



Influence of dietary salt supplementation on sodium potassium ratio and milk production in sodium depleted buffaloes

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Received: 22 August 2010; Accepted: 14 February 2011

Key words: Buffalo, Milk production, Salt supplementation, Sodium-potassium ratio

In Punjab, dairy animals are sparingly offered salt as part of diet (Bakshi and Wadhwa 2011) and most of them are moderately sodium depleted which has direct relationship with milk production (Gajebasia *et al.* 2005). In buffaloes, the incidence of sodium (Na) deficiency is highest at the period commencing at calving and extending until the peak of lactation (Singh *et al.* 2004). Furthermore, this loss in buffaloes is potentiated significantly with heat stress (Shahzad *et al.* 2008). However, the efficacy of supplementary salt for increased milk production especially in Na depleted buffaloes reared under hot ambience is obscure. Hence this study was planned to determine the effect of dietary salt on basic electrolyte ratio like Na and K and its subsequent effect on milk production.

Animals and management: The present study was conducted on 47 non-pregnant lactating buffaloes. All the animals were selected during May-July from various dairy farms situated in the Punjab.

Sample collection: The samples of drooling saliva were collected in the acid washed and clean Petri plates and were transferred into acid washed 10 ml screw capped plastic vials. Similarly, the samples of urine were collected in acid washed glass beakers and transferred into 20 ml acid washed screw capped plastic vials.

Sample storage: One drop of formalin per 5 ml of each of urine and saliva samples was added as preservative. All the samples were stored in deep freeze at -20°C till further use.

Mineral analysis: Sodium and potassium in urine/saliva were estimated by using flame photometer.

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Groups, management and sampling: All the 47 non pregnant lactating buffaloes were screened for Na and P concentration in collected urine and saliva samples, urinary Na concentration < 148.8 mmol/l were considered as criterion to judge sodium deficient animals (Singh *et al.* 1990). Out of 47 buffaloes, 26 animals (average 2.3 month post calving) were diagnosed as sodium depleted and randomly assigned in to 2 groups, viz. group A and B. All the animals were provided with 40–50 kg green fodder, 5–6 kg wheat straw and concentrate ration per day. Concentrate mixture was fed as per requirement (1.5+1.0 kg/2.0 litre milk yield) and includes wheat, deoiled rice polish, dry mustard cake, rice bran and DCP without any supplementation of common salt. In addition, only the buffaloes of group A (n=18) were supplemented 40 g common salt/day/head for 15 days whereas Group B (n=8) kept as control. From all the deficient animals, two samples of urine and saliva were collected for Na and K level estimation just before the start (period 1) and 1 day after the end (period 2) of salt supplementation period. Similarly, per day milk yield (in litres) was recorded before and after salt supplementation.

Statistical Analysis: The data collected were subjected to the statistical analysis using t-test. Statistical significance was considered at P<0.05 (Dytham 1999). All statistical comparisons were made with computer software (SPSS 12.00, SPSS Inc., Illinois, USA).

The sodium and potassium concentrations in urine and saliva before and after salt supplementation are presented in the Table 1. A nonsignificant (P>0.05) increase in urinary Na concentration decrease in K concentration was evident after salt supplementation. This is in agreement with the observations made by Eicher *et al.* (2003). Further, following salt supplementation, salivary Na concentration was markedly (P<0.05) increased, whereas a significant (P<0.05) decrease was observed in K concentration. Moreover, at period 2 the salivary concentration of Na was estimated as 166.61 mmol/l and falls under the range of 160–180 units which is considered as an indicator of adequacy of salivary

Table 1. Effect of salt supplementation on sodium, potassium and their ratio in treated (group A) sodium depleted non pregnant lactating buffaloes

Parameters	n	Period 1	Period 2
Sodium (mmol/l)			
Urine	15	143.17±18.54	151.87±11.19 ^A
Salivary	18	151.89±22.30 ^a	166.61±14.2 ^{Bb}
Potassium (mmol/l)			
Urine	15	129.20±60.15 ^A	123.53±41.3 ^A
Salivary	18	50.89±11.67 ^{Ba}	41.22±7.73 ^{Bb}
Sodium: potassium ratio (mmol/l)			
Urine	15	1.43±0.86 ^A	1.51±0.97 ^A
Salivary	18	3.11±0.74 ^{Ba}	4.17±0.78 ^{Bb}

