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Selenium in Caprine feeding, its transference to the milk and relation with other minerals

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The experiment was performed in the campus of the State University of Alagoas, in Santana do Ipanema, in the semi-arid region of Northeast Brazil. This work is aimed at studying the transferences of Se from animals' food to milk in various levels of offers and its correlations with Ca, P, Mg and soluble Fe. The work also analyzed the somatic cells counts, total bacteria count and chemical composition of milk: Fat, total soluble solids, lactose and proteins. Eight Anglo Nubians animals with a live weight of 60 kg with fifteen days of second lactation were stabled in individual stalls and confined in a completely randomized design, DIC. The animals were fed with 2 kg.day^{-1} of cactus pear and 0.5 to 1.0 kg.day^{-1} Tifton hay (*Cynodon* spp.); concentrated and formed with 333.3 g.day^{-1} corn and 166.67 g.day^{-1} soy. The mineral salt was dosed in three treatments using selenium (Se). The treatments were; Treatment 00: at 0.0 mg kg^{-1} of animal MS.day^{-1} serving as control group with no supply of mineral salt, and if provided, it came from their own diet; Treatment 01: at 0.1 mg MS.day^{-1} of animal.kg-^{1}; Treatment 02: at 0.45 mg of animal. kg^{-1} DM. day^{-1}; and Treatment 03: with 0.90 mg Se animal.kg^{-1} DM.day^{-1} ($p < 0.05$) using Tukey test.

Key words: Calcium, phosphorus, magnesium, soluble iron.

INTRODUCTION

The secretion of the milk itself begins right after the colostrum period and its composition varies in function of the goat's feeding, race, age, the volume of milk produced and the lactation phase. However, the several constituents of milk are produced in many different ways; the fat is synthesized in the alveoli, from the fatty acids contained in the blood, with fermentation occurrence in the rumen. The main fat is the acetic acid. A goat can produce 200 or even 250 g of fat per day.

Milk protein is synthesized in the alveoli as well, from the blood amino acids. The main milk proteins non-existent in the blood are casein and lactalbumin. Lactose is also produced in the alveoli from glucose. Minerals are present in the milk and on the blood in different proportions: milk has 10 to 15 times more calcium, potassium and phosphorus than blood and three times

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less chlorine. The vitamins pass the alveoli walls unaltered and vary in function of feeding and breeding method (Power and Dhamoon, 2019).

Goat milk is one of the main foods of many Brazilian children, mainly in the countryside of Brazil's semi-arid areas and is very rich in protein, lactose, vitamins and mineral salts and is of easy absorption (Leite et al., 2017). It works as tissue protector against oxidative stress, maintenance of the defenses against infections and conformation of the body's growth and development on the human body (Pizzino et al., 2017).

Selenium is an important antioxidant. There are two isoforms of glutathione peroxidase, one selenium dependent (Se/GPx) and one selenium independent (Se/GPx). The Se independent form is found at the cytosol and does not present great H_2O_2reduction capacity. The GPx presents bigger affinity to the hydrogen peroxide when it finds itself in big concentrations at the cytosol (Ferreira and Matsubara, 1997).

Brazil food has low levels of Selenium, thus requiring daily complements to obtain the recommended levels (Silva et al., 2007). The products of vegetal origin present less Se concentration than the ones of animal origin. So milk is one of the products that provide a good quantity of selenium to supply human needs with minerals.

Ghany-Hefnawy and Tortora-Perez (2008) affirm that selenium (Se) is an essential mineral on the animal nutrition and it is associated with many animal production processes, such as species fertility and diseases prevention. The first enzyme where the active presence of selenium and its importance to avoiding the oxidative damage at the cellular membranes was demonstrated was the glutathione peroxidase (GSH-Px).

One of the main roles of selenium on the organism is to be antioxidant, this way it is always associated to the enzyme glutathione peroxidase. Besides acting on the detoxification of the hydrogen peroxide and other organic peroxides, the glutathione peroxidase acts on the maintenance of vital sulfhydryl groups in the reduced form, on the synthesis of hormones and on the metabolism of compounds strange to the organism as well; for example, aromatic compounds derived from plants and pesticides (Kurutas, 2016).

The Selenium (Se) is an example of an essential element becoming more and more insufficient in food crops as a result of intensive plant production in many countries. Se is an essential biological trace element. It is an essential constituent of several enzymes in which it is present in the form of the unusual amino acid selenocysteine (SeCys)(El-Ramady et al., 2015). Few researches show the Se concentration in cow and human milk and there is no thorough research on goat milk in Brazil.

To Hunter et al. (2005), selenium and vitamin E are interdependent, both needed for animals and both have metabolic functions on the organism, besides an antioxidant effect. In some cases, one can replace the other or even slow down the effects of vitamin E deficiency.

The Se shortage causes serious problems on the productive efficiency and animals' health, as the mortality of offspring with severe disabilities, as consequence of myocardial lesions. Between the anomalies studied and documented, they showed less gain of weight, less milk and wool production, low reproductive efficiency, with fertility reduction, the prolificacy and the animal quality (Ghany-Hefnawy and Tortora-Perez, 2010).This work aims to study the transference of Se from animal food to the milk in various levels of offers, as well as its correlations with Ca, P, Mg and soluble Fe. The somatic cells counts, total bacteria count and chemical composition of milk: Fat, Total Soluble Solids, Lactose and Proteins were also analyzed.

MATERIALS AND METHODS

The experiment was conducted on the Campus II of UNEAL in Santana do Ipanema, with 8 goats from the research project of APL Ovinocaprinocultura. This work observed the levels of Calcium, Phosphorus, Selenium and soluble Iron in the goat milk, using three treatments by adding sodium selenite, as well as the physical-chemical properties of milk in its most characteristic composition. The analysis of the minerals Se, Ca, P, Mg and Fe were realized on the labs of the company, Qualitex, located in Marechal Deodoro, AL, Brazil.

