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Comparative Study of Concentration of Some Minerals in Milk and Blood Plasma of Sheep and Goats Native and Foreign During Post-Partum Period under Climatic Conditions of Upper Egypt

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ABSTRACT

The present study aimed to determine concentrations of sodium, potassium, copper and zinc in milk and blood plasma of Awassi, Baladi ewes and Boer, Baladi goats during the winter and summer seasons. Used in this experiment number of 180 ewes and goats. The blood and milk samples were taken after one month post partum. The samples were stored at -18 ºC till time of analysis. The minerals were determined by Atomic Absorption Spectrophotometer used to estimate copper and zinc and Flame Emission Photometry was used for estimation of sodium and potassium. The overall concentrations of (sodium, potassium, copper and zinc) in milk of Awassi and Baladi ewes were (533.8 ± 13.3, 493.9 ± 13.0, 1475.0 ± 20.4, 1372.6± 26.3, 0.740 ± 0.15, 0.442± 0.20, 6.8 ± 0.7 and 5.4± 0.6 mg/l), while in blood plasma were (2321.5± 10.8, 2034.3± 8.8, 186.2± 1.1, 142.5± 2.3, 0.87±0.01, 0.51±0.02, 1.72± 0.01 and 0.56± 0.02 mg/l) respectively. Meanwhile, concentrations of sodium, potassium, copper and zinc in milk of Boer and Baladi goats were (541.0 ± 15.6, 455.6 ± 14.3, 1660.3 ± 19.5, 1511.5 ± 13.9, 0.718 ± 0.25, 0.426± 0.30, 3.2 ± 0.3 and 2.7± 0.3 mg/l), while in blood plasma were (3263.7± 11.3, 1885.8± 11.3, 203.05± 1.7, 161.6± 1.6, 0.89±0.01, 0.55±0.01, 1.1± 0.01 and 0.51± 0.01 mg/l) respectively. The present results display that concentrations of sodium, potassium, copper and zinc in milk and blood plasma were higher in Awassi ewes and Boer goats compared with Baladi ewes and goats. Concentrations of studied elements in milk and blood plasma during the summer season recorded lower levels than winter season in ewes and goats. Thus, the study recommended supplementation of mixture of salts to diet of animals during the summer season in order to conservation of the minerals concentration in the normal levels in milk or blood. In addition, the assay of the studied minerals (sodium, potassium, copper and zinc) in milk compared with blood plasma is more easy and also accurate in ewes and goats.

Keywords: Minerals, milk, blood plasma, ewes, goats, winter, summer season

INTRODUCTION

Awassi sheep and Boer goat's considered as meat breeds were entered to Upper Egypt recently in order to improve the local breed by the crossing between them. Awassi sheep is a local breed distribute in South-West Asia (Iraq, Jordan, Syria, Lebanon and Palestine) Talafha and Ababneh (2011). Boer goats evolved in Southern Africa from indigenous African goats Casey and Van Nierkerk (1988), this breeds are breeding as a meat breeds in addition to acclimation, adaptation, and low parasite infestation Erasmus (2000). Minerals are required for all biological process of animal body functions. Its apart of enzymes structure in addition to regulate many chemical reactions (Ahmed *et al.,* 2000 and Krajnicakova *et al*., 2003). Milk composition of ewes and goats depends on the feed, breed, lactation stage, individual animal, status of udder health and other environmental factors Park *et al.* (2007) and Sanz Ceballos *et al*. (2009). Several studies assess the minerals in ewes milk (Gerchev and Mihaylova, 2012; Catarino *et al*., 2013 and El-bagermi *et al*., 2014) and goats milk (El-bagermi *et al*., 2014; Ojoawo and Akinsoyinu, 2014 and Hernandz and Park, 2014). Recently some researchers determined the minerals in plasma of ewes and goats (Hassabo *et al.*, 2015; Ebrahim *et al*., 2016 and Samadieh *et al*., 2017). There is limited information about concentration of minerals in milk and blood in ewes and goats that rearing under Upper Egypt conditions. In the light of the previous fact, the present study planned to investigate the concentration of minerals in milk and plasma of (Awassi, Baladi ewes and Boer, Baladi goats) reared under climatic conditions of Upper Egypt.

MATERIALS AND METHODS

Location and Climate

This study was carried out in Aswan governorate; it's far 890 km south from Cairo. The experimental period was extended from (May to August) as summer months and from (November to February) as winter months. The Ambient temperature (o C) during the summer season *was (Max* (35.9 – 44.3), *Min* (20.8 – 26.2)) while (*Max* (22.9 - 35.0), *Min* (8.8 - 19.1)) during the winter season. Relative humidity (%) during the summer and winter season was (16 – 26) and (18-40) respectively. The climatic data was collected from The Meteorological Authority, Aswan.

Animals and feeding

The total number of experimental animals 180 (45 Awassi and 45 Baladi ewes) and (45 Boer and 45 Baladi goats). Age and parity of animals ranged between 2 to 3 year and 2nd to 4th , respectively. Live body weights of the experimental animals were showed in table (1). The animals raised in a semi shaded open yards, and were fed on concentrate feed mixture (corn and wheat bran), *Alfa-Alfa*, and Barseem hay, the animals were fed adlibtum. Functions and symptoms of deficiency of (Sodium, Potassium, Copper and Zinc) on sheep and goats were showed in table (2).

