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Growth and intake of Murrah buffalo calves under suckling and non-suckling system of management

CPS Solanki, GP Lakhani, Biswajit Roy, Aditya Mishra, SK Joshi and Bhavna Aharwal

Abstract
For the study a total sixteen recently calved Murrah buffaloes and their calves were selected from Livestock Farm, Adhartal, Department of Livestock Production and Management, College of Veterinary Science & A.H., N.D.V.S.U., Jabalpur (M.P.) and randomly assigned into two different groups as suckling (control) and non-suckling (experimental) based on their lactation yield and parities. The average final body weight of non-suckling and suckling group of calves after 9 months of age was 116.56±2.49 and 125.07±3.17 kg respectively and there was no significant difference was found between the groups. The average daily weight gain (g) was 311.47±9.44 g and 343.61±5.58 g in non-suckling and suckling group calves, respectively and was significantly (P<0.05) higher in suckling group calves than non-suckling group calves. The average daily colostrum intake in 1st 5 days after birth by non-suckling and suckling calved were 2.68±0.08 kg and 2.90±0.09 kg respectively and there was statistically no-significant (P>0.05) difference was found between the groups. The average overall daily milk intake (kg) in non-suckling and suckling calves was 2.25±0.06kg and 2.40±0.06kg respectively. Milk intake for suckling group and non-suckling group showed a non-significant (P>0.05) difference. The overall mean milk intake time for non-suckling and suckling group of calves was 3.92±0.22 and 8.59±0.30 min, respectively and significantly (P<0.05) lower in non-suckling group calves than suckling group. The average dry matter intake (kg) through milk in non-suckling and suckling group calves were 2.67 kg and 2.83 kg, respectively and total dry matter intake from green fodder and concentrate were 7.62 kg vs. 7.75 kg and 7.38 kg vs. 7.39 kg by non-suckling and suckling group calves respectively and non-significant (P>0.05) difference was found between the groups.

Keywords: Murrah buffalo, non-suckling, suckling, milk intake, colostrum, dry matter

Introduction
Currently India rank 1st in milk production and there was gradual increase from 20 million tons (1960) to 187.7 million tons (Annual Report NDDB, 2018-19) and milk is the main output from livestock sector accounting for 66.7% of the total livestock value output. Buffalo population in India is 109.85 million (20thLivestock Census, 2019) [1] and contributes about 51.2% of total milk production in India.

The proper feeding and management of the buffalo calf in the initial stage ensures the productive efficiency of the buffalo and will be throw back later on its performance. Effect of rearing and feeding systems of buffalo calves, calostrum intake, milk intake, feed intake and management affect the growth and performance of buffalo calves. Success for dairy farm enterprise depends up on successful calf rearing because these young calves will be the future replacement stock of dairy farm. Proper rearing of a healthy and viable calf is another prerequisite for making the best use of its genetic potential for dairy animals (Frelich *et al*., 2008 and Rehak *et al*., 2009) [15, 36].

In conventional system of buffalo management, calves are allowed to suckle their dams for let-down of milk as well as milk feeding and separated from dam around one year of age (Khan *et al*., 2007) [24]. However, in organized modern and commercial buffaloes farms the calves are separated from their mothers immediately or shortly after the parturition and reared on whole milk or milk replacer substitute using milk pail (Bucket or nipple) feeding.

In buffaloes, mother and young relationships are closely bonded and buffalo having strong maternal instincts. Buffalo calves are slow learners as compared to the crossbred cattle calves (Hagberg, 2003) [20] and require more time to learn drinking of milk from the pail/bucket under artificial feeding (Smijisha, 2007) [44]. Therefore, separation between buffalo dam and their calves becomes more stressful in comparison to *taurus* cattle's calves (Foulkes, 2005) [14].

Materials and Methods

The study was conducted on the Murrah buffalo's dams and their calves, herd maintained at Livestock Farm, Adhartal, Department of Livestock Production and Management, College of Veterinary Science & A.H., N.D.V.S.U., Jabalpur (M.P.). A total sixteen recently calved Murrah buffaloes and their calves were randomly assigned into two different groups as suckling (control) and non-suckling (experimental) based on their lactation yield and parities. Diet was formulated and fed as total mixed ration according to nutrient requirement of lactating Murrah buffaloes (ICAR, 2013) [22].

Table 1: Experimental Design

Group 1	Suckling or control	1. The calves were allowed for natural suckling of colostrum and milk. 2. The calves were allowed suckling for let-down of milk at the start of milking. 3. At the end of milking, the calves were allowed again to suckle the required amount of colostrums and milk throughout the experimental period.
Group 2	Non-suckling	1. The calves were separated from dam immediately after birth and trained manually to drink colostrum as well as milk. 2. The milk let-down of buffaloes was done by teat massage before milking and provision of concentrate mixture.

The study was conducted for a period of one year (from 1st June, 2020 to 30th May, 2021) at Livestock Farm, Adhartal, Jabalpur. Prior to experimentation, the animals were allowed to 10 days adjustment period to reduce the effect of stress possibly experienced by the animals due to separation from the main stock of the farm.