The analysis of the percentage of fat, protein, lactose and total solids; somatic cells count by Ml × 1000 and total bacteria count by mLx1000 were realized in the lab, PROGENE,of the Northeast Dairy Herds Management Program, from the Zootechnics Department, Federal Rural University of Pernambuco, Brazil.

Collection of milk samples from the dairy goats

Eight Anglo-Nubian animals with live weight of 60kg, with fifteen days from the second lactation, were stabled in individual stalls and confined in an entirely randomized lineation. They were fed with 2 $kg.day^{-1}$ of forage palm, from 0.5 to 1.0 $kg.day^{-1}$ of Tifton grass hay (*Cynodon* spp.) and concentrate formed by 333.3 $g.day^{-1}$ of corn and 166.67 $g.day^{-1}$ of soy.

The mineral salt was dosed on the three treatments of Selenium (Se) usage, this way the treatments were as follows: 0,0 mg of animal $Se.kg^{-1}$ $MS.day^{-1}$to the control group – there was no supply of mineral salt, the Se provided came from the diet itself; the second with supply of 0.1 mg of animal $Se.kg^{-1}$ $MS.day^{-1}$; and the third were provided with 0.45 mg of animal $Se.kg^{-1}$ DM. day^{-1}, level 1 proposed; the forth with 0.90 mg of animal Se. kg^{-1} $DM.day^{-1}$,level 2 proposed. The selenium (Se) was provided on the form of sodium selenite (Na_2SeO_3) powder, added to the mineral salt; the mix was supplied on the dosage of 40 g of animal mineral $salt.day^{-1}$ mixed and added to the soy as well as corn concentrate and given at 16h00min (Pizzino et al., 2017). Mineral salt was provided with the composition of 15 $mg.kg^{-1}$; being proportionally provided with the dosage of the treatment, 01:0.1mg animal $Se.kg^{-1}DM.day^{-1}$.

Basic composition of the mineral salt Caprinofós - Tortuga© (2016)

The basic composition comprised Calcium Phosphate, Potassium Chloride, Calcium Carbonate, Vitamin E, Carbon-Amino- Zinc

Table 1. Composition of the mineral salt provided to the animals on the experiment by 01kg of the product, guarantee levels (Mineral salt to caprineCaprinofósTortuga© (2016).

Component	Quantity (unit)
Calcium	240 g
Phosphorus	71 g
Potassium	28.20g
Sulfur	20.00g
Magnesium	20.00g
Iron	2.500 mg
Zinc	1.700 mg
Manganese	1.350 mg
Fluorine (Max.)	710 mg
Copper	400 mg
Iodine	30 mg
Cobalt	30 mg
Selenium	15 mg
Chromium	10 mg
Vitamin A	135.000 UI
Vitamin D3	68.000 UI
Vitamin E	450 UI
P solubility in citric acid	2 a 95 %

Table 2. Daily needs for the maintenance of confined caprine with 60 kg of live weight (PV) and daily production of 0.5 kg of milk with 3.0% of fat.

Items	DM (kg)	PB (%)	EM (Mcal)	NDT (g)	Ca (g)	P (g)	Se ($mg.Kg^{-1}DM$)	Fe ($mg^{.}kg^{-1}DM$)
Quantitiy	1.09	118	2.79	945	4	2.8	0.1	50

Source: Andriguetto (1983).

Phospho Chelate of Zinc, Copper, Selenium, Manganese and Chromium, Trans-chelated Micromineral Premix, Vehicle Q.S.,Magnesium Oxide, Vitamin D3, Vitamin A, Ventilated Sulfur (Sulfur Flower) (Table 1).

The stabled animals received the proposed diet, with the mineral salt in different treatments every fifteen days. The milk sample were collected and moved forward to the next treatment; that is, every treatment had fifteen days of adaptation to the diet, in order to collect the milk samples. Milk samples were collected at the end of every fifteen days in sterile polyethylene flask with 100mL volume, packed on thermal boxes in low temperatures and sent to PROGENE and Qualitex labs for analysis. The provided diet was calculated based on the indications of daily needs recommended by Andriguetto (1983),related to the contents of dry matter (MS) in Kg, crude protein (CP) in percentage (%), metabolizable energy (ME) in megacalories (Mcal), total digestible nutrients (TDN) in grams, Calcium (Ca) in grams, Phosphorus (P) in grams, Selenium (Se) in milligram by kilogram of dry matter ($mg.kg^{-1}DM.^{-1}$) and Iron (Fe) in milligram by kilogram of dry matter ($mg.kg^{-1}M.S.^{-1}$) (Table 2).

The daily diet provided by stabled animal by Day was composed of small forage palm (2 $kg.day^{-1}$), Tyfton hay (1 $kg.day^{-1}$), concentrate containing 152.5g of soy bean meal, 347.5g of powdered corn and 40g of mineral salt for caprine. The ingredients composition can be found on chart 5.3. The provided ingredients data were analyzed at the Qualitex lab, in Marechal Deodoro, Alagoas, by Andriguetto (1983) and National Research Council (2001).

The forage palm, *Nopanalea cochonilifera,* is most used locally, because this cactus adapts well to the semi-arid and today represents the second most cultivated culture on the state of Alagoas, after sugar cane. Also, it serves as roughage; utilized hay of the *Cynodon* type, the *Tyfton*gramineous, the most important gramineous in the hay production today on Brazil's northeast. The bromatological composition of the nutrients of the diet used in thestudy was based on the following analysis: dry matter (DM), crude protein (CP), ethereal extract (EE), crude fiber (CF), total digestible nutrients (TDN), metabolizable energy (ME), Calcium (Ca), Phosphorus (P), Selenium (Se) and soluble iron (Fe) (Table 3). Analyses were carried out on Qualitex labs, consistent with Studies by Andriguetto (1983) and National Research Council (2001).