Table 1. Means of live body weight of the experimental animals.

Breeds	Range	Mean ± SE
	Ewes	
Awassi	40 - 60	48.5 ± 5.97
Baladi	30 - 42	36.73 ± 3.85
	Goats	
Boer	35 - 43	39.46 ± 2.58
Baladi	22 - 35	29.06 ± 3.46

Table 2. Functions and symptoms of deficiency of minerals on sheep and goats (National Research Council,1980).

Element	Function	Deficiency
Sodium	Electrolyte, nerve impulse transmission	Common in grazing cattle, depressed appetite
Potassium	Electrolyte, nerve impulse transmission	Rapid decline in feed and water intake, loss of vigour, pica
Copper	Many enzyme systems, hemoglobin formation, cartilage/bone formation	Poor or faded hair, reduced growth, lameness
Zinc	Epidermal tissues, skeletal formation healing	Poor reproduction, rough skin, poor immune function, reduced intake growth

National Research Council (1980). Mineral Tolerance of Domestic Animals, Washington, D.C. National Academy of Sciences.

Blood, milk and diet samples collection and determination of minerals

Blood samples (10 ml) were collected from the jugular vein from all ewes and goats into heparinized tubes. Plasma collected upon centrifugation at 3000 rpm for 10 min, and stored at -18°C until analyzed. Milk samples (50 ml) were collected from all experimental animals (n=180) and stored till the analysis; all the blood and milk samples were taken at the morning, after one month post-partum. The diets of animals were analyzed Table (3). The minerals were determined by Atomic Absorption Spectrophotometer (AAS) (ICE 3000C113500040 v1.30, England) used to estimate copper and zinc and Flame Emission Photometry was used for estimation of sodium and potassium. Minerals were analyzed according to (AOAC, 2000).

Table 3. Analysis of sodium, potassium, copper and zinc elements in green and dray forages throughout the experimental period.

Element	Alfa-Alfa	Barseem hay	Concentrate feed mixture	Critical level in Blood (ppm)*
Sodium meq/kg DM	130.5-152.3	261-304.5	226.2-243.6	-
Potassium meq/kg DM	409.6-435.2	281.6-332.8	163.8-171.5	-
Copper (mg/kg)	15.3-21.2	8.7-16.4	11.1-16.3	0.6
Zinc (mg/kg)	10.6- 16.5	7.2-14.2	14.5-18.7	0.6

***McDowell, L.R. 1985. Nutrition of grazing ruminants in warm climates. Academic Press Inc. San Diego CA. p. 168-169.**

Statistical analysis:

Data were analyzed to the effect of season of the year on concentrations of minerals in milk and blood plasma of (Awassi and Baladi ewes, Boer and Baladi goats) using the general linear model procedure (SAS, 2002). Significance among the means was checked using T. test and Chi Squire was performed. The used model was:

$$Yij = \mu + Bi + eij$$

Where:

Yij = The measured trait **μ = Overall mean**
Bi =Effect of season (summer =1, winter = 2)
eij = Experimental error assumed to be randomly distributed (0, ∂^2).

RESULTS AND DISCUSSION

I-Minerals concentrations in milk of ewes and goats

Sodium concentrations in milk of ewes

Sodium concentrations in milk of ewes are presented in Table (4). The mean of sodium concentrations in milk were higher of Awassi than Baladi ewes (*P <0.05*). The obtained averages were agree with that reported by Moreno-Rojas *et al.* (2009), Goran *et al.*(2010) and Gerchev and Mihaylova (2012) they reported a concentrations of sodium in ewes milk ranged between (490 and 543 mg/l). While, concentrations of sodium in ewes milk were lower than that reported by (Sahan *et al.,* 2005 and Catarino *et al.,* 2013) found that sodium concentrations were ranged between 612.0 and 743.0 mg/l. This result may be due to different conditions around the study like (breed difference, nutrition, climate, season, lactation stag and heat tolerance). From table (4) concentrations of sodium in milk of ewes were higher (*P <0.05*), during the winter than summer season. Similar trend was reported by Nantapo *et al.* (2013) who found concentration of sodium was higher in milk of ewes in the cold season than hot season.

Sodium concentrations in milk of goats

Concentrations of sodium in milk of goats are presented in Table (4). Concentrations of milk sodium were higher of Boer goats than Baladi goats (*P <0.05*),Table (4) . The results were close to that reported by Kedzierska -Matysek *et al*. (2013) and Hernandz and Park (2014) who found milk sodium in goats ranged between (464.0 and 545.2 mg/l). Meanwhile it was higher than that reported by Park *et al*. (2007) and Moreno-Rojas *et al.* (2009) (410 - 440.0 mg/kg) in goats milk. On the other hand, the present result was lower than that reported by Guzeler *et al*. (2010) and Ojoawo and Akinsoyinu (2014) (670.5 and 882.0 mg/l). The different between concentrations of sodium in milk of goats may be due to experimental conditions, Sanz Ceballos *et al*. (2009) reported that milk composition of goats depends on the feed, breed, lactation stage, individual animal, status of udder health and other environmental factors. There is a significant difference (*P <0.05*) in concentrations of sodium in milk of goats during two seasons summer and winter Table (4). Nantapo *et al.* (2013) found that no difference in concentration of sodium in milk of goats during the seasons of the year.

