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Evaluation of Serum Levels of Copper in Holstein Cows and Their Calves During Colostrum Nourishing

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Abstract: Copper is one of the most essential trace elements with important roles in livestock metabolism. The aim of this study was to evaluate postpartum serum levels of copper in cows and their new born calves during colostrums consumption. This survey was conducted on 40 Healthy Holstein cows and their calves. Samples were collected from parturient cows 24h before and at parturition time; and from their new born calves at calving time and 24, 48 and 72 hr after the birth. Serum values of Cu in the cows were 97.6±2.2 and 99.8±2.76 (µg/dl), respectively. Serum level of Cu in the calves at birth time was estimated as 91.2±3.65 µg/dl and was significantly ($p<0.05$) lower than maternal level. Cu levels at 24, 48 and 72 hr after the birth were 99.5±3.83, 101.4±4.53 and 115.6±3.86 µg/dl, respectively. The results obtained, indicated that serum levels of Cu in calves at birth time was lower than their mothers which increased significantly following colostrum intake.

Key words: Cu · Holstein · Cow · Calve · Colostrum

INTRODUCTION

The transition at the birth of a calf from a fetal to neonatal environment is very dramatic [1]. This transition is from sole dependency on maternal sources to one in which the neonate must maintain homeostasis [2]. Colostrum is a vital source of nutrients and passive immunity for neonatal calves. Survival of newborn calves is dependent on sufficient colostrum intake soon after birth [3]. Colostrum and milk differ in several characteristics. Also, casein is present in both colostrum and milk and the concentration of Immunoglobulin, fat and minerals are much different. For example, bovine colostrum contains four times more than the concentration of protein found in milk, most of this extra protein is Immunoglobulin and not casein [4]. Colostrum intake modifies gastrointestinal tract (GIT) development and digestive and absorptive capacity in neonates, not only through provision of nutrients, minerals, vitamins and energy, but probably also due to effects of growth-promoting factors in various species, including calves [5]. In newborn calves, great morphological and functional changes are necessary and calves must adapt to various environmental adaptation [5]. At birth, many changes occurs enabling survival of newborns [6,7]. Nutrient supply is converted from maternal sources to the GIT so that the GIT is the most markedly affected organ [1]. Also, the kidney assumes control of electrolyte and water balance rather than the placenta [8]. Other changes in newborn calves are alternation in blood metabolites and functionality of the liver and other organism [5], so that, the age of the calf has an important role for the precise interpretation of laboratory results. In this concept, Mohri *et al.* [9] found that many values vary with the age of animal, with major changes occurring after birth. Blood biochemical analyses are valuable tools for evaluation health of livestock, both in diagnosing disease and

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clinical monitoring of the individual. This trial was undertaken to determine serum Cu levels of new born calves at 0, 24, 48 and 72 h after birth and their mother 24 h. before and at parturition time and evaluation of the effects of colostrum intake on blood serum cu levels in calves.

MATERIALS AND METHODS

This study was done on 40 Healthy Holstain cows at a range of 2-3 years old and their calves (20 male and 20 female) from an industrial farm in Tabriz city from Azarbaijan province. All of the cows classified as high production and were on the last day of pregnancy. All the selected cattle and calves reared under the same management and environmental conditions. The common food available for the mothers consisted mainly of forage (alfa alfa) and plate food (based on S.B.M, barley, corn and supplements). All new born calves were left with their mothers and housed in their special sites. In this site they were feed 3 days with colostrum and milk. All new born calves and their mothers were subjected to clinical investigations; No metabolic or reproductive disorders occurred for cows around parturition. Also, there was no evidence of health disorders among calves. Blood was drawn from the jugular vein of all mother cows 24h before and at parturition time and from their calves at calving time and 24, 48 and 72 hr after the birth. Considering a reproductive or metabolic disorder in research animals, they withdrew from the study. After sampling, blood was allowed to coagulate and the harvested serum was stored at freezing condition until processing. Blood serum values of Cu was determined spectrophotometricaly using already manufactured colourometric test kits (Giesse diagnostic co. Italy) with Alcyon 300 auto analyzer. Obtained dates analyzed by t-Test, using SPSS 14 software. $p<0.05$ was considered significant.

RESULTS

Mean values of serum levels of Cu from the cows and their calves are shown in Table 1. Serum Cu levels in the calves at calving time is significantly lower than the other times ($p<0.05$). Table 2 shows mean serum levels of Cu in the calves at different times and sex. There was statistically significant increase in serum levels of Cu at various periods in comparison with calving time. Irrespective of the time, female calves had significantly higher level of Cu in their serums compared to the males ($p<0.05$).

DISCUSSION

In this study serum Cu level at the birth time have the lowest amounts and show statistically significant decrease in contrast with other times. But, after 24h serumic Cu levels significantly increase. Maybe this shortage of Cu at birth time was due to time consuming procedure of copper release from hepatic sources to blood [8, 10]. These results agree with the reports of Mohamad [12] who reported low Cu levels in newborn calves. Colostrum is rich in cu, allowing the new born with its preferential ability to absorb copper to increase hepatic stores [8]. Therefore; with colosteral consuming serumic Cu levels will increase. According to this fact, serumic Cu increase in calves at 24, 48 and 72 hrs after birth can be discribed. However kume and Tanabe [11] reported that the increase in plasma Cu of newborn calves was due to the deposits of liver Cu rather than colostral Cu. Serum copper levels in female calves was higher than males and except the birth time, in other times there were statistically significant increase in females rather than males [11]. These differences may happen because of post calving period nutrition in female calves. These results agree with the reports of Mohamad [12] which reported that serum Cu levels of newborn calves increase significantly in first 3 weeks of life opposite of first day.

Table 1: Mean serumic levels of Cu in cows and calves according to different times (µg/dl)

	Cow, 24h before parturition	Cow, at parturition time	Calf, at birth time	Calf, 24h after birth	Calf, 48 after birth	Calf, 72h after birth
Copper serumic levels	97.6±2.25[a]	99.8±2.76[a]	91.2±3.65[b]	99.5±3.83[a]	101.4±4.53[a]	115.6±3.86[a]

Dissimilar letters in each line shows significant difference between times ($p<0.05$)

Table 2: Mean serumic levels of copper in calves according to sex in different times (µg/dl)

		Calf, at birth time	Calf, 24h after birth	Calf, 48h after birth	Calf, 72h after birth
Copper serumic levels	Male	85.25±2.6[a]	91.00±2.41[b]	92.75±3.2[b]	105.00±4.10[b]
	Female	90.83±2.1[a]	105.17±1.5[b*]	110.17±1.8[b*]	122.67±2.78[b*]

Dissimilar letters in each line shows significant difference between sex in different time ($P<0.05$)

*sign in each column shows significant difference between sex in different times ($P<0.05$)

Furthermore, it agreed with Pavlata *et al*. [13] which reported that serum cu levels in calves at the birth time statistically decrease in contrast with mother and these amounts significantly increase after colotural nutrition. Smyth *et al*. [14] reported that single suckling calves had low levels of Cu in their blood serum. Pudhorsky *et al.* [15] found that in calves with clinical forms of disease, the results thus prove that the incidence of metabolic disorder in dairy calves in Czech Republic represents a highly actual problem and one of the significant factors that influence this condition is the insufficient car for and the related insufficient colostral Nutrition of the calves. Breed and age with the possibility of maturation of organs play an important role in attaining mineral homeostasis during the first weeks of life in the bovine [12].

In conclusion, results from this study suggested that colostural nutrition soon after birth play an important role to provide copper for calves and in this way guaranteed their health and postnatal growth.

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