The offered concentrate (0.5 kg) formed by 30.5% of soybean meal (*Glycine max* L.) as protein source and 69.5% of crushed corn grain (*Zea mays* L.) supplied daily through soy and milk of 68.60 and 31.40 g of crude protein respectively. This corresponds in metabolizable energy to 0.401 and 0.990 Mcal for soy and corn respectively. The roughage provided had as base the grass hay Tifton (*Cynodon* spp.) of $1kg.day^{-1}$and small forage palm (*Nopalea cochonilifera*) of 2 $kg.day^{-1}$; supplying 102.50g and 10.0g of crude protein and 1.515 and 0.286 Mcal of metabolizable energy for hay and palm respectively (Table 4).

Table 3. Contents of dry matter (DM), crude protein (CB), ethereal extract (EE), crude fiber (CF), total digestible nutrients (TDN), metabolizable energy (ME), calcium (Ca), phosphorus (P), Selenium (Se) and soluble iron (Fe) of the ingredients used on the diet of the animals stabled for the study.

Items	Tyfton 68 hay	Forage palm	Soybean meal	Powdered corn
Dry matter (MS) %*	89.71	10.53	87.16	87.19
Crude protein (PB) %**	10.25	5.00	45.00	9.30
Ethereal extract(EE) %**	1.80	2.40	0.90	4.30
Crude fiber (FB) %**	28.30	8.00	6.00	2.00
Total digestable nutrients (NDT) %**	55.00	***66.16	73.00	80.00
Metabolizable energy (EM) Kcal/kg**	1.515.00	***1.430.00	2.639.00	2.846.00
Calcium (Ca) g/100g*	0.32	0.03	0.28	0.02
Phosphorus (P) g/100g*	2.14	0.065	1.48	0.37
Selenium (Se) g/100g*	0.001	0.001	0.001	0.001
Soluble iron (Fe) g/100g*	1.039	0.022	1.73	0.013

*Analysis realized on the Qualitex lab - Al. **(Andriguetto, 1983); *** (NRC, 2001).

Table 4. Contents of crude protein (CP) and metabolizable energy (ME), balance for the daily diet supplied to maintain 60 kg caprine and production of 0.5 kg of milk with 3% of fat.

	CP (g)	ME (Mcal)
Concentrate (soy + corn) (0.5 kg)		
Soy (30,5%)	68,60	0.401
Corn (69,5%)	31,40	0.990
Subtotal	**100.00**	**1.390**
Roughage (hay + small palm) (3.0 kg)		
Hay (1kg)	102,50	1.515
Palm (2kg)	10,00	0.286
Subtotal	**112.50**	**1.804**
Total	**212.50**	**3.191**

Values quoted by Andriguetto (1983).

Processing of the collected samples

At the PROGENE lab, the samples were analyzed using the method of flow cytometry to total bacteria count and somatic cells count and milk composition with infra-red Bentley – Infra Bentley 2000 Sumercont 300.The mineral contents were analyzed on the Qualitex lab in an atomic absorption device (using acetylene flame) coupled to a hydride generator. The calibration curve was prepared with a solution proper to atomic absorption. The analyses were realized according to a methodology quoted by Greenberg et al. (2012).Calcium SMEWW 3111 B; Selenium SMEWW 3113 B; Humidity Pl122; Phosphorus SMEWW 4500:Method of ascorbic acid; Iron SMEWW 4500 Method of phenanthroline

Data analysis

The data were analyzed statistically in its diverse correlations between Se and other items to analyze the mineral influence on the different dosages, utilizing the Origin program version 8 and analyzed by the Tukey test $p < 0.05$.

RESULTS AND DISCUSSION

The development of these studies brought possibilities of chemical evaluations in the comparison of influences of the many minerals studied and in the general composition of the analyzed goat milk.

The result of Se levels on the milk was always inferior to 0.001 mg.100 ml^{-1}. This way, all the results obtained on every milk analysis were 0.001 mg.100ml^{-1}. Similarly, the considered values of Se were 0.001 mg.100g^{-1}.

The results suggest that with mineral salt application, in general, there was an increase in the Ca levels on the milk, proving a direct transfer between the diet and the quantity of Ca provided on the milk. Effectively, the different levels of Se on the diet did not interfere with the Ca levels provided by the result of milk contents (Figure 1). The Ca levels were elevated from an average of 60 mg.100 ml^{-1} to results above 140 mg.100 ml^{-1}, more than