Table 4. Mean ± SE (mg/l) of sodium in milk of ewes and goats during summer and winter season.

Breed	season		Overall mean
	Summer	Winter	
Ewes			
Awassi	493.5 ± 15.3^{a}	574.0 ± 11.3^{u}	533.8 ± 13.3^{a}
Baladi	455.6 ± 12.4^{a}	532.2 ± 13.6^{p}	493.9 ± 13.0^{p}
Goats			
Boer	484.3 ± 18.4^{a}	597.7 ± 12.9^{p}	533.8 ± 13.3^{a}
Baladi	422.5 ± 12.1^{a}	488.7 ± 16.4^{p}	493.9 ± 13.0^{p}

[a, b]: values within the same row having different superscripts are significantly different at (*P <0.05*).

Potassium concentrations in milk of ewes

Concentrations of potassium in milk of ewes are presented in Table (5). Concentrations of potassium in

milk of Awassi ewes were higher (1475.0 ± 20.4 mg/l) compared with Baladi ewes (1372.6± 26.3 mg/l) (*P <0.05*). The result was agrees with that reported by Raynal-Ljutovac *et al*. (2008) who found that concentrations of potassium in milk of ewes were ranged between (1360 and 1400 mg/l). Lower concentrations of potassium in milk of ewes reported by Sahan *et al.* (2005), Catarino *et al*. (2013) and El-bagermi *et al*. (2014) (593.9 and 1199.0 mg/l . On contrary, higher concentrations of potassium in milk of ewes reported by Moreno-Rojas *et al*. (2009), Goran *et al*. (2010) and Zamberlin *et al* (2012) (1570 to 2137.7 mg/l. The different in concentrations of potassium in milk of ewes compared to the previous works may be due to the different of breed, content of food from minerals and content of soil from minerals. Park *et al.* (2007) found that milk composition of ewes affected by the feed, lactation stage, breed, status of udder health, individual animal, and other environmental factors. Concentrations of potassium in milk of ewes during winter season were higher (1530± 18.4 , 1390.7± 28.4 mg/l) than summer season (1420 ± 22.4 , 1354.5 ± 24.2 mg/l) (*P <0.05*). There is a significant difference (*P <0.05*) in concentrations of potassium in milk of ewes during two season summer and winter table (5). Similar result reported by Nantapo *et al.* (2013) in the cold and hot seasons.

Potassium concentrations in milk of goats

Potassium concentrations in milk of goats are presented in Table (5). The present means of potassium concentrations in milk of Boer goats were higher (1660.3 ± 19.5 mg/l) compared with Baladi goats (1511.5 ± 13.9 mg/l) (*P <0.05*).The present mean of potassium concentrations in milk agrees with that reported by Moreno-Rojas *et al*. (2009), Guzeler *et al.* (2010) and Ojoawo and Akinsoyinu (2014) (1460.0 - 1630.0 mg/l). Higher concentrations of potassium were reported by Kedzierska -Matysek *et al*. (2013) and Hernandz and Park (2014) (1717.0 and 1968.0 mg/l) in goat milk. Lower concentration of potassium concentrations in milk of goats compared with some authors may be due to different breed or the offered feed and the grazing. Sanz Ceballos *et al*. (2009) Milk composition of goats depends on the feed, breed, lactation stage, individual animal, status of udder health and other environmental factor. There is a significant difference (*P <0.05*) between winter and summer season of potassium concentrations in milk of Boer and Baladi goats Table (5). Guler (2007) reported that the difference in concentrations of milk mineral within winter and spring season is due to effect of dilution.

Table 5. Mean ± SE (mg/l) of potassium in milk of ewes and goats during summer and winter season.

Breed	season		Overall mean
	Summer	Winter	
	Ewes		
Awassi	1420 ± 22.4^{a}	1530± 18.4^{p}	1475.0 ± 20.4^{a}
Baladi	1354.5 ± 24.2^{a}	1390.7± 28.4^{p}	1372.6± 26.3^{p}
	Goats		
Boer	1560.6 ± 17.9^{a}	1760 ± 21.2^{b}	1660.3 ± 19.5^{a}
Baladi	1432.3 ± 11.9^{a}	1590.6 ± 13.9^{b}	1511.5 ± 13.9^{b}

$^{a, b}$: values within the same row having different superscripts are significantly different at (*P <0.05*).