Feeding schedule of non-suckling group calves

All the experimental non-suckling calves were maintained under uniform managemental conditions. All non-suckling calves were fed as per the following feeding schedule.

Table 2: Feeding schedule of non-suckling calves

Age (days)	Colostrum	Milk	Calf starter	Chaffed green
1-4	1/10th of BW	-	-	-
5-15	-	1/10th of BW	-	-
16-20	-	1/10th of BW	*ad libitum*	*ad libitum*
21-40	-	1/15th of BW	100g	*ad lib*
41-60	-	1/20th of BW	250g	*ad lib*
61-90		Milk is gradually reduced	500g	*ad lib*

(Reddy, 2009)

The feeding of milk was carried out twice a day i.e., in morning (7.00 am) and evening (5.30 pm). The care was taken that the temperature of milk offered to the calves was as close to the body temperature of calves as possible.

Feeding schedule of suckled group calves

The calves were allowed to suckling for colostrums feeding and for the let-down of milk at the start of milking and the calves were again allowed to suckle the required amount of milk for 15 minutes at end of the milking up to 90 days.

Body weight of calves (kg)

Body weight of all calves were recorded on weekly basis up to 90 days in the morning before feeding with the use of platform type electronic weighing balance and thereafter monthly up to 9 months.

Average daily body weight gain (ADG)

The daily weight gains (g) of each calf for various stages of growth were calculated by formula given below up to 9 months.

Average daily gain (g/day) = Total body weight gain (g) / Duration of the growth trial (days)

Colostrum Intake (kg)

The calves were weighed before and after colostrum feeding to calculate the colostrum intake in naturally suckling group of calves. In the non-suckling group of calves weighed amount of colostrum was offered and the residual colostrum was measured to calculate the colostrum intake (Kantharaja *et al*., 2018) [23].

For suckled group of calves, colostrum intake was calculated by following formula-

Colostrum intake by suckling calf = Wt. of calf after milking – Wt. of calf before milking

Milk intake (kg)

Milk intake of the calves in the suckling group was recorded daily. To calculate the total milk consumed by the calf, body weight immediately before and after suckling was taken using electronic weighing balance.

Formula used-

Milk intake= Weight of calf after suckling - Weight of calf before suckling

Milk intake was also calculated weekly by

Milk intake of suckling calf = (Total milk yield of 7th day– Average milk yield of 6 days)

Milk intake of non-suckling calves was recorded as milk offered to calves as per standard feeding schedule. Milk intake by calves was recorded up to 90 days.

Dry matter estimation

The total dry matter intake (DMI) was calculated for the both group calves at fortnightly interval taking into account the daily average amount of milk, green mix and concentrate mixture consumed. To estimate the total dry matter intake difference between offered dry matter and left-over dry matter was measured next day in the morning. The offered feed samples and milk were analyzed as per AOAC Official Method 934.01.

Table 3: Chemical compositions (%) of milk offered to the calves

Particulars	Non-suckling	Suckling
Fat %	6.95±0.11	6.59±0.09
Lactose %	5.79±0.06	5.93±0.04
Protein %	3.88±0.04	4.00±0.00
SNF %	10.63±0.11	10.66±0.07
TS %	17.70±0.17	17.38±0.11

Table 4: Chemical composition (%) of feeds and fodder offered to the calves

Feeds and fodder	DM %
Concentration	89.5
Maize	15.72 (14.32-17.12)
Oat	14.57 (11.52-17.63)
Barseem	14.50 12.50-16.50)

Results and Discussion

Body weight of calves (kg)

Growth rates of calves and conversion of milk into live weight gain were improved when calves were reared by restricted suckling rather than with milk from a bucket (Velazco *et al*., 1983) [47]. Wagenaar and Langhout (2007) [48] reported that suckling up to 3 months of age had a positive effect on calf growth as compared to bucket fed calves.

Initially average body weight (kg) in non-suckling and suckling calves was 31.95±0.63 and 31.75±1.24 kg respectively. The average final body weight of non-suckling and suckling group of calves after 9 months of age was 116.56±2.49 and 125.07±3.17 kg respectively and there was no significant difference between the groups.