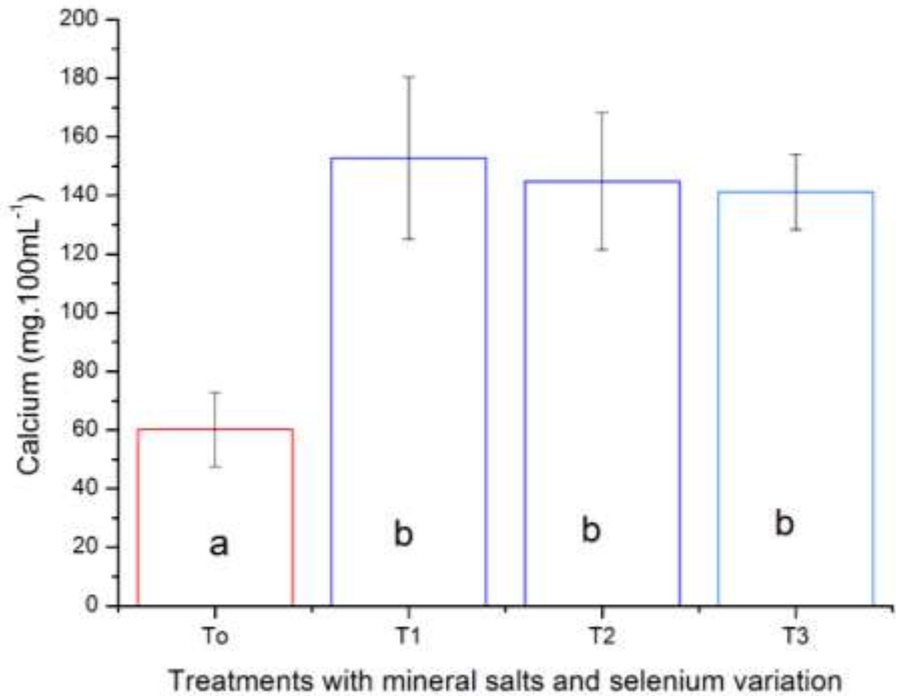

Figure 1. Calcium levels on goat milk with adding of mineral salt and three levels of selenium. The bars represent the average and the vertical lines the standard errors (n=32). Different letters represent significant difference related to the control group ($p<0.05$) by the Tukey test.

the double of Ca level of the control group; which is due basically to the simple supply of mineral salt on the caprine diet.

Nascimento et al. (2008) studied the effect of dietetic supplementation of Selenium (Se) on the production and quality of the caprine embryo: the control group received 25g of mineral salt that contained 30 mg of Selenium.Kg^{-1} and the experimental group received 25g of mineral salt that contained 90mg of Selenium.Kg^{-1}. The study showed that for the embryos of degree 1 (5.46 ± 1.37) and infeasible (2.68± 1.36) bigger on the control ($p<0.05$) and 3.98 ±1.48 of the embryos of group 2 is bigger on the treated ones ($p<0.05$). The authors concluded that there was no difference ($p>0.05$) between the initial selenium plasmatic levels between the two groups and that the mineral salt administration containing 30mg of selenium.kg^{-1} is enough to produce quality caprine embryos.

According to Khalili et al. (2020) there was no significant difference in haematological parameters before and after delivery in experimental and control groups. However, in the prepartum period, MCH tended to increase significantly in selenium methionine treatment ($p < 0.05$). The mean of rectum temperature in the treatment of selenium methionine was significantly lower than that of the control group ($p < 0.05$). On the other hand, the purulent vaginal content, retained placenta, and mastitis were lower in this group. The results of this experiment showed that feeding organic selenium supplementation in multiparous dairy cow's diet may improve their health and reproduction.

The study takes into consideration that the Phosphorus levels did not obtain the same behavior like Calcium. The control group presented results around 32 mg.$100ml^{-1}$ of P and lower results for treatments 1 and 2 with additional applications of selenium with an average of 22 mg.$100ml^{-1}$ of P. The treatment 3, however, presented a recovery and an overcoming of P value on the significant milk ($p<0.05$) to the increase of selenium on the lactating goat diet (Figure 2).

Brasil et al. (2000) in a study on goats under neutral thermal zone and under stress obtained Phosphorus93.36 mg/dL in the morning and in the afternoon an average of 88.92 mg/dL. Souza et al. (2013) cited thatunder the conditions of the present study, it is concluded that the goats were influenced by climatic factors, where the rainy period was more likely to cause thermal stress in the animals.

The results of soluble iron suggest, such as the calcium results, a raise on the values of treatments 1 to 3 (from 1.4 mg.$100ml^{-1}$ to 1.6 mg.100 ml^{-1}) in relation to the control group (0.5 mg.$100ml^{-1}$). However, it suggests, as well, that the variations of selenium offers on the diet did not interfere with the results, because the differences

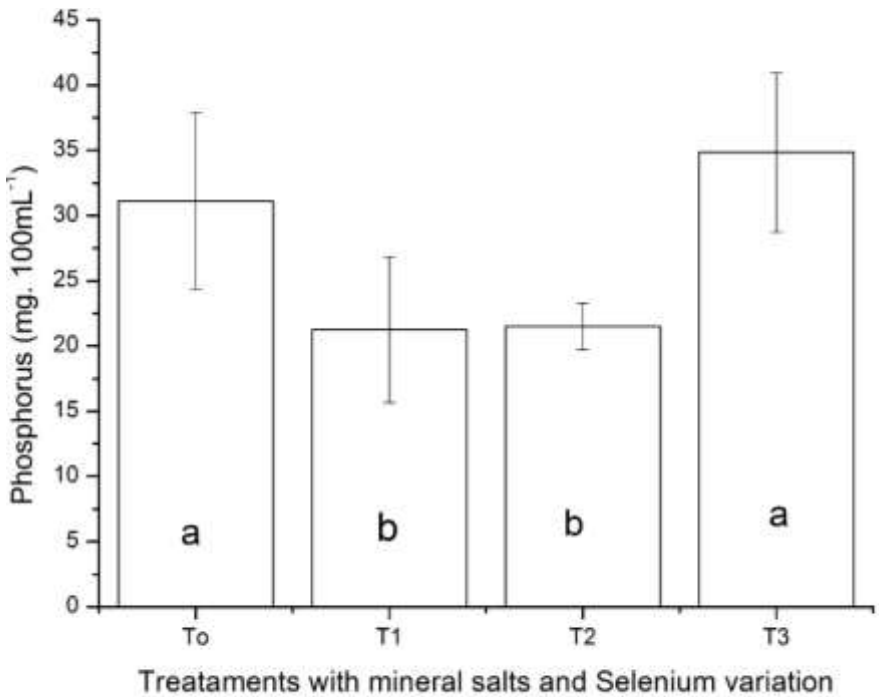

Figure 2. Phosphorus levels on goat milk with adding of mineral salt and three levels of selenium. The bars represent the averages and the vertical lines the standard errors (n=32). Different letters represent significant difference related to the control group ($p<0.05$) by the Tukey test.

between the treatments were not significant ($p > 0,05$) to the following treatments: Treatment 00, on the levels 0.0 mg of animal Se.kg^{-1} MS.day^{-1}; Treatment 01, with supply of 0.1 mg of animal Se.kg^{-1} MS.day^{-1} according to Andriguetto (1983) recommendations; and Treatment 03, with 0.90 mg animal Se.kg^{-1} DM.day^{-1}. Although significant ($p < 0.05$), Treatment 02 provided 0.45mg animal Se. kg^{-1} DM. day^{-1} (Figure 3). Additional to the deepening data on the goat milk composition, a study of chemical composition through X-Ray Fluorescence Spectroscopy by dispersive energy on a Shimadzu equipment, model EDX – 800HS was realized (Table 5).