Copper concentrations in milk of ewes

Copper concentrations in milk of ewes are shown in Table (6). Concentrations of copper in milk of Awassi ewes were higher (0.740 ± 0.15mg/l) compared with Baladi ewes (0.442 ± 0.20 mg/l) (*P <0.05*). The present means of copper concentrations are closed to that reported by Raynal-Ljutovac *et al*. (2008), Etonihu and Alicho (2010) and Zamberlin *et al*. (2012) (0.40- 0.89 mg/l) in milk of ewes. Higher concentrations of copper were reported by Gerchev and Mihaylova (2012) (1.2 and 1.8 mg/l) in milk of ewes. On contrast, lower concentrations of copper were reported by Abdalla *et al*. (2013) and El-bagermi *et al*. (2014) (0.09 -0.2 mg/l) in milk of ewes. Copper concentrations in milk of ewes are significantly (*P <0.05*) higher in winter (0.760 ±0.1 mg/l) than in summer season (0.720 ± 0.2 mg/l), respectively (Table, 6). Nantapo *et al.* (2013) reported higher concentration of copper in milk during cold months (0.20 mg/l) than hot months (0.17 mg/l). Park *et al.* (2007) and Sanz Ceballos *et al.* (2009) reported that milk composition of ewes and goats depends on the breed, feeding, lactation stage, individual variations, status of udder health and environmental factors.

Copper concentrations in milk of goats

Copper concentrations in milk of goats are shown in Table (6). Concentrations of copper in milk of Boer goats were higher (0.718 ± 0.25 mg/l) compared with Baladi goats (0.426± 0.30mg/l) (*P <0.05*). The present means are closed to that reported by Kondyli *et al.* (2007), Abed Al-Helaly *et al*. (2013) and El-bagermi *et al*. (2014) (0.37- 0.8 mg/l) in milk of goats. On the contrary, lower concentrations of copper were reported by Zamberlin *et al*. (2012) and Abdalla *et al.* (2013) (0.1mg/l) in goats of milk. Higher concentrations of copper in goats milk were reported by Hernandz and Park (2014) (9.8 -10.5 mg/l). Concentrations of copper during winter season were significantly (*P <0.05*) higher (0.734± 0.2, 0.430± 0.3 mg/l) than summer (0.702± 0.3, 0.422± 0.3 mg/l) season in two breed Boer and Baladi goats respectively. Concentration of copper in milk of goat during winter season was higher (*P <0.05*) than summer season Table (6). Similar results were reported by Khan *et al.* (2003) and Kędzierska-Matysek *et al*. (2013). Michlova *et al.* (2016) found that the variation in concentrations of goat's milk minerals might be due to feed and pasture quality, throughout the different grazing seasons.

Table 6. Mean ± SE (mg/l) of copper in milk of ewes and goats during summer and winter season.

Breed	season		Overall mean
	Summer	Winter	
	Ewes		
Awassi	0.720 ± 0.2^{a}	0.760 ±0.1^{p}	0.740 ± 0.15^{a}
Baladi	0.434 ± 0.2^{a}	0.450± 0.2^{p}	0.442± 0.20^{p}
	Goats		
Boer	0.702± 0.3^{a}	0.734± 0.2^{p}	0.718 ± 0.25^{a}
Baladi	0.422± 0.3^{a}	0.430± 0.3^{b}	0.426± 0.30^{p}

$^{a, b}$: values within the same row having different superscripts are significantly different at (*P <0.05*).

Zinc concentrations in milk of ewes

Concentrations of zinc in milk of ewes are presented in Table (7). Concentrations of zinc in milk were higher (6.8 ± 0.7 mg/l) of Awassi ewes compared with Baladi ewes (5.4 ± 0.6 mg/l) (*P <0.05*). The present means were closed to that reported by Gerchev and Mihaylova

(2012) and El-Bagermi *et al.* (2014) (5.4 - 7.1 mg/l). Lower concentrations reported by Abdalla *et al.*(2013) and Abed Al-Helaly *et al.* (2013) (0.24 - 0.79 mg/l) respectively. On contrast, higher concentrate reported by Goran *et al.* (2010) (9.5 mg/l). In the present study the lower concentrations of zinc in milk of ewes compared some authors may be due to dietary levels of zinc in two experiments (Underwood, 1981). Zinc concentrations were higher ($P < 0.05$) in winter season (7.2 ± 0.8, 6.4 ± 0.6 mg/l) than summer season (5.7± 0.7, 5.1 ± 0.5 mg/l) in two breed Awassi and Baladi ewes. This results agrees with that reported by Khan *et al.* (2003), who found that concentrations of zinc in milk in the cold season was higher (1.29 mg/l) than hot season (0.56 mg/l) in sheep.

Zinc concentrations in milk of goats

Concentrations of zinc in milk of goats are presented in Table (7). Concentrations of zinc in milk were higher (3.2 ± 0.3mg/l) of Boer goats compared with Baladi goats (2.7 ± 0.3 mg/l) ($P < 0.05$). The present means are closed to that reported by Kondyli *et al.* (2007) and Zamberlin *et al.* (2012) (2.4 – 3.7 mg/l) in milk goats, but the means were lower compared with that reported by Hernandz and Park (2014) (11.7 - 17.5 mg/l). Opposite trend, reported by Abed Al-Helaly *et al.* (2013) and Abdalla *et al.* (2013) found low concentrations of zinc in milk ewes (0.99- 1.24 mg/l). Concentrations of zinc were higher ($P < 0.05$) in winter season (3.3 ± 0.5, 2.9 ± 0.3 mg/l) than summer season (3.1 ± 0.2, 2.4 ± 0.4 mg/l) in two breed Boer and Baladi goats. Similar trend was reported by Bartowska *et al.* (2013) who found that seasonal variations of mineral in goat's milk might be due to the fluctuations in goats feeding during the different grazing season.