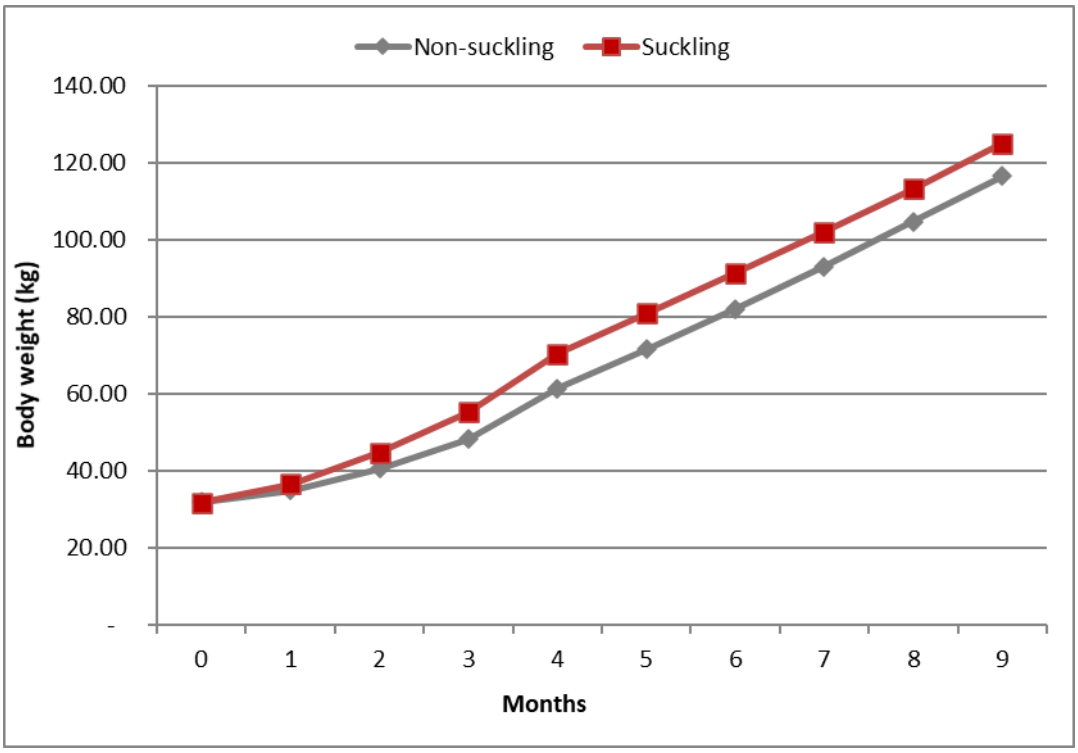

Fig 1: Average monthly body weight (kg) of Murrah buffalo calves in non-suckling and suckling group

The development of social bonds of nursing calves with the dam resulted in higher weight gain in suckling group as compared to non-suckling (Shahid *et al*., 2019) [40].

Present findings are in agreement with Boonbrahm *et al.* (2004) [10], Grondahl *et al.* (2007) [19], Roth *et al.* (2009) [38], Mendoza *et al.* (2010) [31], Ghodasara *et al.* (2015) [18], Bharati *et al.* (2018) [8] and Riaz *et al.* (2021) [37] who reported higher weight gain in suckling group of calves than non-suckling group calves. Nursing with dam could provide good health and welfare advantages to calves (Krohn, 2001; Flower and Weary, 2003 and Shahid *et al*., 2019) [26, 13, 40]. It will improve the gut microflora and gut micro flora and has positive impact on growth (Qiu *et al*., 2020) [34]. Calves reared with their dams had better weight gain than the calves reared in artificial rearing system (Flower and Weary, 2001) [12].

Average daily gain (ADG)

The average daily weight gain (g) was 311.47±9.44 g and 343.61±5.58 g in non-suckling and suckling group calves, respectively and was significantly (P<0.05) higher in suckling group calves than non-suckling group calves.

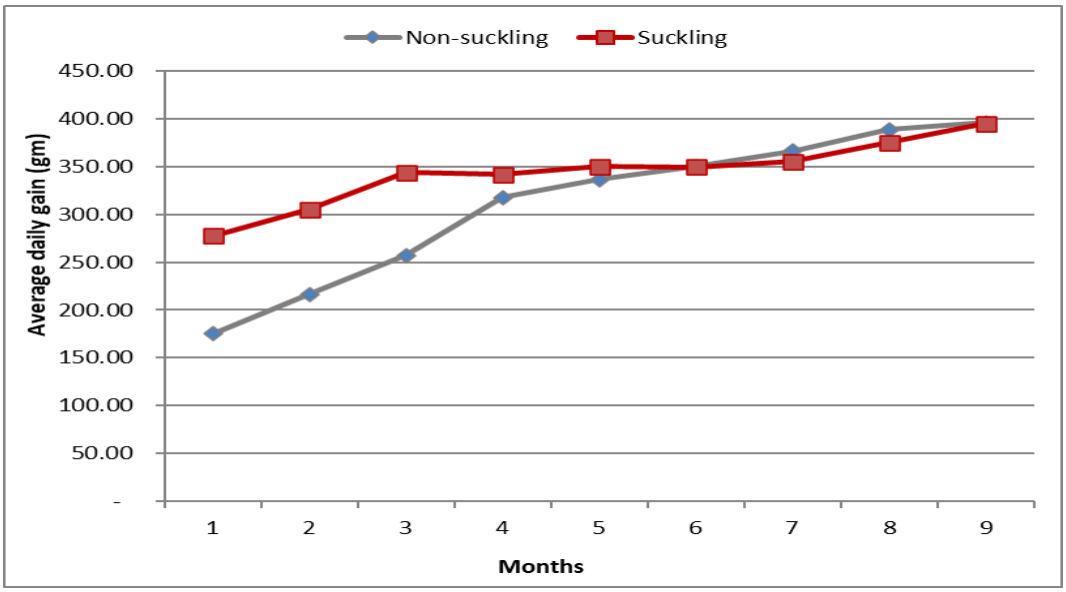

Fig 2: Average daily body weight (g) gain (ADG) of Murrah buffalo calves in non-suckling and suckling group

Significantly higher daily weight gain for suckling group than non-suckling group is because of higher milk intake. After 3rd month, milk feeding reduced gradually and calves were maintained on solid feed and fodder. Thus, there was no apparent difference in nutrition fed to the calf as result of this daily weight gain after 3 months was not differed significantly in both the groups.