Physicochemical analysis

The average results of fat, protein, lactose and total solids dry extract (Chart 5.6) are inside the general patterns for the other goat milks, with 3.7% of fat, 3.61% of protein, 4.46% of lactose and 12.17% of total solids dry extract (Table 6). They do not differ much from the values of Pereira et al. (2009). Oliveira (1986) described the centesimal composition of milk of many species, in which the caprine milk contains 4.0% of protein, 3.0% of fat, 4.8% of lactose, 0.8% of ashes and 87.4% of water. Devendra (1972) and Jenness (1980) studied the content of Anglo Nubian milk in tropical and subtropical regions and found the following average content: ESST 12.2%, 4.1% of fat, 4.4% of crude protein and 0.79% of ashes.

Pereira et al. (2009) obtained in the dry season on IFMG, campus Bambui, three repetitions to “in natura” goat milk average levels of fat (3.19%), protein (3.24%), lactose (4.00%), total solids (11.28%) and defatted dry extract (8.09%).

Kouri et al. (2019) obtained mean rates of fat, proteins, lactose and SNF as 34.9 ± 1.8, 38.9 ± 0.6, 48.8 ± 0.8 and 107.1 ± 1.5 g L^{-1} respectively. The concentration of fat dropped by 54.8 % from the 1st (66.5 ± 15.4 g L-1) to the3rd week post-partum (30.0 ± 1.7 g L^{-1}), then stabilized for the rest of early lactation period. Proteins, lactose and SNF rates were the highest in the 1st week post-partum (44.7 ± 4.0, 55.9 ± 4.9 and 122.1 ± 10.0 g L^{-1} respectively). They decreased through the 1st month of lactation before stabilizing in the two next months. The average concentration of minerals remained relatively stable throughout early lactation; ranging between 5.9 and 7.6 g L^{-1} with a mean of 6.7 ± 0.2 g L^{-1}.

The fat results suggest anon-significant increase ($p > 0.05$) by the Tukey test to the treatment 01 with supply of 0.1 mg animal Se.kg^{-1} MS.day^{-1}regarding the control group. However, a significant decrease in the fat content of the group from treatment 02, supplied 0.45 mg animal Se.kg^{-1} MS.day^{-1}($p < 0.05$) were observed, by the Tukey test in relation to the control group (Figure 4).

Gomes et al. (2004) observed during the eight months of lactation that the fat values increased on the first four months, getting to 5.39, from then the percentages decreased. The average value of fat was 4.10% for the

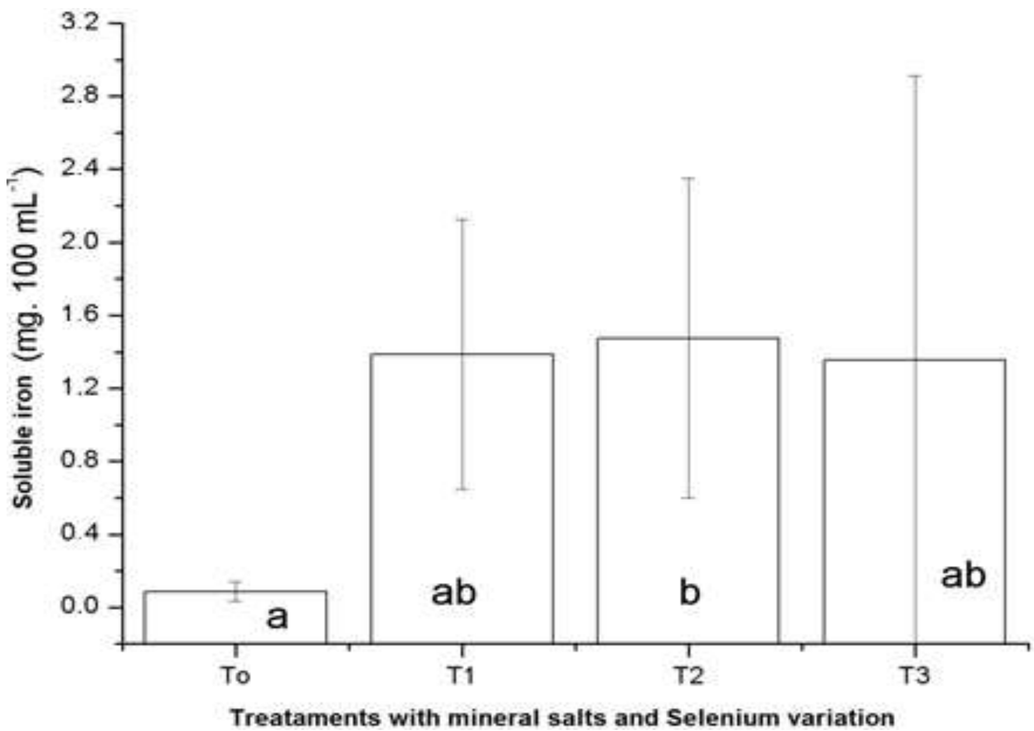

Figure 3. Soluble iron levels on goat milk with adding of mineral salt and three levels of Selenium. The bars represent the averages and the vertical lines the standard errors (n=32). Different letters represent significant difference related to the control group (p<0.05) by the Tukey test.