Table 7. Mean ± SE (mg/l) of zinc in milk of ewes and goats during summer and winter season.

Breed	season		Overall mean
	Summer	Winter	
Ewes			
Awassi	6.4 ± 0.6^{a}	7.2 ± 0.8^{b}	6.8 ± 0.7^{a}
Baladi	5.1 ± 0.5^{a}	5.7 ± 0.7^{b}	5.4 ± 0.6^{b}
Goats			
Boer	3.1 ± 0.2^{a}	3.3 ± 0.5^{b}	3.2 ± 0.3^{a}
Baladi	2.4 ± 0.4^{a}	2.9 ± 0.3^{b}	2.7 ± 0.3^{b}

[a, b]: values within the same row having different superscripts are significantly different at ($P < 0.05$).

2-Minerals concentrations in blood plasma of ewes and goats

Sodium concentrations in blood plasma of ewes

Concentrations of sodium in blood plasma of ewes are presented in Figure (1). Concentrations of sodium in blood plasma of Awassi ewes were significantly higher (2321.5± 10.8 mg/l) compared with Baladi ewes (2034.3± 8.8 mg/l) ($P < 0.05$). The obtained means were agrees with that reported by Sowande *et al.* (2008) (2326.9 mg/l), but the mean was higher than that reported by Ebrahim *et al.* (2016) (1090.5 mg/l). While the obtained mean was lower than that reported by Hassabo *et al.* (2015) (2648.9 mg/l) in plasma of sheep. The different results may be due to the breed, feed or status of ewes during the experiment. Macro-mineral status in ewes change during oestrous cycle, pregnancy, at lambing, post-lambing lactation days (Bonchev,1985 and Bhatt *et al.*,1996). Concentrations of sodium in blood plasma was higher ($P < 0.05$) in winter season than summer season, this results agree with that reported by Khan *et al.* (2003) and Sowande *et al.* (2008) who found higher concentration of sodium in blood plasma during the winter season compared to summer season in sheep. This result may be due to increased loss more quantity of sodium by sweating throughout the summer season.

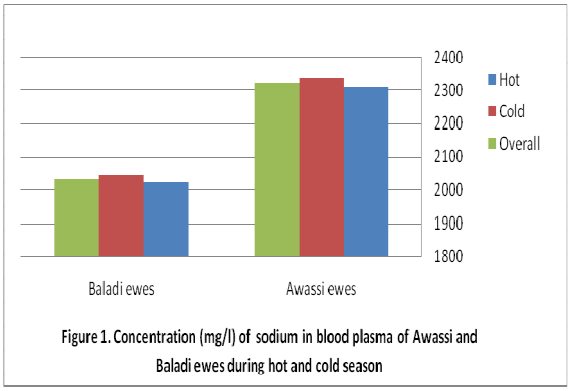

Figure 1. Concentration (mg/l) of sodium in blood plasma of Awassi and Baladi ewes during hot and cold season

Sodium concentrations in blood plasma of goats

Sodium concentrations in blood plasma of goats are presented in Figure (2). From figure (2) concentrations of sodium in blood plasma of Boer goats was higher compared with Baladi goats ($P < 0.05$). The obtained means of Boer goats were agreement with that reported by Altug *et al.* (2013) and Hafid *et al.* (2013) (3266.0 - 3268.3 mg/l), but the means of Baladi goats were lower might be due to breed difference, feed and pasture. Sodium concentrations in blood plasma was higher (P <0.05) in winter season than summer season, similar trend, reported by Khan *et al.* (2003) and Sowande *et al.* (2008) who found that sodium concentrations in blood plasma was higher during the winter season than summer season in sheep. This result may be due to increased the sweating and loss more quantity of sodium in the summer season.

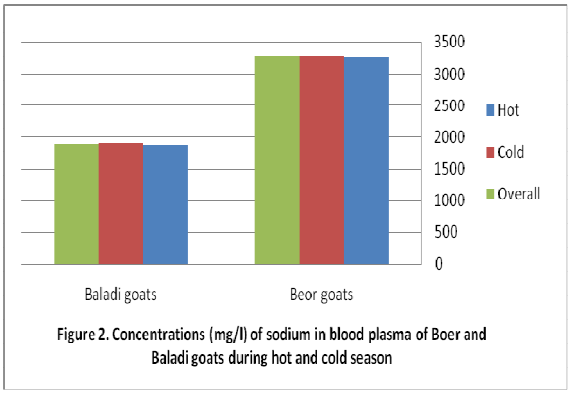

Figure 2. Concentrations (mg/l) of sodium in blood plasma of Boer and Baladi goats during hot and cold season

Potassium concentrations in blood plasma of ewes

Potassium concentrations in blood plasma of ewes are presented in Figure (3). Figure (3) indicate higher concentrations of potassium in blood plasma of Awassi ewes compared with Baladi ewes ($P < 0.05$). This means agree with that reported by Sowande *et al.* (2008) (208.3 mg/l) in sheep. The means were higher than that reported by Ebrahim *et al.* (2016) (40.05 mg/l).

this different result might be due to differences of breed or content of minerals in feed. Potassium concentrations in blood plasma was higher (P <0.05) in winter season than summer season, similar finding, reported by Khan *et al*. (2003) and Sowande *et al.*(2008) found that potassium concentrations in blood plasma during winter season were higher than summer season the in sheep.

