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**COMPARATIVE STUDY OF MEASUREMENT OF NA AND K IN DAIRY CATTLE'S  
SALIVA BEFORE AND AFTER INFUSION OF 7.5% SALINE HYPERTONIC SERUM**

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**ABSTRACT**

Saliva is a fluid that cause wet feed preparation, easy of chewing and facilitate the passage of digesta to the lower part of the digestive system. This liquid causes environment suitable for the growth of bacteria and food digestion and to keep the neutral pH buffer percentage of rumen. The aim of the present study reviews the amount of sodium saliva before and after the injection of the hypertonic serum. In this study, eight dairy cows were selected and after examination and insurance the absence of obstruction of the urinary tract and digestive problem, inside the mouth washed with distilled water to wash any food or digestive contents to be out. Then hypertonic serum at the dose of 4 ml per kg body weight injected intravenously. After completing the injection, blood and saliva samples were obtained at 10, 20 and 60 minutes. It has been observed that there is significant difference among animals in case of Na and K values. As well as the results of this study showed significant difference between the serum and saliva sodium and potassium values in animals in different times.

**Keywords: Na, K, Hypertonic Serum, Saliva, Serum, Dairy Cow**

**INTRODUCTION**

Saliva is a watery substance located in the mouths of animals, secreted by the salivary glands. Human saliva is 99.5% water, while

the other 0.5% consists of electrolytes, mucus, glycoproteins, enzymes, and antibacterial compounds such as secretory IgA and

lysozyme [1]. The enzymes found in saliva are essential in beginning the process of digestion of dietary starches and fats. These enzymes also play a role in breaking down food particles entrapped within dental crevices, protecting teeth from bacterial decay [2]. Furthermore, saliva serves a lubricative function, wetting food and permitting the initiation of swallowing, and protecting the mucosal surfaces of the oral cavity from desiccation [3].

Various species have special uses for saliva that go beyond predigestion. Some swifts use their gummy saliva to build nests. Aerodramus nests are prized for use in bird's nest soup [4]. Cobras, vipers, and certain other members of the venom clade hunt with venomous saliva injected by fangs. Some arthropods, such as spiders and caterpillars, create thread from salivary glands.

While ruminants are eating food, saliva is secreted by the parotid, the submaxillary, and the sublingual glands [5, 6]. According to [6] the submaxillary glands secrete only during eating and volumes as great as 480 ml in 1 h are produced by these glands in cows. The parotid glands, on the other hand, secrete continuously although their activity is greatly enhanced during the mastication of food.

A number of workers have studied the relationship between the rate of secretion and

the concentration of cations in the saliva [7, 8]. In general the conclusion has been that whereas the concentration of sodium in the saliva rises with increasing rate of stimulation, the concentrations of both potassium and calcium are substantially independent of the rate of secretion. At very low rates of secretion, however, most of these authors have recorded an increase of potassium concentration. The aim of present study was to determine the relationship between Na and K rates in saliva before and after infusion of hypertonic serum.

#### **MATERIALS AND METHODS**

In present study, 8 dairy cows were selected having the same feed. After recording of animals' age, physical examination carried out and after insurance the absence of obstruction of the urinary tract and digestive problem, were included in the study then the animals mouth were opened using an appropriate tools to increase salivary secretion. Then, inside the mouth washed with distilled water to wash any food or digestive contents to be out. Then, fluids of the oral cavity were excluded using suction. Blood samples were taken concomitant with collecting the saliva. Hypertonic serum at the dose of 4 ml per kg body weight injected intravenously. After completing the injection, blood and saliva samples were obtained at 10,

20 and 60 minutes. The values of Na and K were measured using ionometry method.

Data were analyzed using SPSS software and ANOVA and T-test statistical methods and  $p < 0.05$  considered as statistical significance.

## RESULTS

It has been observed that there is significant difference among animals in case of Na and K values. As well as the results of this study showed significant difference between the serum and saliva sodium and potassium values in animals in different times (Figures 1-4).