Table 5. Chemical composition of the goat milk from the experiment animals with three different levels of selenium on the diet (n=8), (treatment 00) on the levels **0.0 mg** of animal Se.kg^{-1} DM.day^{-1}obtained through X-Ray Fluorescence Spectroscopy by dispersive energy on a Shimadzu equipment, model EDX – 800HS.

Element	Precentage	µg.cm^{-2}	kα (Alpha layer)
K	36.548	0.588	0.0438
Cl	25.972	0.905	0.0099
Ca	25.593	0.292	0.1193
P	4.227	0.169	0.0095
Cu	3.142	0.196	0.0972
S	1.871	0.100	0.0098
Br	1.817	0.089	0.0233
Fe	0.831	0.084	0.0086

Table 6. Average of fat, protein, lactose and total solids values of goat milk on the period between July and September of 2009, Campus II UNEAL, Santana do Ipanema, Alagoas, 2009

Parameter	Average (%)*
Fat	3.07
Protein	3.61
Lactose	4.46
Dry extract total solids	12.17

* (n=32)

eight months studied. Studies developed with animals of the Alpina type by Voutsinas et al. (1990) showed average fat values of 3.44%. Bueno et al. (1991), in an experiment realized on 40 Anglo Nubian goats, found values of 4.79% of fat. The percent of lactose results on the goat milk showed significant difference ($p < 0.05$) between the treatments T2 provided 0.45 mg animal Se. kg^{-1} MS. day^{-1} e and the control group treatment T0 with levels 0.0 mg of animal Se.kg^{-1} MS.day^{-1} (Figure 5).This suggests a proportional increase of lactose from the raise of selenium levels on the animal diet.

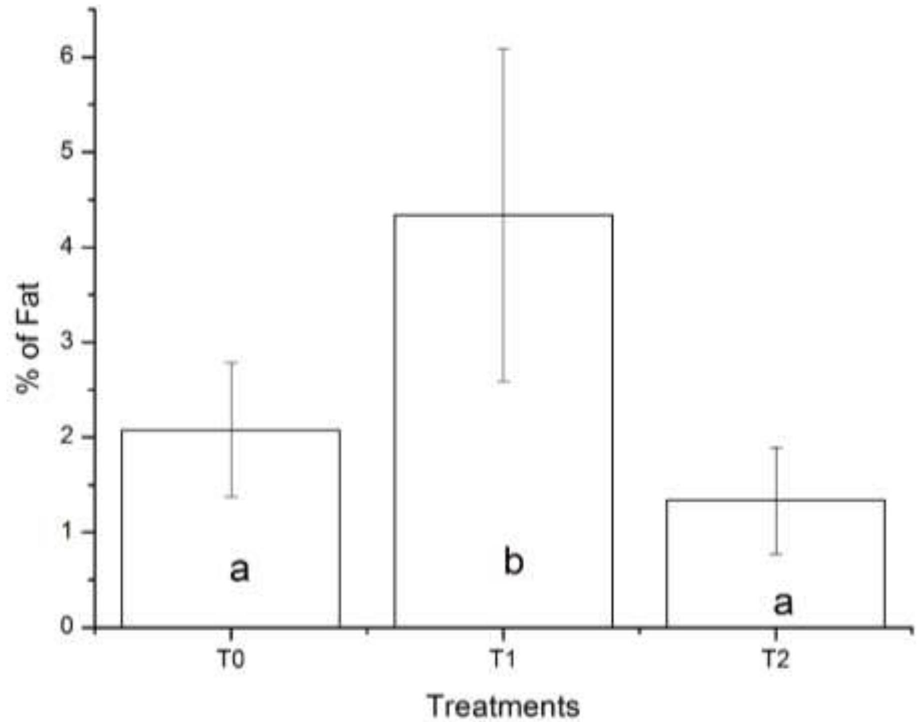

Figure 4. Percentage of fat on goat milk from adding mineral salt and two levels of selenium. The bars represent the averages and the vertical lines the standard errors (n=32). Different letters represent significant difference related to the control group ($p<0.05$) by the Tukey test.

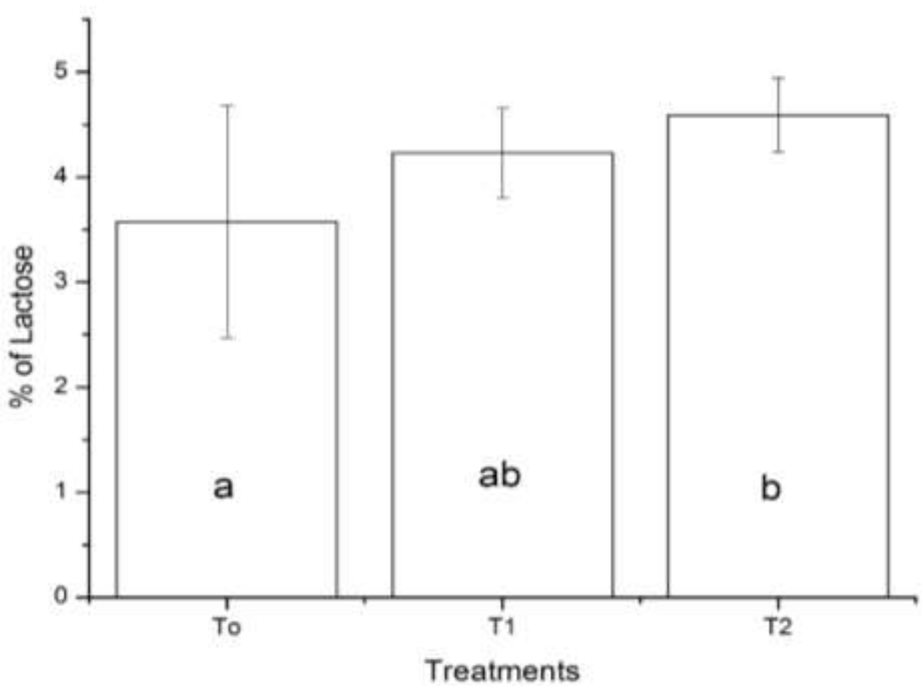

Figure 5. Lactose percentage on the goat milk with adding of mineral salt and two levels of selenium. The bars represent the averages and the vertical lines the standard errors (n=32). Different letters represent significant difference related to the control group ($p<0.05$) by the Tukey test.