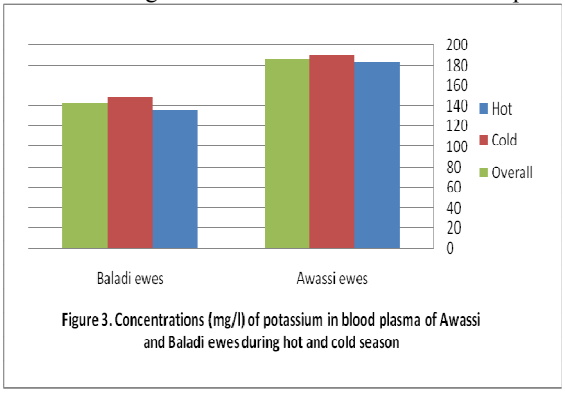

Figure 3. Concentrations (mg/l) of potassium in blood plasma of Awassi and Baladi ewes during hot and cold season

Potassium concentrations in blood plasma of goats

Potassium concentrations in blood plasma of goats are presented in Figure (4). Concentrations of potassium of Boer goats was higher compared with Baladi goats (*P <0.05*) Figure (4) . The means of potassium of two breed were agreement with that reported by Al-Sobiyl (2010) and Altug *et al*. (2013) (138.9 -206.7 mg/l) in sheep. On contrary, higher concentrations were reported by Hafid *et al*. (2013) 250.8 mg/l in ewes. Potassium concentrations in blood plasma of goats were higher (P <0.05) during the winter than summer season. The result was agreement with that reported by Khan *et al*. (2003) who found potassium concentrations in blood plasma was higher during the winter season than summer.

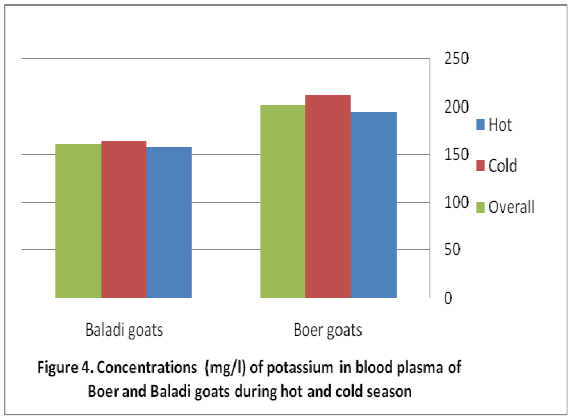

Figure 4. Concentrations (mg/l) of potassium in blood plasma of Boer and Baladi goats during hot and cold season

Copper concentrations in blood plasma of ewes

Copper concentrations in blood plasma of ewes were shown in Figure (5). Concentrations of copper in blood plasma of Awassi ewes were higher compared with Baladi ewes (*P <0.05*), Figure (5). The obtained means were agree with that reported by Hajer *et al*. (2014) and Nawito *et al*. (2015) (0.44 – 0.84 mg/l) in ewes, but the means was lower than that reported by Ebrahim *et al*. (2016) and Samadieh *et al*. (2017) (1.01 – 1.09 mg/l) in sheep. Copper concentrations were higher (P <0.05) in winter season compared with summer season in the two breeds. Similar trend reported by Dar *et al.* (2014) and Bafti (2016) in sheep. Khan *et al.* (2003) reported that in ewes copper concentrations in blood plasma was higher during the winter season than summer.

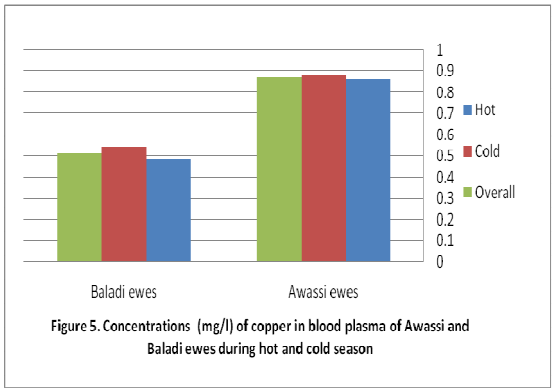

Figure 5. Concentrations (mg/l) of copper in blood plasma of Awassi and Baladi ewes during hot and cold season

Copper concentrations in blood plasma of goats

Copper concentrations in blood plasma were shown in Figure (6). Concentrations of copper in blood plasma of ewes of Boer goats were higher compared with Baladi goats (*P <0.05*) Figure (6). The means of copper were closed to that reported by Altug *et al*. (2013), Yatoo *et al*. (2013) and Hajer *et al*. (2014) (0.55 – 0.88 mg/l) in sheep, while the means were higher than that reported by Al-Sobaiyl (2010) and Nawito *et al*. (2015) 0.15 and 0.4 mg/l respectively. Copper concentrations were higher (P <0.05) in winter season compared with summer season in the two breeds of goats. Khan *et al*. (2008) and Bafti (2016) found that in goats serum copper concentration was higher during autumn than spring and summer. Similar trend was reported by Khan *et al*. (2003) who observed that in goats copper concentrations in blood plasma was higher during the winter season than summer.

