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Influence of Weaning on Immune Status and Health of Buffalo (*Bubalus bubalis*) Calves

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ABSTRACT: The aim of the study was to determine the effect of weaning and suckling on immune status and health of buffalo calves. Sixteen freshly calved buffaloes and their newly born calves were selected from the Murrah buffalo herd maintained at the ICAR-National Dairy Research Institute (Karnal). The calves were divided into two groups of 8 each group; suckled and weaned group. The calves in the suckled group were allowed natural suckling of colostrum as well as milk and for let-down of milk and in weaned group, the calves were separated from their dams immediately after birth. The mean daily colostrum intake during the first two feedings were significantly (P<0.05) lower (1.80, 2.44 vs. 2.29, 2.73 kg) in weaned calves as compared to suckled calves. Level of immune status in buffalo calves was higher in suckled calves as compared to weaning calves. It was concluded that the immune status and health performance of naturally suckled buffalo's calves were better as compared to weaned calves.

Keywords: Buffalo calves, Colostrum intake, Health, Immunoglobulin, Suckling, Weaning.

INTRODUCTION

The key of profitable dairy farming is successful calf rearing for raising called future replacement stock for dairy farm. Calves play an important role in the development of dairy of the country (Sabapara *et al.,* 2015). Buffalo is a one of the most efficient milk producer reared under traditional management system. Unlike, crossbred cow based commercial dairy farm, 8 buffalo calves are allowed to suckle their dams for their milk feeding as well as letdown of milk that have some positive impact on dam's milk production, calf growth and body weight gain whereas it may negatively affect reproduction of dam (Kumar *et al*., 2017; Cruz-Cruz *et al*., 2019). Weaning is a modern and economical practice at present dairy farms, however, mother and young are closely bonded in buffaloes and calf usually becomes more stressed when separated from the dam than do the calves of cattle (Foulkes, 2005). The buffalo are slow learner and take more time to learn to drink from pail/bucket under artificial condition (Hagberg, 2003). Therefore, they do not consume needed amount of colostrum (Smijisha and Kamboj 2007), depriving the immunoglobulin during post-nantal period resulting in higher disease incidence and mortality in weaned calves. Suckling may increase intake of colostrum thereby improve immune status and thus reduce incidence of disease and mortality in buffalo calves. The information on beneficial effect of suckling vis-à-vis weaning in Murrah buffalo calves and its effects on calf immune status and health is scanty. Therefore, the present study was undertaken to study the effect of weaning on immune status and health of Murrah buffalo calves.

MATERIALS AND METHODS

Sixteen freshly calves buffaloes and their calves were selected from the Murrah buffalo herd maintained at ICAR-National Dairy Research Institute (Karnal). The selected buffaloes and their calves were divided into two groups 8 in each as suckled and weaned group. The suckled group of buffaloes were allowed natural suckling of colostrum as well as milk twice a day before/ after milking from birth to 90 days of age and in weaned group, the calves were weaned separated from their dams immediately after birth and fed artificially. The experiment trail was continued for 180 days of age of calves from their birth. Each calf in suckled group was fed with colostrum of its own dam within few hours after birth and twice daily for first 5 days of age and later allowed to suckled its dam twice daily before/after milking. The weaned calves were fed as per feeding schedule followed at the institutional farm (Table 1). The milk was fed to weaned calves with the help a bottle with nipple. Both the groups of calves were kept separately under loose housing system in well ventilated, clean and dry pens. They were having free access to calf starter along with green succulent forage (berseem, maize, and oat).

Feeding schedule of weaned group of calves. The weaned group of calves were offered weighed amount of colostrum as well as milk and the residual amount was measured to calculate the colostrum and milk intake by bottle with nipple feeding.

Feeding schedule of suckled group of calves. The colostrum intake of suckling calves was recorded by weighing the calves immediately before and after suckling by using digital weighing balance to calculate the total milk consumption. Milk intake of the calves in the suckling group was recorded once in a week. The complete milking was done on the seventh day without allowing the calves to suckle. However, the calves was allowed to suckle their dams at the start of milking just for the let-down of milk. The milk intake by the calves were calculated by deducting the average daily milk yield of the buffalo on other 6 days of the week from the milk yield on the 7th day when the calves were not allowed to suckle their dams.

Table 1: Feeding schedule of weaned and suckled group of calves.