The better performance of the calves in suckling is consistent with results of Bar-Peled *et al*. (1997) [5] and Boonbrahm *et al*. (2004b) [9] and may be attributed to their higher milk intake. The lower body weight gain in non-suckling calves may be due the fact that the calves under suckling system consume milk at an optimal temperature and with minimal possibilities of contamination and ingest the residual milk whereas, in non-suckling system of management calves were fed restricted milk (Ontsouka *et al*., 2003) [33]. Social interaction between cow and calf during early life has a positive effect on the daily gain of the calf (Krohn *et al*., 1999) [27].

The present findings are in agreement with Froberg *et al*. (2007) [16], Upadhyay *et al*. (2014) [46], Bharti *et al*. (2015) [7], Abbas *et al*. (2017) [2], Kumar *et al*. (2017a) [28], Singh *et al*. (2018) [43] and Riaz *et al*. (2021) [37] who reported higher daily body weight gain in suckling calves than non-suckling calves.

In contrast to the present findings, Sikka *et al*. (2002) [41] and Schoonmaker *et al*. (2004) [39] did not find any significant effect on total body weight gain in suckling versus non-suckling buffalo calves (from birth to 3 months). Froberg *et al*. (2008) [17] also observed no apparent difference in average daily weight gain between restricted suckling and artificial reared calves.

Daily Colostrum intake (kg)

The mean daily colostrum intake on 1st day was significantly higher in suckling group calves than non-suckling group calves because non-suckling buffalo calves take more time for learning milk from pail or bucket. From 2nd to 5th day, there was no significant difference between both the groups. Overall average daily colostrum intake was higher in suckling group (2.90±0.09) than non-suckling group (2.68±0.08), but statistically there was no-significant difference found between the groups.

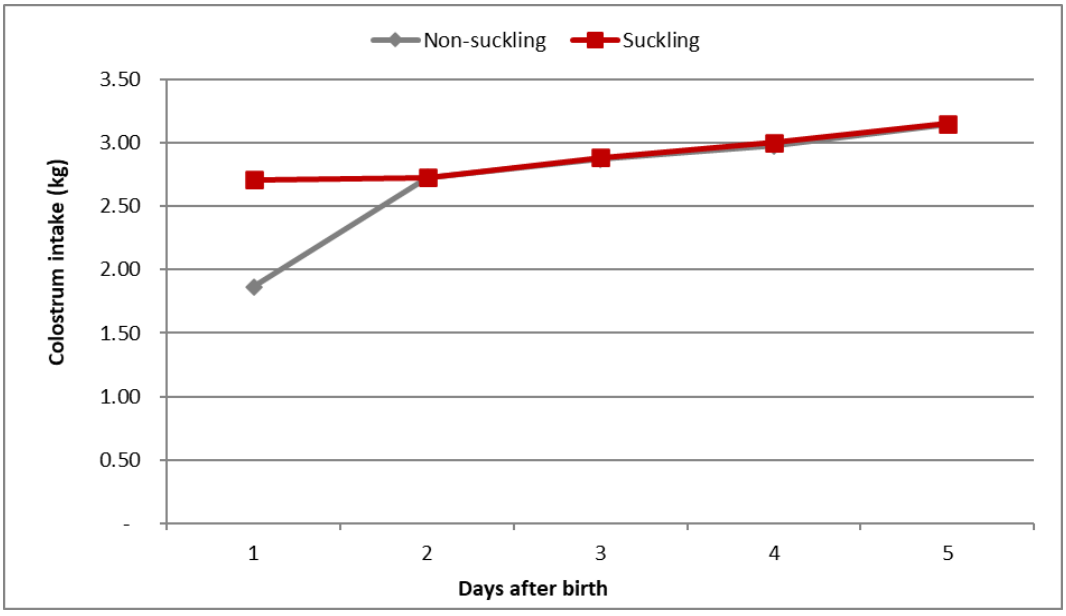

Fig 3: Average daily colostrum intake (kg) of experimental Murrah buffalo calves in non-suckling and suckling group

Present findings are supported by Smijisha and Kamboj (2012) [45] who reported the overall means of daily intake of colostrum up to five days after birth in suckling and non-suckling group and there was no significant difference among the two groups. Singh *et al*. (2018) [43] reported that the colostrums intake in suckling calves were significantly (P<0.05) higher as compared to non-suckling calves.