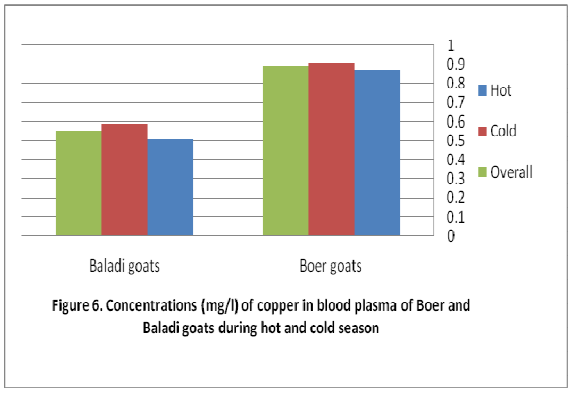

Figure 6. Concentrations (mg/l) of copper in blood plasma of Boer and Baladi goats during hot and cold season

Zinc concentrations in blood plasma of ewes

Zinc concentrations in blood plasma of ewes were shown in Figure (7). Concentrations of zinc in blood plasma of Awassi ewes were higher compared with Baladi ewes (*P <0.05*) Figure (7). The means were closed to that reported by Ebrahim *et al*. (2016) and Samadieh *et al*. (2017) 0.58 and 1.79 mg/l respectively. Higher concentration of zinc in sheep milk was reported by Nawito *et al*. (2015) 4.3mg/l. The different result might be

due to differences of breed or content of minerals in feed or grazing. Zinc concentrations were higher (P <0.05) in winter season compared with summer season in two breeds of ewes. Similar trend, reported by Khan *et al*. (2008) and Dar *et al*. (2014) found that plasma copper concentration was higher during winter than summer season in ewes. Khan *et al.* (2003) observed that in ewes zinc concentrations in blood plasma was higher during the winter season than summer season.

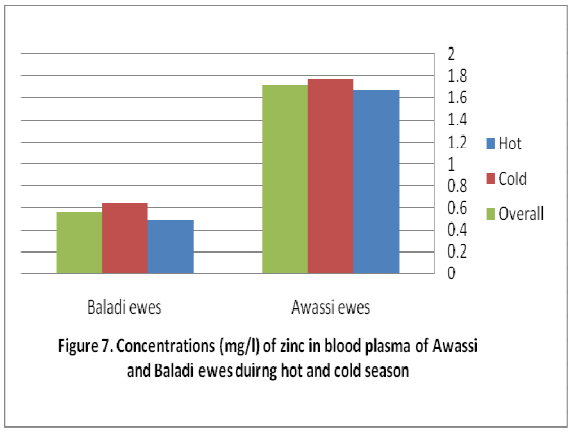

Figure 7. Concentrations (mg/l) of zinc in blood plasma of Awassi and Baladi ewes duirng hot and cold season

Zinc concentrations in blood plasma of goats

Zinc concentrations in blood plasma of goats were shown in Figure (8). Concentrations of zinc in blood plasma of Boer goats were higher compared with Baladi goats (*P <0.05*) Figure (8). The present means are in agreement with that reported by Altug *et al*. (2013) and Hajer *et al*. (2014) found that concentration of zinc in serum and plasma was 0.57 and 1.2 mg/l respectively. On contrast, higher concentration of zinc was reported by Donia *et al*. (2014) and Nawito *et al*. (2015) (4.01 - 5.9 mg/l) in ewes. In the present study the lower concentrations of zinc in blood plasma of goats compared some another authors may be due to dietary levels of zinc in two experiments (Underwood, 1981). Zinc concentrations were higher (P <0.05) in winter season compared with summer season in two breeds of goats. Similar trend, reported by Khan *et al*. (2008) who found seasonal variations in blood minerals in goats.

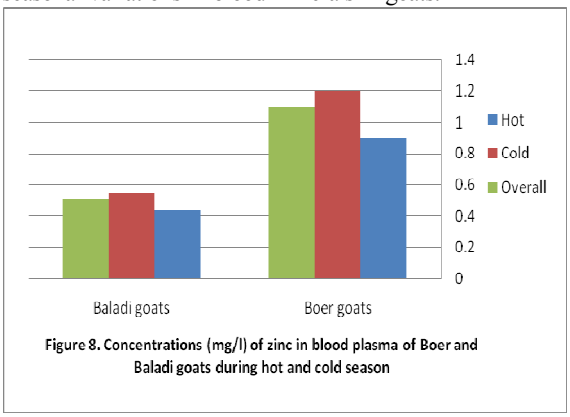

Figure 8. Concentrations (mg/l) of zinc in blood plasma of Boer and Baladi goats during hot and cold season

3-Correlation coefficient (*r*) of sodium, potassium, copper and zinc in blood and milk of Awassi, Baladi ewes and Boer, Baladi goats.

