±1.41	78.07±0.83 ^a	74.18±0.86 ^b	75.20±0.81 ^b	87.85±0.67 ^A	81.63±0.99 ^B	83.50±1.28 ^B
III	69.57±0.81 ^a	65.81±1.15 ^b	66.60±1.40 ^{ab}	81.64±0.78 ^a	77.72±0.63 ^b	78.40±0.89 ^b	91.42±0.76 ^a	86.00±1.20 ^b	87.90±1.26 ^b
IV	73.57±0.77 ^a	69.81±1.16 ^b	70.60±1.34 ^{ab}	84.35±0.77 ^a	80.72±0.58 ^b	82.00±0.76 ^b	96.21±0.70 ^a	90.72±1.01 ^b	92.70±1.12 ^b
V	76.78±0.62 ^a	73.45±1.09 ^b	74.80±0.96 ^{ab}	88.14±0.79 ^a	83.45±0.51 ^b	85.50±0.71 ^b	100.85±0.94 ^A	95.09±0.70 ^B	96.90±1.23 ^B
VI	80.50±0.69 ^a	78.09±0.97 ^b	77.00±0.73 ^b	91.78±0.93 ^a	86.27±0.55 ^b	88.50±0.63 ^b	106.07±1.11 ^A	99.27±0.81 ^B	101.00±1.23 ^B

^{a,b}Means bearing different superscripts within the row (between the groups) differ significantly ($P<0.05$). ^{A,B}Means bearing different superscripts within the row (between the groups) differ significantly ($P<0.01$).

in learning to drink milk by pail (Krohn 2001, Bharti *et al.* 2015a). The effect of rearing system had significant ($P<0.05$) effect on growth rate of buffalo calves (Roldan 2005, Kantharaja 2011) and had positive influence on growth and health performance during first few months of life (Gallego *et al.* 2011, Azim *et al.* 2011). The growth of calves in weaned groups might be affected due to difference in immunoglobulin level through passive transfer (Mastellone *et al.* 2011, Bharti *et al.* 2015c). However, in contrast to our findings, Aref *et al.* (2016) reported no association between growth rate and stress in early weaned buffalo calves.

Body measurement of calves: The body measurement (cm) of buffalo calves, viz. body length, height at withers and heart girth are given in Table 2.

Body length (BL): BL was significantly ($P<0.05$) higher in control than that in T1, however, it was nonsignificantly different from T2. Throughout the experiment, similar trend was observed. The final BL in control was significantly ($P<0.05$) higher than T1 and T2, however, there was no significant difference between T1 and T2. Significantly higher fortnightly BL in calves of control group might be due higher weight gain in this group than calves of weaned groups. Similarly, Kantharaja (2011) also reported significant ($P<0.01$) effect of calf rearing system on most of the weekly body lengths during 2–23 weeks, where he concluded higher body lengths in suckling system than weaned counterparts.

Height at wither (HW): Initial HW was significantly ($P<0.01$) higher in control than that in T1 and T2, however, there was no significant difference between T1 and T2 (Table 2). The final HW in control was significantly ($P<0.05$) higher than T1 and T2, however, there was no significant difference between T1 and T2. Comparatively, higher HW in suckling group reflects better growth due to higher milk consumption in addition to its higher value at birth too (Bharti *et al.* 2015a). This is also supported by the findings of Kantharaja (2011), who reported that system of rearing significantly affected body height ($P<0.01$) but in an erratic manner. Krohn (2001) reported that limiting the milk consumption at the end of the pre-weaning period increases body size seems to be positively affected by suckling process.

Heart girth (HG): The HG of calves belonging to control was significantly ($P<0.05$) higher than T1 and T2 groups (Table 2). But the values did not differ significantly between T1 and T2. The similar trend persisted at different intervals of recordings throughout the experiment. Further, the final HG of calves in control, T1 and T2 indicated the similar trend as in the beginning. Significantly ($P<0.01$) higher HG in control at the end might be due to better weight gain than other 2 groups. Kantharaja (2011) reported that the effect of system of rearing was significant ($P<0.01$) on most of the heart girths during 1–28 weeks. The suckling calves showed more increase in HG over their weaned counterparts (Aref *et al.* 2016).

Table 3. Blood parameters of buffalo calves reared under suckling versus weaning groups