Daily milk intake (kg)

Average overall daily milk intake (kg) in non-suckling and suckling calves was 2.25±0.06kg and 2.40±0.06kg respectively. Milk intake for suckling group and non-suckling group showed a non-significant (P>0.05) difference.

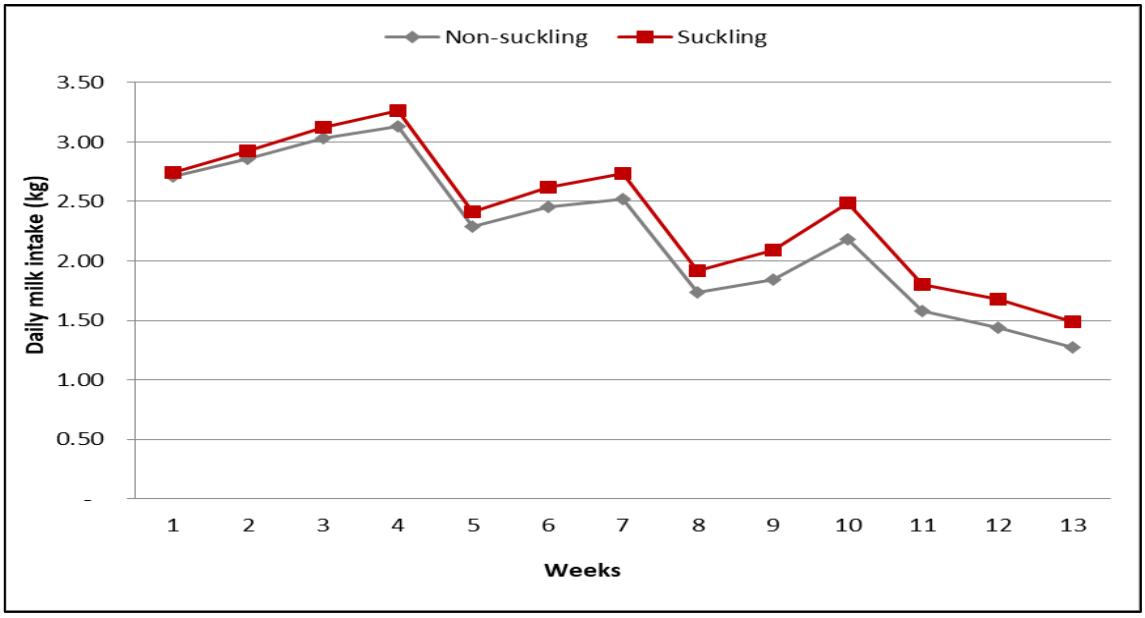

Fig 4: Daily milk intake (kg) of Murrah buffalo calves in non-suckling and suckling group

More milk intake by suckling calves in present study are in accordance with Borderas *et al*. (2009) [11] who reported that suckling calves can drink more milk than weaned without any negative effects on their health. Significantly, more growth in suckling may also be due to daily dam-calf social interaction at the time of milking which might have influenced the growth of calves positively (Kisac *et al*., 2011) [25] and may be due to native maternal milk obtained to offspring which might have impacted offspring behavior and resulted in subsequent health and development (Hinde and Capitanio, 2010) [21].

In the support of present study Singh *et al*. (2017) [42] reported the mean squares value of milk intake from sixth day after birth to 12 weeks of age in suckling calves were significantly higher (P<0.01) as compared to non-suckling calves. This difference of milk feeding might be due to difference in the digestion of some nutrients contained in milk due to salivary enzymes.

Milk intake time (min)

The overall mean milk intake time for non-suckling and suckling group of calves was 3.92±0.22 and 8.59±0.30 min, respectively and significantly (P<0.05) higher in suckling group calves than non-suckling group.