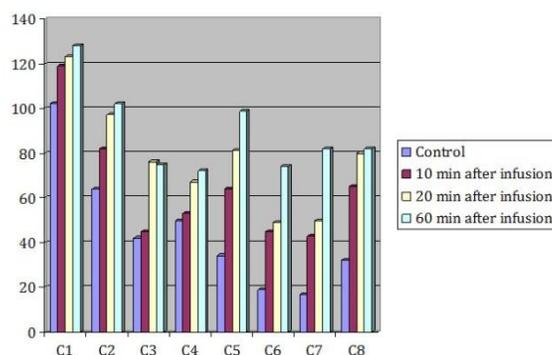


Figure 1: Comparative Diagram of Salivary Value of Na in Different Times of Sampling

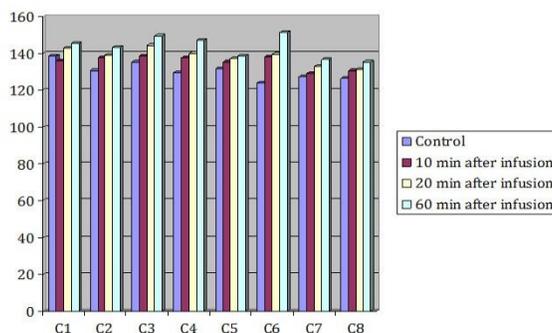


Figure 2: Comparative Diagram of Serum Value of Na in Different Times of Sampling

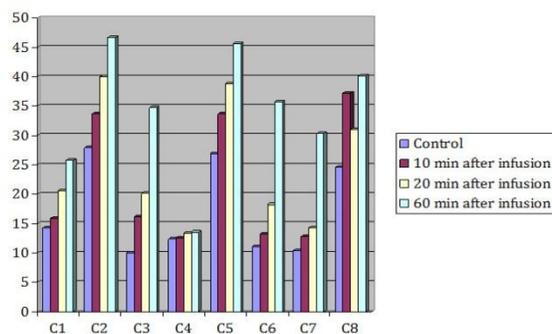


Figure 3: Comparative Diagram of Salivary Value of K in Different Times of Sampling

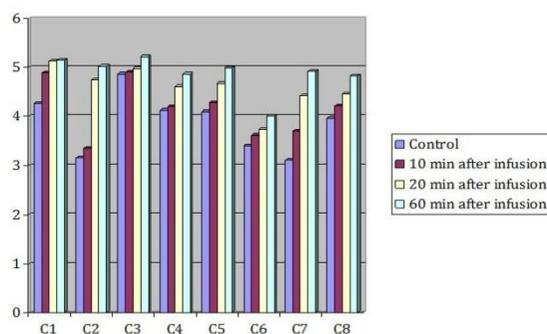


Figure 4: Comparative Diagram of Serum Value of K in Different Times of Sampling

## DISCUSSION AND CONCLUSION

In present study, after completing the injection, blood and saliva samples were obtained at 10, 20 and 60 minutes. It has been observed that there is significant difference among animals in case of Na and K values. As well as the results of this study showed significant difference between the serum and saliva sodium and potassium values in animals in different times.

[9] observed salivary levels of Na from 115 to 159 m-equiv/l, K from 7 to 14 m-equiv/l, and Na/K ratios from 8 to 30, in cattle with adequate Na intake from pasture. The resting values in the present study were within this normal range, but some factor associated with mustering caused marked deviations of K and Na/K. Evidence from the resting values and from the coastal nature of the environment indicate that the cattle were not deficient in sodium. The phenomenon observed is not likely to have arisen, therefore, from a reduction in parotid salivary secretion rate,

which reduces the NajK ratio in sodium-depleted sheep but not in sodium-repletesheep [10, 11].

It is more likely that the mustering effect was mediated through an alteration of adrenal gland secretion. This could be caused by some severe changes in renal haemodynamics, associated with mustering, activating the renin-angiotensin system for stimulating aldosterone secretion [12], or by corticotrophin (ACTH).