Age	Colostrum	Whole milk	Concentrate mixture (kg)	Green fodder
Up to 5 days	1/10thbody weight	—	—	—
6-30 days	—	1/10thbody weight	—	—
1-2 months	—	1/15thbody weight	0.120	*ad libitum*
2-3 months	—	1/25thbody weight	0.250	*ad libitum*
3-4 months	—	—	0.650	*ad libitum*
4-5 months	—	—	1.00	*ad libitum*
5-6 months	—	—	1.500	*ad libitum*

Health performance. The health parameters were recorded based on the direct observation method. The number of calves suffered, kind and duration of illness such as diarrhea, dysentery, respiratory problems, naval ill or any other health related clinical/sub-clinical symptoms were recorded daily. The faecal consistency score (FCS) was recorded twice daily in morning and evening as per Larson *et al*. (1977). The calves with FCS value more than two were considered as diarrheic and equal to/ less than 2 were considered normal.

Immune status. Blood sample were collected on day 2, 7, 28, 42 and 56 after birth of calves. Immune statuswas analyzed by the estimation of immunoglobulin IgG, IgM and IgA levels in calves serum by sandwich enzyme-linked immunosorbent assay (ELISA), using a kit from Koma Biotech, Korea.

Milk composition. Fat, protein and lactose content in milk were estimated using the Lactoscan Milkometer (Mega-Netco, Bulgaria, MMB-965-3100).

Statistical analysis. The data obtained on different parameters was analyzed using the SPSS, version 16 (SPSS1996).

RESULTS AND DISCUSSION

Colostrum Intake. The mean values of colostrum intake in suckled and weaned calves on first day 2.29±0.21and1.80±0.12 and on second days 2.73±0.11 and 2.44±0.07 kg per day respectively were significantly (P<0.05) higher for suckled than the weaned groups of calves (Table 2). However, on the subsequent days (third to fifth day) there was not much difference in the daily intake of colostrum in the two groups because after the 2-3 feeding the weaned calves learned to drink colostrum from bottle.

This is in agreement with the finding of Singh *et al.* (2019) who reported that the daily intake of colostrum up to five days after birth in suckled and weaned calves was 2.96 and 3.03 kg and similar findings also reported of Smijisha and Kamboj (2012). In the first 1-2 days after birth the buffalo calves may not adapt to artificial feeding because buffalo calves are slow to learn to drink colostrum as well as milk from artificial means as compared to the natural suckled buffalo calves. However, on the subsequent days (third to fifth) there appear to be little difference in the daily intake of colostrum in the two groups as the weaned calves learned to drink milk from bottle with a nipple. This is corroborated by Stafford *et al.* (2005) who studied the feeding ability of newborn dairy calves fed with feeder bottle for the first 4 days after birth and concluded that majority of the calves become efficient drinkers within 48 hours of birth. But a small number of slow feeders may need individual feeding at least up to 4 days after birth.

Table 2: Average colostrum intake (kg) of weaned and suckled buffalo calves.

Days after birth	Weaned calves	Suckled calved
1	1.80±0.12^{a}	2.29±0.21^{b}
2	2.44±0.07^{a}	2.73±0.11^{b}
3	2.79±0.09	2.91±0.10
4	3.00±0.08	3.01±0.09
5	3.03±0.04	3.10.±0.03
Overall	**2.61±0.01**	**2.79±0.08**

*Means bearing different superscript differ significantly (P <0.05)

Immunoglobulin concentration.

Serum immunoglobulin G (IgG) concentration.

The mean serum immunoglobulin G (IgG) concentration on 2nd day after birth and thereafter at 7th, 28th, 42 and 56th days of age in experimental calves are presented in Table 3. The means of serum immunoglobulin G concentration in weaned and suckled on 2nd day after birth were significantly higher (36.23±0.26 mg/ml) in suckled group of calves as compared to the weaned group of calves (30.88± 0.28 mg/ ml). This is in agreement with Purohit and Singh (2008) who observed that on the first day after calving the IgG level in buffalo calves serum was 32.25 mg/ml and on third day after birth the IgG level was 28.94 mg/ml and the concentration of IgG in colostrum was 42.84 mg/ml. Smijisha and Kamboj (2007) also

