IJAS vol 1, issue 1, No1, January 2016, ISSN:2371-0381

Transfer of Sodium from Plasma to Milk in Lactating Cows

A Case study in Livestock station

Khizarabad, Sargodha Pakistan

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International Journal of Applied Sciences

(ISSN: 2371-0381)

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IJAS vol 1, issue 1, No1, January 2016, ISSN:2371-0381

ABSTRACT

An investigation was carried out in Livestock station at Khizarabad, Sargodha Pakistan. An experiment was conducted to determine the sodium status in blood plasma and milk of lactating cows in four sampling phases (October, November, December and January). Milk and blood plasma samples were collected in four sampling phases of winter seasons of 2014. Transfer of minerals from blood plasma to milk possessed many effects on ruminants so there is need to elaborate translocation quantity of minerals to overcome diseases related to ruminants.

Key words: Transfer, Blood plasma, Milk, Cows

INTRODUCTION

Minerals are necessary for life because it maintain the specific physicochemical processes. It is present in all parts of body and their existence is very essential. In different ways, body uses the minerals as chemical constituents. Energy is not given by minerals, they play vital role in the body to perform various activities (Malhotra, 1998; Eruvbetine, 2003).These minerals or inorganic elements are essential for every living matter to carry out the function of normal life (Ozcan, 2003; Hays and Swenson, 1985). Minerals are divided in to micro (trace) or macro (major) elements. Ultra trace element is the third category of minerals. The micro-minerals consist of cobalt, iodine, manganese, zinc, copper, iron, selenium, sulfur, chromium, fluoride and molybdenum while macro-elements comprise of chloride, calcium, sodium and phosphorus (Eruvbetine, 2003). The amount of micro-minerals, which is essential for normal growth, is less than 100 mg/dl and macro-minerals are required in amount more than 100 mg/dl (Murray *et al*., 2000). Nickel, arsenic, boron and silicon are ultra-trace elements, which are present in animals, are known to be essential for animals. Evidence for other minerals like lithium, tin, cadmium, vanadium and lead for its essential use in animal is so weak. Mineral elements are different entities from other essential nutrients like fat, carbohydrates, vitamins and proteins. Animal husbandry established a basic need of minerals in diet of animals (Hegsted*et al*., 1976). In this century, importance and significance of mineral elements for animal and human nutrition clarified by biological assay method. Biological assay method also help to clarified modern analytical techniques which help for detection of trace elements and this is active research area till now.

In all parts of the body, Sodium is absorbed by the body in the form of Na ions whenever it is required. Through the process of perspiration, it is secreted from the body. Body volume and

acid base balance is mostly regulated by it. Hypertension may be caused due to its inadequate amount (McDowell, 1992). So it must be supplied in the diets of ruminants. Vomiting, diarrhea and any kind of impediment in digestive tract are the main reasons of its secretion from the body, which results in hyponatremia about 0.2% of Na + concentration, are presented in the body of animals.

Upper portion of small intestine absorbs sodium and Chlorine ions and they are excreted from the body as salts in urine. It regulates the functioning of nerve impulse, cell permeability and muscular functions (Soetan*et al.*, 2010).This investigation was carried out to determine the effect of early and late winter seasons on the translocation of sodium from blood plasma to milk which used by humans to fulfill their nutrient requirements.

MATERIALS AND METHODS

Present Study was performed at local Cows farm Khizarabad Livestock station situated in Sargodha. Samples were collected from lactating and clinically healthy cows. Six samples from cows were gathered for four times after the period of one month. Blood samples were collected by the disposable syringes from jugular vein. A pinch of anticoagulant ethylene-di-amine-tetra-acetic acid (EDTA) was added in it to avoid the blood clotting of sample. Samples were centrifuged (HERMLE, Z-233 M-2, abnet, Germany) at 3000 rpm for 20 minutes to separate the blood plasma. Morning and evening, samples of milk were collected from lactating cows mix to make them uniform sample and stored in freezer at -20°C (SANYO, biochemical freezer, Model MDF-U333, Japan). Blood plasma samples were analyzed by following Mpofu et al. (1998), while milk by following Stelwagen et al. (1999). A flame photometer (Jenway, PFP-7) was used for determination of sodium by using spectrophotometer and standard curves. A split-plot design (Steel and Torrie, 1980) was used for analysis of data. Duncan's new multiple ranges test (Duncan, 1955) was used for ranked differences among means.

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RESULTS AND DISCUSSIONS

1. Blood plasma

There was a significant (P<0.001) effect of sampling periods on plasma sodium concentration (Table 1). During first sampling period (October), plasma had maximum sodium while minimum sodium concentration was reported during fourth sampling period (January) (Fig 1). The values during all sampling periods ranged from 92.6087 mmol/L to 139.5652 mmol/L. The deficient level of Na in Plasma found in lactating cows during lactation, due to secretion of large quantity of Na in milk and loss of Na through excretion in feces and urine or due to low Na content in pasture as reported by Khan *et al* (2007). Our present findings are higher than those observed by Mpofu*et al*, (1995) who reported low level of Na in blood plasma of cows.