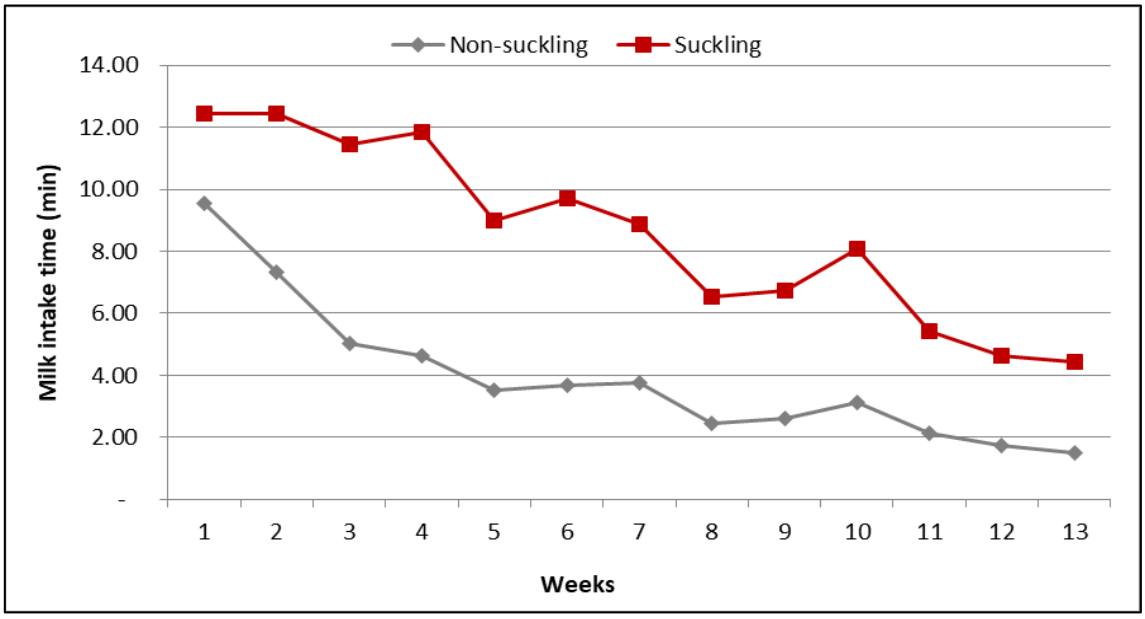

Fig 5: Daily milk intake time (min) of Murrah buffalo calves in non-suckling and suckling group

The slower rate of feeding in suckling buffalo calves as compared to non-suckling buffalo calves may be due to narrow opening of the teat of buffalo's udder, while in case of non-suckling calves once they learn milk feeding from pail or bucket, they finish faster because there was no limitation of narrowing of passage. In the agreement of present findings Boonbrahm *et al*. (2004) [10], Froberg *et al*. (2008) [17], Roth *et al*. (2009) [38] and Singh *et al*. (2018) [43] reported that the mean of milk intake time was significantly (P<0.01) higher in suckling calves as compared to non-suckling calves.

Dry matter intake through milk (kg)

Initially up to 2nd fortnight dry matter intake through milk was higher in both the group thereafter continuously declined, because milk quantity reduces with the advancement of age. The average dry matter intake (kg) through milk in non-suckling and suckling group calves were 2.67 kg and 2.83 kg, respectively and there was no significant (p>0.05) difference.

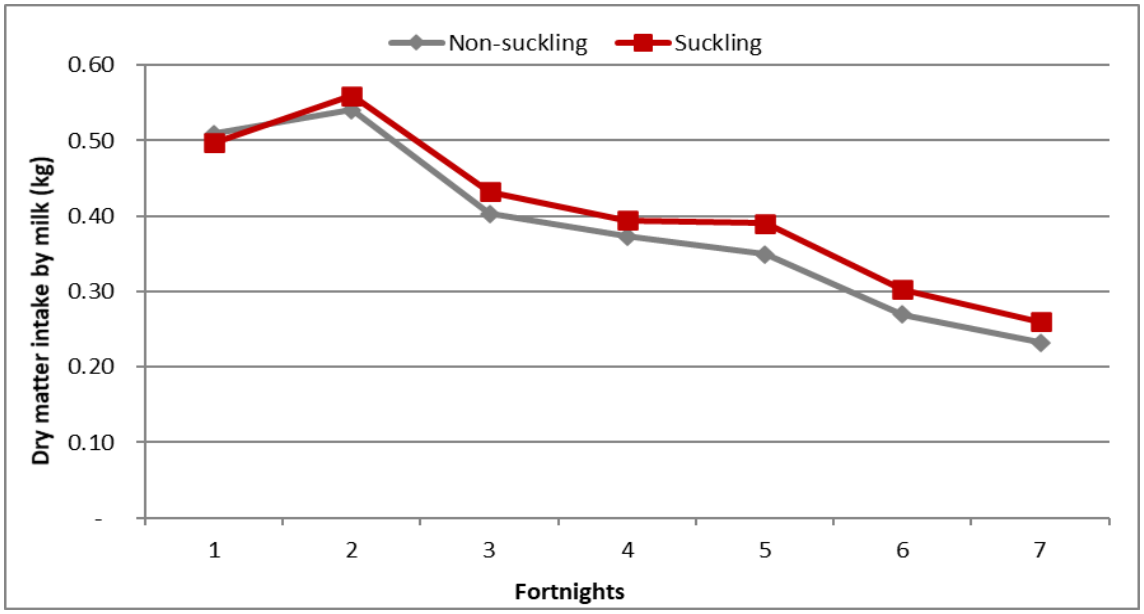

Fig 6: Average daily dry matter intake (kg) through milk on fortnight basis of Murrah buffalo calves in non-suckling and suckling group

Higher dry matter intake through milk in suckling group of calves could be due to the better quality of residual milk. Dry matter intake from milk reported in the present study was in accordance to the previous studies of Babu (2000) [4] and Bharti (2007) [6]. Higher DMI in suckling than non-suckling calves might be due to more dependency on milk in suckling calves, being milk the principal feed whereas comparatively lesser milk intake in non-suckling group calves (Bharti *et al*., 2015) [7]. Kumar *et al*. (2017a) [28] reported that the average milk intake was similar in both the groups but average dry matter intake from milk was significantly higher in suckling group as compared to the non-suckling group of buffalo calves (P<0.05).