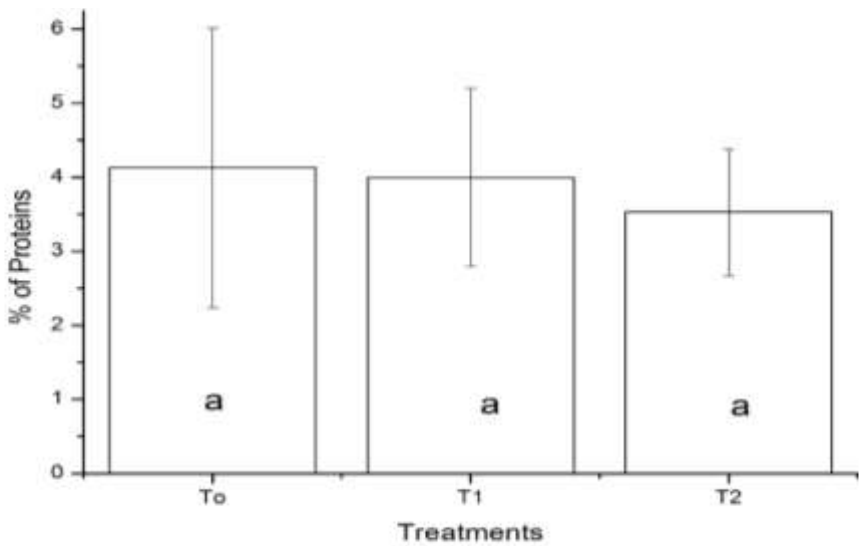

Figure 6. Protein percentage on the goat milk with adding of mineral salt and two levels of selenium. The bars represent the averages and the vertical lines the standard errors (n=32). Different letters represent significant difference related to the control group ($p<0.05$) by the Tukey test.

Brasil et al. (2000) found that goats under caloric stress, in the morning, have an average of 4.72% of lactose and, in the afternoon, an average of 4.57%. The study shows that the protein results were similar to the control group, not having present significance ($p > 0.05$). Besides that, the results are in good protein levels beside the values presented by others authors. The result obtained in the afternoon equals to that obtained on treatment 2 of thisstudy. Bueno et al (1991), in a study realized on 40 Anglo Nubian goats, found values of 5.32% to the lactose. The protein values resulted from the two treatments with selenium obtained non-significant results ($p > 0.05$).This showed the non-influence of the mineral on protein variation of the milk (Figure 6).

Anglo Nubian goats were studied by D'Alessandro (1991) and showed an average of 4.3% for total protein. Bueno et al (1991), in an experiment realized with 40 Anglo Nubian goats, found values of 3.28% to the protein. From studies with Saanen goats, Prata et al. (1998) concluded that, by the determined global values, 90.83% of the total nitrogen corresponds to the true protein (TP) and 9.17% to the non-protein nitrogen fraction (NNP). The same way, of the true protein, 81.82% corresponds to the casein fraction, important in obtaining dairy products; and 18.18% corresponds to the other proteins remaining afterthe caseins precipitation. From the ESST obtained results, that verify non-significant values ($p > 0.05$) by the Tukey test, on treatment 01 (0.1 mg animal Se. kg^{-1} MS. day^{-1}), there was an addition in relation to the control group. This is related to the elementary fact of the simple supplementation of animals with the commercial mineral salt, also advantageous to the raise of total solids, which would allow a bigger exploitation by volume of milk used on the cheese and other dairy products production (Figure 7); however, non-significant ($p > 0.05$).

Prata et al. (1998), in his studies on Saanen goats, concluded that ESST varied from 10.60 to 15.30%, with 75% of the results up to 13.85% and average of 12.445±0.785%. EESD varied from 8.21 to 10.06%, with 75% of the results up to 9.36 and average of 8.895 ± 0.337%. The average somatic cells count (CCS) to the treatments (treatment 00) on the levels of 0.0mg of animal Se.kg^{-1} MS.day^{-1}; (Treatment 01) with supply of 0.1 mg of animal Se.kg^{-1} MS.day^{-1}. According to Andriguetto (1983 recommendations, (Treatment 02) supplied 0.45 mg of animal Se.kg^{-1} MS. day^{-1} and (Treatment 03) with 0.90mg of animal Se.kg^{-1} MS.day^{-1} was around 409.11 SCC.mL^{-1}.1000, (n=32) and also the average of colony forming units (UFC) was 544.56 UFC.ml^{-1} 1000 (n=24) (Table 7).

As regards the selenium adding treatments to the mineral salt, results only for the treatments 01 and 02 was obtained, because the treatments 03 on the samples were lost. That way, there was a decrease on SCC.mL^{-1}.1000 with significant difference ($p<0.05$) between the control group and the treatment 2 with adding of Se to the mineral salt (Figure 8). Studies developed by Pereira et al. (2009) showed that for the goat milk in the dry season of IFMG, campus Bambui, 2009, the somatic cell count.ml^{-1}.000 showed a result of 1.731 and the colony forming units.ml^{-1}.1000 were 359.