2. Milk

From the Analysis of variance the data revealed significant (P<0.001) effect of sampling periods on milk sodium concentration (Table 1). The higher value of sodium was reported at second sampling period (November) while lower value of sodium was observed during fourth sampling period (January) (Fig 2). The values ranged from 395 mg/L to 590 mg/L during all sampling periods. These values of milk Na are similar to the values found by earlier researchers (Under wood, 1981; Cuesta *et al.*, 1993). Our values are higher than those found by Khan *et al*, (2007).

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CONCLUSION

The results showed that the lactating cows living on this forage showed adequate level of Sodium in their blood plasma. There is no need of any supplement to these animals. The Na level in milk of these animals was also found sufficient.

Table1: Analysis of variance of data for Sodium concentrations in blood plasma and milk, at different sampling intervals

Source of Variation (s.o.v)	Degree of freedom (df)	Mean Squares	
		Blood plasma	Milk
Sampling Period	3	2018.510***	36114.583***
Error	16	36.578	1078.125

*** =significant at 0.001level

*=significant at 0.05 level

ns=non significant

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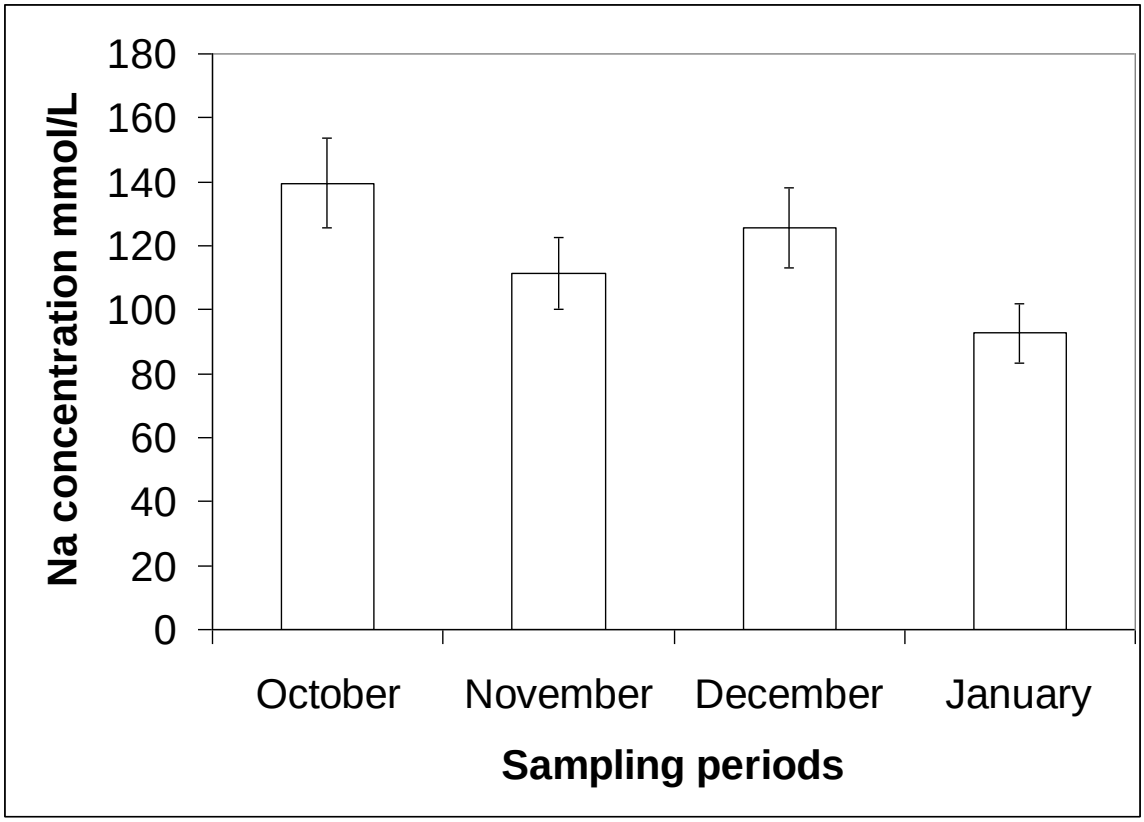

Figure 1: Fluctuation in levels of Sodium in blood plasma at different sampling periods.