Dry matter intake (kg) through green fodder and concentrate

The average dry matter intake (kg) through green fodder and concentrate in non-suckling and suckling group of buffalo calves at fortnight intervals up to six months period is presented in figure 7 and 8.

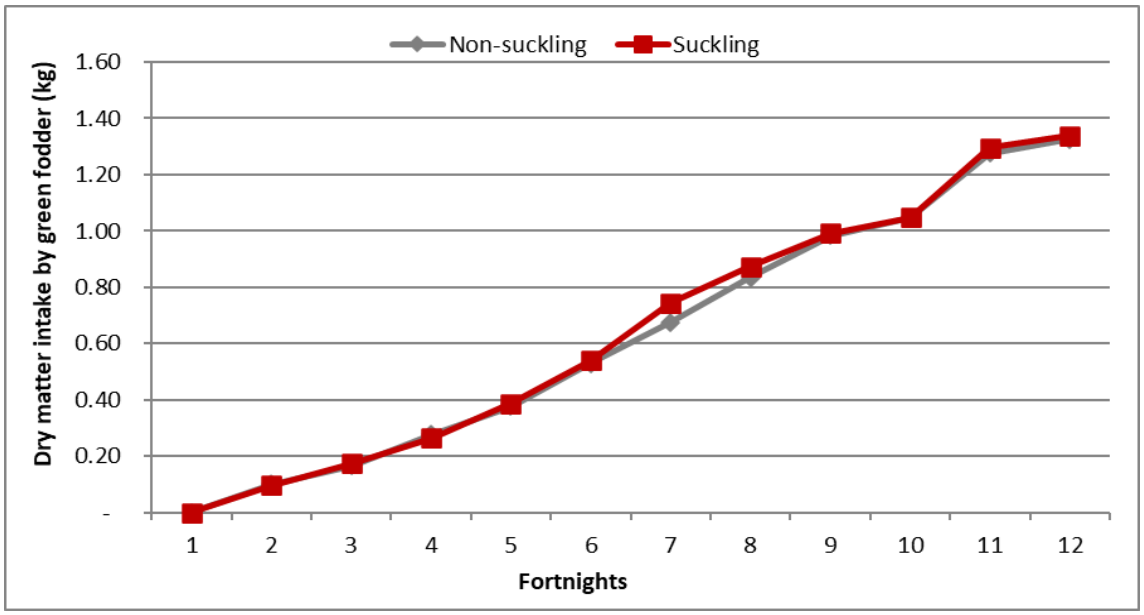

Fig 7: Average daily dry matter intake (kg) through concentrate on fortnight basis of Murrah buffalo calves in non-suckling and suckling group

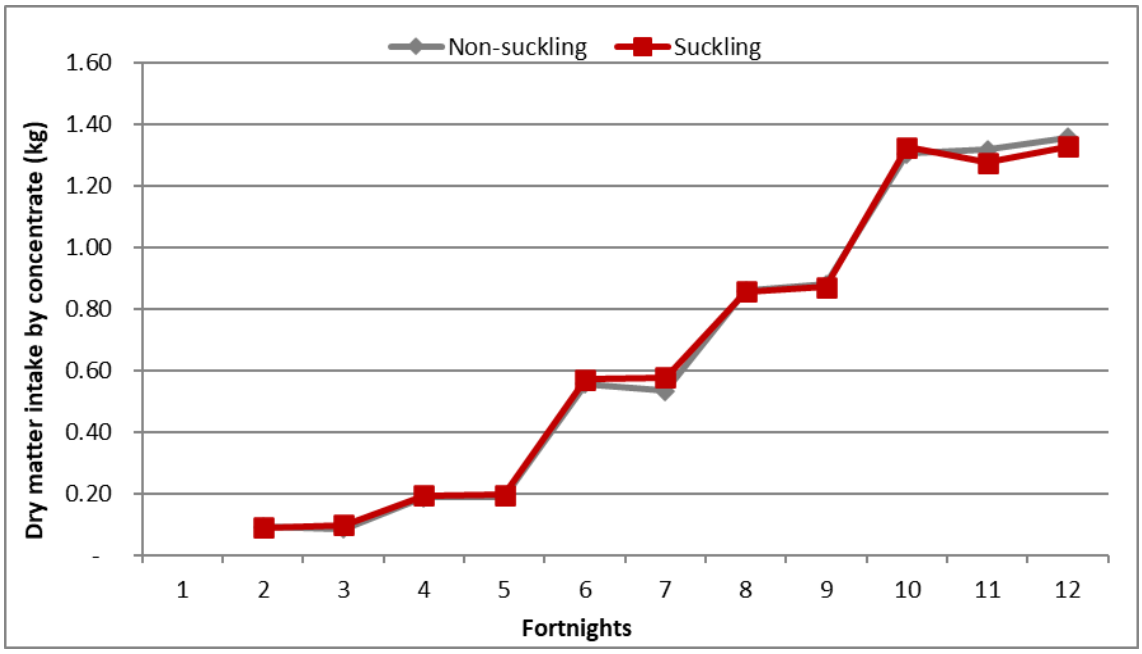

Fig 8: Average daily dry matter intake (kg) through concentrate on fortnight basis of Murrah buffalo calves in non-suckling and suckling group

The total dry matter intake from green fodder and concentrate were 7.62 kg vs. 7.75 kg and 7.38 kg vs. 7.39 kg by non-suckling and suckling group calves respectively. There was no significant difference in dry matter intake through green fodder and concentration in both the groups.