reported that IgG levels in buffalo calves serum was significantly higher in bottle fed calves (39.68 mg/ml) than the pail fed calves (31.56 mg/ml). Mastellone *et al.* (2007) studied the passive immunity transfer status and growth performance in newborn buffalo calves allowed to nurse the dam. They reported that the serum IgG concentration at 24 hours after parturition was 34.3±5.1 mg/ml which is the almost similar to that observed the present study. Brignole and Stott (1980) found that concentration range of IgG in calves from absorption of colostral Ig after being left with their dams to suckle was 0 to 63 mg/ml with a mean of 11.3 mg/ml. The levels of IgG obtained in the present study fall within this range. The significantly higher amount of colostrum intake at first two feeding after birth may be the reason for a higher level of IgG in suckled group of calves. This finding is similar to that reported by Vann *et al.*, 1995 and McGee *et al*., 2005. They found that immunoglobulin concentrations in second-milking colostrum are substantially lower than first-milking colostrum in beef dairy cow. They found that there is a strong relationship with the quantity of colostrum intake and immune status of calves. It is evident that the serum IgG level was highest at 48 hrs after birth in both the groups of calves and it subsequently reduced up to 28 to 42 days and then again started to improve and attain a steady state by 2 months of age. This indicated that after one month to one and a half months after birth, the calves start to develop their own immunity. Stott *et al.* (1979) reported that rates of early absorption and maximum absorption of colostral Ig were greater in calves that suckled than in calves fed colostrum by bottle. The reasons behind the higher Ig concentration of serum in suckled calves reported included suckling occurs within the first 6 h postpartum; the amounts of colostrum consumed are usually large when compared to those traditionally offered by bucket; and calves are somehow rendered far more efficient absorbers of immune lactoglobulins if left with their dams, possibly as a result of the prolonged grooming they usually receive.

Serum immunoglobulin M (IgM) concentration. The mean IgM level at 2nd day of birth was 2.66±0.02 mg/ml and 3.22±0.02 mg/ml in weaned and suckled group of calves respectively. The mean levels of serum IgM in suckled group were significantly (P<0.001) higher than weaned group on 2nd day as well as thereafter on 7th, 28th, 42nd and 56th days of calf's age. The significantly higher amount of colostrum intake by suckled calves at the first two feeding and after birth from weaned calves might have resulted a higher level of IgM in suckled group of calves (Table 3). Purohit and Singh (2008) also observed that first day after calving the IgM level in buffalo calves serum was 3.49 mg/ml and on third day after birth the IgM level was 2.99 mg/ml. Abel Francisco *et al.* (1993) studied the serum immunoglobulin concentrations after feeding maternal colostrum or maternal colostrum plus colostral supplement to dairy calves. They found that the mean serum IgM concentration in calves was 2.24 mg/ml at 24 hours. Husband *et al.* (1972) reported that the concentration of immunoglobulins IgM in seven (4 Ayrshire, 1 Friesian and 2 of mixed bred) un-suckled calves from birth to 18 weeks of age in calves' serum on 1st, 2nd, 4th, 8th, 16, 32nd, 64th and 128th days were found to be 6.01, 4.65, 3.21, 1.68, 0.99, 0.76, 1.47 and 2.91 mg/ml respectively. Brignole and Stott (1980) found that concentration of IgM in dairy calves from colostral after being left with their dams to suckle was 0 to 15 mg/ml with a mean of 2.90 mg/ml of calf serum. Stott and Fellah (1983) studied on 120 Holstein-Friesian weaned calves at birth and fed either 1 or 2 liters colostrum. They found that the immunoglobulin concentration of IgM was ranging from 0.46 to 11.19 mg/ ml in their serum. Jezek *et al.* (2012) found that the serum immunoglobulin IgM concentration in cows of black and white breed calves and fed colostrum though teat bottle. The concentration of IgM in calves' serum was 1.13 g/L on 1st week of age.

Serum immunoglobulin A (IgA) concentration. The mean of IgA in weaned and suckled on 2nd day was 1.18 and 1.37 mg/ml respectively. The levels of serum Immunoglobulin A (IgA) in suckled calves was higher as compared to weaned group of calves on 2nd day as well as on 7th, 28th, 42nd and 56th days of age after birth. The significantly higher intake of colostrum by suckled calves at the first two feeding after birth than the weaned may be the reason for a higher level of IgA in suckled group calves. Purohit and Singh (2008) observed that first day after calving the IgA level in buffalo calves serum was 1.35 mg/ml and on third day after birth the IgA level was 0.98 mg/ml. Zarcula *et al.* (2008) studied the colostral immunity in newborn calf: methods for improvement of immunoglobulins absorption. They found the immunoglobulins (IgG, IgM and IgA) concentration in calves serum were 25.0, 3.1 and 0.4 mg/ml respectively in dairy calves. Jezek *et al.* (2012) found that the serum immunoglobulin IgA concentration in calves' serum was 0.54 g/L on 1st week of age. Stott and Fellah (1983) studied on 120 Holstein-Friesian weaned calves at birth and fed either 1 or 2 liters colostrum. They found that the immunoglobulin concentration of IgA was ranging from 0.38 – 5.53 mg/ ml in their serum.