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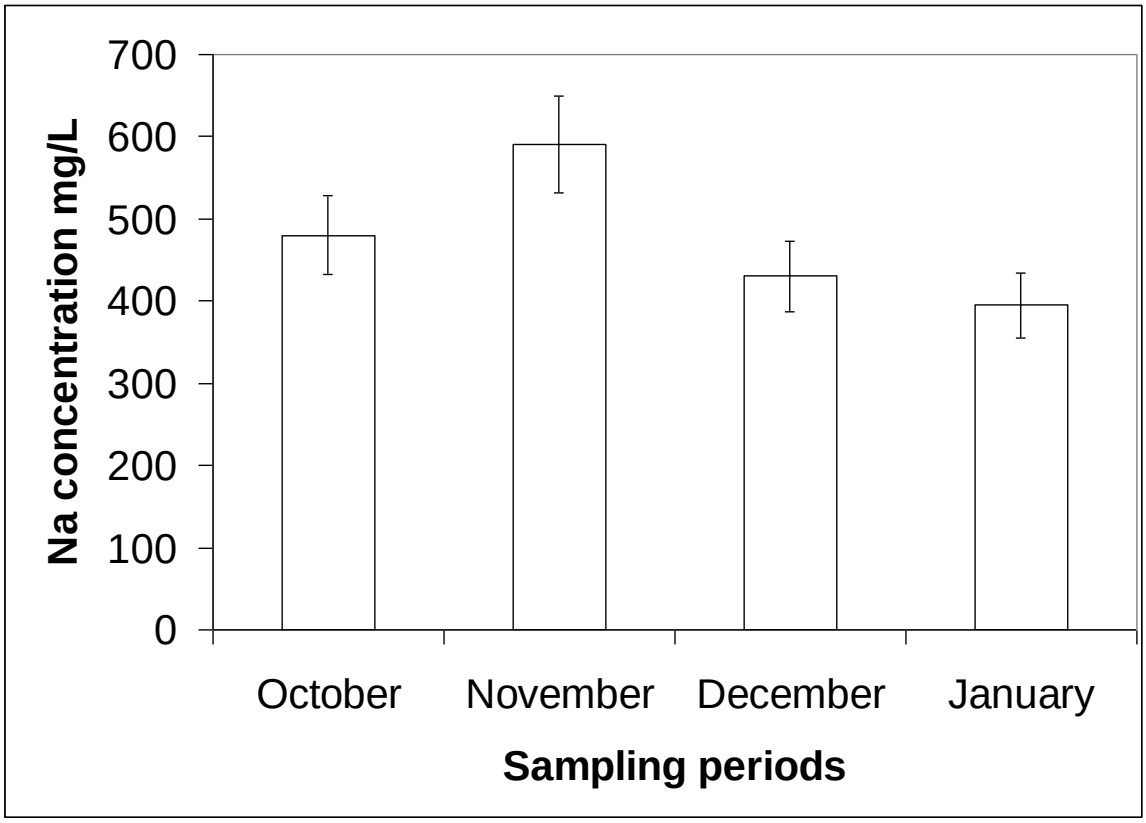

Figure 2: Fluctuation in levels of Sodium in milk at different sampling periods.

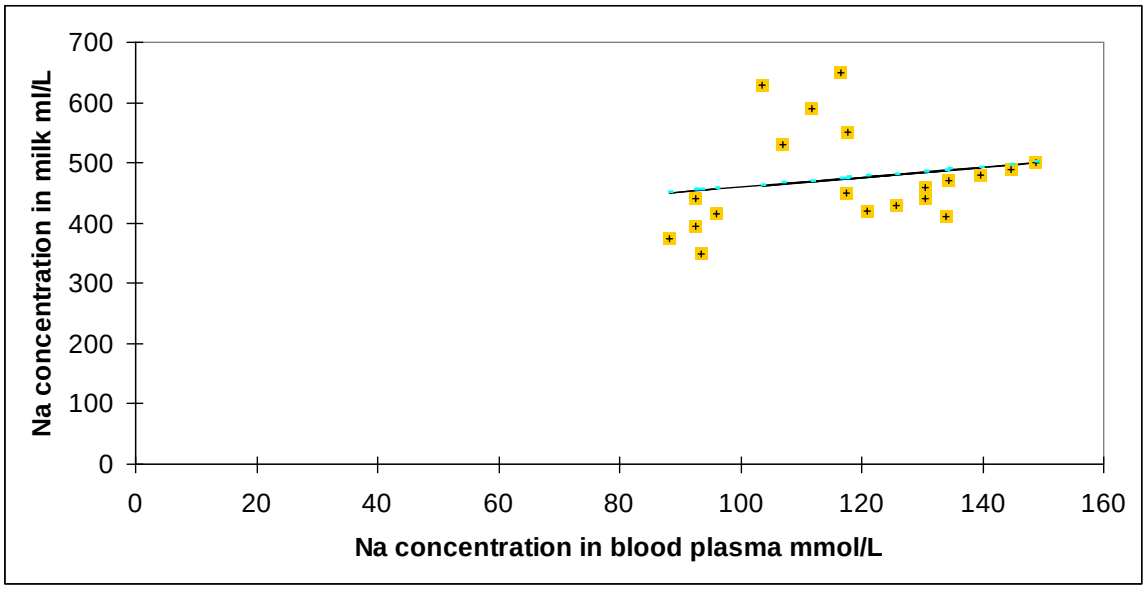

Figure3: Relationship between blood plasma and milk Na concentrations**.**

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