^{AB} Within a column and an analyzed parameter, values (mean±SD) with different superscript differ significantly ($P<0.05$); ^{ab} within a row, values (mean±S.D) with different superscript differ significantly ($P<0.05$). Period 1, Just before start of salt supplementation; Period 2, 1 day after end of salt supplementation

Table 2. Effect of salt supplementation on daily milk production in sodium depleted non pregnant lactating buffaloes

Parameters	n	Period 1	Period 2
Milk production (l/day)			
Group A	18	9.65±0.61 ^a	10.32±0.46 ^{Ab}
Group B	8	9.27±0.61	9.09.46 ^B
Parameter	n	Period 1	Period 2
Milk production (l/day)			
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Group B	8	9.27±0.61	9.09.46 ^B

^{AB} Within a column, values (mean±SD) with different superscript differ significantly ($P<0.05$); ^{ab} within a row, values (mean±SD) with different superscript differ significantly ($P<0.05$); Period 1, Just before start of salt supplementation; Period 2, one day after end of salt supplementation.

Na concentrations in bovines (NRC 2001). Although urinary Na: K ratio remain statistically ($P>0.05$) unchanged between the period 1 and 2, salivary Na: K ratio significantly ($P<0.01$) increased after salt supplementation. Singh and Rani (1999) also recorded direct reflection of changing Na: K ratio only in salivary secretion. Therefore our study clearly indicates that changes in sodium status of body are reflected earlier and more pronounced in saliva than in urine. Unsurprisingly, no change in any of the analyzed parameter was observed in control group in comparison with treatment group and therefore not mentioned in table 1.

Current investigation indicated increased overall milk yield by 0.5–1.25 litres/day/head after salt supplementation for 15 days (Table 2). The finding of increased milk production after sodium supplementation is in agreement with the observations recorded in earlier studies (Phillips *et al.* 2000, Granzin and Gaughanb 2002). Sodium supplements are considered to reduce the amount of stereotypic behaviour

of buffalo which has strong physiological link with sodium intake (Phillips *et al.* 1999), suggests that the increase in milk yield might in part be attributed to alleviation of mineral deficiency induced stress (Phillips *et al.* 2000). Moreover, adequate sodium intakes are particularly important for heat-stressed animals as it increases both water intake and the blood-buffering capacity to counteract increased bicarbonate ion (HCO_3) excretion caused by respiratory alkalosis (Shahzad *et al.* 2008). Thus our results add validity to the study of Singh *et al.* (2004) who advocated salt supplementation for proper production in lactating buffaloes.

It was evident that salivary sodium concentration increased significantly after dietary supplementation of salt in sodium depleted buffaloes. It may be concluded that saliva is the best indicator to assess Na status of buffaloes and dietary supplementation of salt is recommended to improve overall milk production in lactating buffaloes.

SUMMARY

The present study was conducted on 47 non-pregnant lactating buffaloes to determine the influence of dietary supplemented salt on body's basic electrolyte ratio, viz. sodium (Na) and potassium (K) and its subsequent effect on milk production in sodium depleted animals. Out of total, 26 Na depleted buffaloes were identified and randomly assigned into group A and B. Buffaloes of group A (18) were supplemented 40 g common salt/day/head for 15 days, whereas group B (8) kept as control. Additionally, from all of these Na deficient buffaloes, 2 samples of urine and saliva were collected for Na and K analysis immediately before the start (period 1) and 1 day after the end of salt supplementation period (period 2). The salivary Na concentration increased, whereas the salivary K concentration decreased after dietary supplementation of salt in Na depleted buffaloes. Consequently, salt supplementation significantly improved salivary Na: K ratio. Furthermore, a significant increase in the daily milk production was evident in salt supplemented buffaloes. However, in group B, all of the analyzed parameters remained same between the periods as well as in comparison with group A. In conclusion, dietary supplementation of salt is recommended to improve overall milk production in lactating buffaloes.

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