The serum immunoglobulin concentration in calves may be influenced by many factors, including the age at the first feeding (Rajala and Castren 1995), amount of the colostrum consumed (Besser *et al*., 1985), colostral quality (Houghton *et al*., 1990) and method of colostrum feeding (Brignole and Stott 1980). Intake of colostral marked influence on blood immunoglobulin concentrations (Hopkins and Quigley 1997).

Table 3: Immune status of suckled and weaned Murrah Buffalo calves.

Age of calf (days)	IgG (mg/ml)		IgM (mg/ml)		IgA (mg/ml)	
	Suckled calves	Weaned calves	Suckled calves	Weaned calves	Suckled calves	Weaned calves
1	36.23±0.26^{b}	30.88±0.28^{a}	3.22±0.02^{b}	2.66±0.02^{a}	1.37±0.02^{b}	1.18±0.03^{a}
7	30.46±0.23^{b}	26.20±0.27^{a}	1.82±0.03^{b}	1.61±0.03^{a}	0.70±0.02^{b}	0.61±0.02^{a}
28	27.06±0.44^{b}	24.41±0.18^{a}	1.17±0.02^{b}	0.97±0.02^{a}	0.43±0.01^{b}	0.35±0.01^{a}
42	24.61±0.34^{b}	21.01±0.30^{a}	1.38±0.02^{b}	1.26±0.02^{a}	0.61±0.02^{b}	0.50±0.02^{a}
56	28.13±0.18^{b}	25.06±0.19^{a}	1.57±0.02^{b}	1.43±0.02^{a}	0.89±0.02^{b}	0.71±0.01^{a}

Immunoglobulin IgA (mg/ml) in serum of buffalo calves

Health performance of buffalo calves. There were four major health disorders namely, diarrhea, eye infection, naval ill and fever observed in the suckled groups and weaned group of calves throughout the experimental period (Table 4). Incidence of diarrhea, Naval ill fever and eyes infection were numerically more in weaned calves as compared to suckled calves. The incidence of total number of afflictions was significantly higher in weaned (5) than suckled and followed by suckled calves (3). This may be due to a better immune status of suckled calves. Incidence of disease in weaned and suckled buffalo calves as evident for higher concentration of IgG, IgM and IgA levels as compared to weaned group of calves.

Table 4: Incidence of disease in weaned and suckled buffalo calves.

Name of disease	Weaned calves	Suckled calves
Diarrhea	2 (25%)	1(12%)
Naval ill	4	2
Fever	3	2
Eyes infection	3	0
Total	**5 (62%)^{a}**	**3 (38%)^{b}**

*Means bearing different superscript differ significantly (P <0.05)

Ugarte and Preston (1972) reported that low mortality rate was in suckled (5.2%) compared to bucket fed buffalo calves (12.3%). Milk fed through bucket resulted in less availability of these antibodies and cell types to coat the gut mucosa as they remain attached to the surface of bucket, thereby increasing the mortality rate in the later. Boonbrahm *et al.* (2004) found that the no mortality in restricted suckled calves (0%) while in bucket calves had 15%. They also found the cases of morbidity were high in BR calves than RS calves. Mejia *et al.* (1998) reported that there was very low calf mortality in RS calves as compared to artificial reared calves. Out of 18 artificially reared calves only one died, while there were no deaths in the restricted suckling group. Intestinal parasites were more common in the bucket-fed animals (though not as common as in multiple-suckled calves. Although the temperature of bucket-fed milk, the rate of drinking and the quantity at each feed can also affect the health of bucket-fed calves (Stewart 1976; Taylor and Stewart 1976). They suggested that the risk of infection is definitely increased by simply handling the milk. Possibly the milk antibodies and cells attach to the surface of the bucket, so less are available to coat the gut mucosa.

CONCLUSIONS

It is concluded that naturally suckled buffalo calves consume more colostrum during first two days after birth and that have better immune status leading to lower incidences of disease that in weaning and weaned buffalo calves.

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Conflict of Interest. None.

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