Parameter	Group	Day-0	Day-15	Day-30	Day-45	Day-60	Day-75	Day-90
Cortisol (nM/L)	Control	17.36±6.07	13.93±3.86	10.71±2.30	8.44±1.96	9.17±2.45 ^b	9.77±2.05	10.62±2.49
	Treatment 1	19.11±2.30	18.09±3.66	12.05±3.89	11.40±2.54	11.80±2.29 ^{ab}	9.12±3.27	6.49±1.39
	Treatment 2	18.19±3.50	15.49±3.03	12.78±2.39	14.18±1.64	16.30±2.18 ^a	10.62±2.49	8.55±1.97
SGPT (IU/L)	Control	38.52±1.19	40.65±1.77	39.57±1.05	37.52±1.89 ^b	37.97±1.15 ^b	39.10±0.89	39.80±0.78
	Treatment 1	39.42±0.92	42.07±1.62	42.54±1.44	42.90±1.11 ^b	39.16±1.45 ^b	40.55±1.97	41.50±1.26
	Treatment 2	38.92±2.00	40.02±1.53	39.17±2.20	44.14±2.26 ^a	43.03±1.93 ^a	41.96±2.00	42.19±1.57
SGOT (IU/L)	Control	87.17±2.21	89.12±3.15	90.27±3.34	89.19±2.11	88.95±2.46	86.62±2.49	86.16±2.25
	Treatment 1	92.58±1.95	95.12±1.97	91.43±2.42	88.80±2.06	90.25±2.39	89.08±2.35	88.33±1.99
	Treatment 2	88.72±2.13	89.93±2.22	91.38±2.78	97.67±5.40	94.54±3.38	92.17±2.26	91.64±2.85
TP (g/dL)	Control	8.43±0.26	8.08±0.35	8.40±0.24	8.24±0.24	8.41±0.23	8.30±0.42	7.74±0.27
	Treatment 1	8.60±0.33	8.74±0.57	8.32±0.47	8.58±0.25	8.28±0.27	8.00±0.30	7.96±0.36
	Treatment 2	8.63±0.62	8.49±0.40	8.59±0.38	8.66±0.44	8.30±0.19	8.26±0.51	8.63±0.64
T-3 (nM/L)	Control	2.94±0.19	2.69±0.13	2.87±0.15	2.76±0.15	2.85±0.13	2.90±0.18	2.81±0.17
	Treatment 1	3.02±0.18	2.87±0.19	2.89±0.13	2.91±0.14	2.94±0.13	2.97±0.15	2.90±0.09
	Treatment 2	2.95±0.20	2.85±0.14	2.82±0.19	3.01±0.24	2.93±0.16	2.71±0.16	2.64±0.22
T-4 (nM/L)	Control	60.13±1.22	62.55±1.788	61.10±1.04 ^b	59.00±1.89	59.56±1.18 ^b	60.60±0.89	61.30±0.78 ^b
	Treatment 1	63.42±1.02	66.98±3.19	65.99±1.90 ^a	64.17±3.42	61.61±3.24 ^{ab}	62.73±3.05	63.68±2.63 ^{ab}
	Treatment 2	60.32±2.00	61.42±1.53	60.57±2.20 ^b	65.54±2.26	67.43±1.93 ^a	66.36±2.00	66.59±1.57 ^a

^{a,b}Means bearing different superscripts within the column (between the groups) differ significantly ($P < 0.05$).

Serum biochemical parameters of calves

Cortisol: The cortisol level was not affected at most of the sampling days (Table 3), however, at day-60, it was significantly ($P < 0.05$) higher in T2 than that in control but nonsignificantly different from T1. The cortisol is a prime biochemical indicator, which is increased during the stress. Weaning immediately after birth (T1) did not affect cortisol level in calves than suckling group. The higher cortisol at 60th day of age in T2 indicates weaning at 45th day might have sustained stress not only because of break in established social bonds from dams (Hickey *et al.* 2003, Loberg *et al.* 2008, Bharti *et al.* 2017) but also due to nutritional stress, which could be owing to lower intake of whole milk (Blanco *et al.* 2009) and consequent shifting to higher solid diets (Gudev *et al.* 2007). The weaning stress might have resulted in lowered feed intake in calves of weaned groups, which was reflected through behavioural changes in calves (Bharti *et al.* 2015b) and slightly higher fecal consistency scores (Bharti *et al.* 2015c). The present finding is in agreement with the reports from previous reports (Sikka *et al.* 2002, Sharma and Tripathi 2006, Ahmad *et al.* 2009); contrarily, Landa (2011) observed no effect on fecal concentration due to abrupt and fence line weaning in beef calves.

Serum glutamic pyruvic transaminase (SGPT): The SGPT level was significantly higher at day-45 and day-60 in T2 than that in control and T1 (Table 3). The SGPT was nonsignificant among the groups at other stages of sampling, which indicates higher metabolic stress in calves weaned at 45th day of age. The late weaned calves however are less affected in terms of survival rate and growth performance in comparison to calves weaned at birth, but the social distress could be quite evident (Hickey *et al.* 2003, Rashid *et al.* 2013).

Serum glutamic oxalo-acetic transaminase (SGOT): The SGOT level was not affected by weaning (Table 3) at different age (at birth and 45th days) in comparison with suckled calves. The results are within the normal range as reported in other bovine species (Mamun *et al.* 2013).

Total protein (TP): The TP level was not affected by weaning (Table 3) at different age (at birth and 45th days) in comparison with suckled calves. The present finding is in agreement with the earlier reports (Lone *et al.* 2003, Aref *et al.* 2016).

Tri-iodo thyronine (T₃) and tetra-iodo thyronine (T₄): The serum T₃ level was not affected by weaning (Table 3) at different age (at birth and 45th days) in comparison with suckled calves. The serum T₄ level had fluctuating trends and it was significantly higher at day-30 of sampling in T1 compared to control and T2 groups. Similarly, its level at day-60 and day-90 of sampling was significantly higher in T2 than control group. The reason for higher T₄ level may be due to elevated compensatory metabolic heat with low protein intake from whole milk in both weaned groups for certain duration after weaning. The present finding is in agreement with the previous reports (Qureshi 2008).

From the present study, it can be concluded that growth measurements were more affected on weaning at birth in comparison to late weaning, however the stress in terms of bio-chemicals was more evident in the late weaned buffalo calves. The weaning practice in buffalo calves needs intensive care in view of better neonatal management.

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