Total dry matter intake (kg) through milk, green fodder and concentrate

The overall dry mater intake (from milk, green fodder and concentrate) was 17.67 and 17.97 kg in non-suckling and suckling group, respectively. There was no significant difference found between the groups.

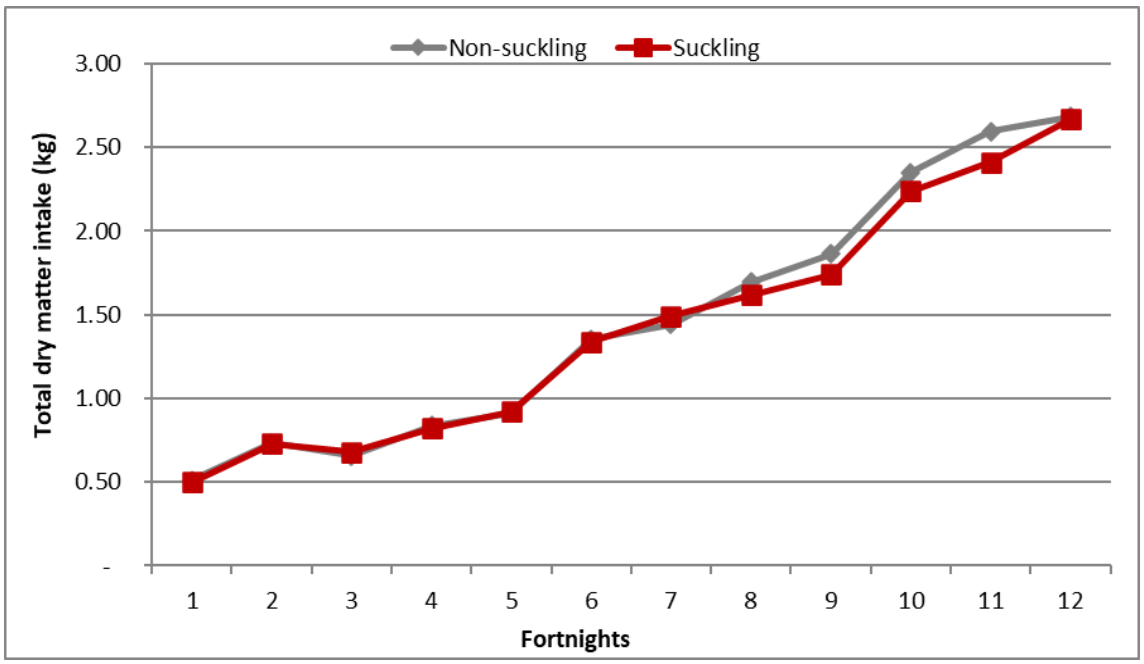

Fig 9: Average daily total dry matter intake (milk, green fodder and concentrate) on fortnight basis of Murrah buffalo calves in non-suckling and suckling group

Langhout (2003) [29] reported that the calves allowed to suckle twice a day ate very little concentrates after non-suckling compared to the calves removed immediately after birth. They had also difficulties in changing from large quantities of milk to only concentrates and hay, which impaired the growth for the first three weeks after non-suckling. However, measured over the whole period after non-suckling (42 till 101 days) there was no difference in feed intake.

When calves fed similar amounts of dry matter from milk or milk replacer; then whole milk fed calves were heavier than those offered milk replacer. Better performance of whole milked fed calves was attributed to better bioavailability of nutrients and unknown growth factors present in whole milk (Lee *et al*., 2009) [30]. Singh *et al*. (2018) [43] reported the average dry matter intake in the suckling calf was higher as compared to the non-suckling calves although there was no statistically significant difference found.

Conclusion

Milk feeding by bucket was not satisfied sucking motivation completely. Calves having contact with their mother are able to cope with housing conditions even if this contact is very limited. Main effects of suckling are related to the higher energy intake due to the higher fat content of suckled milk than the milk fed to bucket calves. Restricted suckling therefore is a very important and sustainable method in dairy production to optimize output and efficiency. A natural suckling buffalo calf shows better growth performance as compared to non-suckling buffalo calves. The findings of the research indicated that the effect of maternal behavior was more critical in the pre non-suckling phase on growth performance and the welfare of calves as compared to bucket feeding. It was observed that a positive effect on growth performance continue for the first few months, after that non-significant difference in weight gain was observed. The present study was concluded that the calves reared with suckling system attain higher body weight, average daily gain than the non-suckling system of rearing.

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