According to Paes et al. (2003), the antioxidants have the function of stopping that there is an accumulation of oxygen reactive species on the cell mean, minimizing compromising damages on the defense cells of the mammary gland. Burk et al. (2008) affirmed that the Se

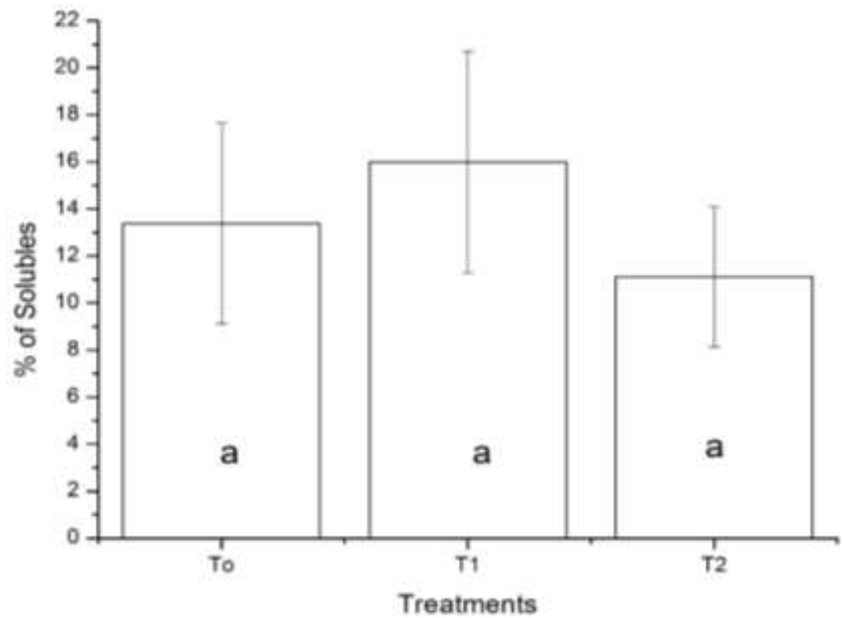

Figure 7. ESST percentage on the goat milk with adding of mineral salt and three levels of selenium. The bars represent the averages and the vertical lines the standard errors (n=32). Different letters represent significant difference related to the control group (p<0.05) by the Tukey test.

Table 7. Average values of SCC.ml^{-1}.1000 and UFC/mL^{-1}1000 of goat milk from the period of July to September, Campus II UNEAL, Santana do Ipanema, Alagoas, 2009.

Parameter	Average
CCS.ml^{-1}.1000	409.11*
UFC/ml^{-1}.1000	544.56**
* (n=32) ** (n=24)	

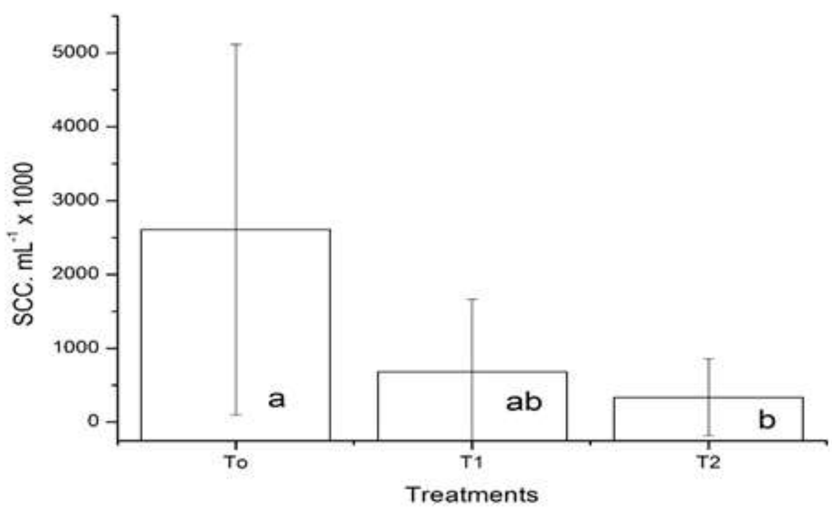

Figure 8. Somatic cell count SCC ml*1.000 on the goat milk with adding of mineral salt and three levels of selenium. The bars represent the averages and the vertical lines the standard errors (n=32). Different letters represent significant difference related to the control group (p<0.05) by the Tukey test.

deficiency increases the endogenous oxidative cytosolic stress. The antioxidant action of Se associated to the glutathione peroxidase enzyme works on the metabolism of compounds strange to the organism (Pizzino et al., 2017).

Studies developed in dairy cows by Zanetti et al. (1998) did not show decrease of subclinical mastitis diagnosed through the CMT Test on cows receiving vitamin E, but found a positive effect of Se after implementation with 5mg day^{-1}. The Se and vitamin E supplementation realized in the peripartum on dairy cows by Paschoal et al. (2006) did not affect the milk somatic cell count. This was possibly due to the low levels utilized. The experimental units were distributed randomly in four treatments: 2.5mg of selenium in the form of sodium selenite, 1000 UI of vitamin E in the form of alpha tocopherol acetate, 2.5mg of Se + 1000 UI of vitamin E and the control group. The author suggested new studies to best evaluate the effects of minerals and vitamins supplementation on the prevention and control of mastitis.

Conclusion

The supply of mineral salt proved to be essential in the response of essential minerals to human health, such as Ca and soluble Fe with significant increases, P did not respond to the increase, even decreasing its value with the increase of Selenium. The CCS decreased significantly with the increase of Se in the diet, more extensive studies with different dosages and forms of application are suggested. The Milk did not directly transfer the increased selenium dosages in animal feed. Studies on selenium dosages via venal are suggested to analyze its transfer.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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