It is well known that stresses associated with handling of untrained animals evoke ACTH, which stimulates adrenal secretion, but mainly secretion of glucocorticoids. In the sheep [13] the adrenal must be stimulated to 50% or more of its functional capacity to secrete cortisol before hypersecretion of aldosterone occurs. Cortisol and corticosterone in physiological doses do not affect salivary Na/K ratio in the sheep whereas infusion of aldosterone at physiological levels causes a marked reduction in the ratio 1-2 hr

after the beginning of infusion [14]. If the pituitary mediated the effect observed in the cattle, either ACTH secretion was near a maximum level, or the response of the adrenal to ACTH or of the salivary glands to cortisol was different from that found in sheep.

The fall in potassium concentration with prolonged stimulation has been shown previously by [15], but their paper has been largely discounted by other authors. [15] reported a similar response in the sodium secretion, but it will be shown elsewhere that this is a somewhat different type of response. The relative constancy of the potassium level in human parotid saliva is presumably due to the fact that this is a constantly secreting gland, so that stimulation of secretion, whether by reflex activation or by drugs, produces no transition between rest and activity but just an increase in activity.

There is only one account in the literature that cannot be correlated with our results: that is the report by [16] that whereas the submaxillary glands of both cat and dog lose considerable amounts of potassium when stimulated by pilocarpine, the losses are small when the glands are stimulated for 35 min through the chorda tympani.

[17] has recently found that asymmetrical diffusion of thiourea can occur across frog's skin with active water transfer. It may well be

that such an effect is sufficient to account for the asymmetry of these gland cells and for the secretion of potassium at a higher concentration than in the plasma. Another example of secretion in both directions by the salivary gland has been reported recently by [18], who have found a bradykinin-like vasodilator substance in both saliva and submaxillary venous blood.

There is an alternative possible explanation of a raised potassium concentration in the venous blood, similar in time course and proportional in magnitude to the potassium transient in the saliva. Potassium secreted by the salivary gland into the acinar lumen may be able to diffuse through the intercellular spaces back into the blood. If the intercellular space permits the diffusion of potassium it would presumably also permit the passage of water, sodium and other small molecules. Such a process is compatible with the known composition of saliva and in fact would provide a satisfying explanation of many otherwise intractable facts: but the data presented in this paper are not adequate to exclude either of these explanations. Experiments designed to test for intercellular diffusion are in progress and further discussion of this question will be deferred.

The increased saliva potassium concentration that accompanies the increase of plasma

potassium during steady state secretion is presumably due to the maintenance of a higher intracellular potassium concentration under these conditions. If the inward permeability to potassium is independent of the external concentration, then the influx of potassium across the outer cell face would be expected to rise proportionately to the plasma concentration. This greater influx would raise the intracellular potassium, which would increase the initial saliva potassium, and in the steady state maintain the intracellular and hence the saliva potassium at a raised level. The presence of this relationship is likely in an experiment reported by [19], although these authors concluded that there was no such relationship between plasma and salivary potassium levels. The constant relationship between the saliva and plasma potassium in the steady state is remarkable, and is very interesting in connexion with attempts to assess adrenocortical function by the salivary Na/K ratio [20]. A change of plasma potassium level will change the ratio, quite apart from any changes due to hormonal influences. In one experiment on the dog submaxillary gland the Na/K ratio was 10-3 when the plasma K was 3.1 m-equiv/l. and fell to 3.0 when the plasma K was raised to 10 m-equiv/l. It is difficult to know to what extent the changes in Na/K ratio reported in

disease, and after administration of adrenal corticoids, merely reflect changes in the plasma potassium.

This study, though inconclusive in defining the cause and pathway of mediation, shows that the infusion of hypertonic serum can have a profound effect on salivary Na/K ratio. This is an important consideration in studies involving saliva samples collected in the field. Further investigations, to clarify factors controlling salivary electrolytes, are needed.

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