Correlation coefficients of sodium, potassium, copper and zinc in blood and milk of Awassi, Baladi ewes and Boer, Baladi goats are presented in Table (8). In Awassi ewes milk copper was significantly negatively correlated (- r= 567, P<0.05) with blood plasma copper. While, significantly and positively correlated (r = 0.788, 0.657 P<0.05) was showed among milk zinc and blood plasma zinc in Awassi and Baladi ewes respectively. Non-significant negative correlation was found for sodium and potassium in blood plasma and milk in Awassi and Baladi ewes Table (8). Positive correlation was observed in Boer and Baladi goats milk sodium, potassium and copper and blood plasma Table (8), but milk zinc was positively correlated with blood plasma in Boer and Baladi goats. Similar trend was reported by Ranjith and Pandey (2015) in Deccani sheep.

Table 8. Correlation coefficient (r) of sodium, potassium, copper and zinc in blood and milk of Awassi, Baladi ewes and Boer, Baladi goats.

Minerals in blood	Minerals in milk	Correlation coefficient (r)			
		Ewes		Goats	
		Awassi	Baladi	Boer	Baladi
Sodium	Sodium	-0.307	-0.287	-0.233	-0.224
Potassium	Potassium	-0.187	-0.165	-0.211	-0.155
Copper	Copper	-0. 567*	-0.434	-0. 467	-0.345
Zinc	Zinc	0.788*	0.657*	0.675*	0.643*

* values with having superscripts are significantly different at (P<0.05).

CONCLUSION

The present results display that concentrations of sodium, potassium, copper and zinc in milk and blood plasma were higher in Awassi ewes and Boer goats compared with Baladi ewes and goats. Concentrations of studied elements in milk and blood plasma during the hot season recorded lower levels than cold season in ewes and goats. Thus the results recommended supplementation of mixture of salts to diet of animals during the hot season in order to conservation of the minerals concentration in the normal levels in milk or blood. In addition, the assay of the studied minerals (sodium, potassium, copper and zinc) in milk compared with blood plasma is more easy and also accurate in ewes and goats.

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دراسة مقارنة تركيز بعض المعادن في اللبن وبلازما الدم في الأغنام والماعز البلدية والأجنبية أثناء فترة ما بعد الولادة تحت الظروف المناخية لصعيد مصر

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تم إجراء هذه الدراسة لمقارنة تقدير تركيز كلا من الصوديوم , البوتاسيوم, النحاس و الزنك في اللبن و بلازما الدم في الأغنام العواسي والبلدية وكذلك الماعز البور والبلدية خلال فصلى الصيف والشتاء. استخدم في هذه التجربة عدد مئة وثمانون من الأغنام والماعز بالتساوي. أخذت عينات اللبن والدم بعد شهر من الولادة. تم حفظ العينات بالتجميد في الفريزر حتى وقت التحليل. تم تقدير العناصر باستخدام جهاز الامتصاص الذرى لتقدير النحاس والزنك وإشعاع اللهب لتقدير الصوديوم والبوتاسيوم. كان المتوسط العام لتركيز كلا من الصوديوم, البوتاسيوم , النحاس والزنك في لبن الأغنام العواسي والبلدية هي (٥٣٣.٨ ± ١٣.٣ , ٤٩٣.٩ ± ١٣.٠ , ١٤٧٥.٠ ± ٢٠.٤ , ١٣٧٢.٦ ± ٢٦.٣ , ٠.٧٤٠ ± ٠.١٥ , ٠.٤٤٢ ± ٠.٢٠ , ٦.٨ ± ٠.٧ و ٥.٤ ± ٠.٦ مليجرام/لتر) بينما كان تركيز هذه العناصر في بلازما الدم كالتالي (٢٣٢١.٥ ± ١٠.٨ , ٢٠٣٤.٣ ± ٨.٨ , ١٨٦.٢ ± ١.١ , ١٤٢.٥ ± ٢.٣ , ٠.٨٧ ± ٠.٠١ , ٠.٥١ ± ٠.٠٢ , ١.٧٢ ± ٠.٠١ و ٠.٥٦ ± ٠.٠٢ مليجرام/لتر) على التوالي. كان تركيز كلا من الصوديوم, البوتاسيوم , النحاس والزنك في لبن الماعز البور والبلدية هي كالتالي (٥٤١.٠ ± ١٥.٦ , ٤٥٥.٦ ± ١٤.٣ , ١٦٦٠.٣ ± ١٩.٥ , ١٥١١.٥ ± ١٣.٩ , ٠.٧١٨ ± ٠.٢٥ , ٠.٤٢٦ ± ٠.٣٠ , ٣.٢ ± ٠.٣ و ٢.٧ ± ٠.٣ مليجرام/لتر) بينما تركيز هذه العناصر فى بلازما الدم كان كالتالي (٣٢٦٣.٧ ± ١١.٣ , ١٨٨٥.٨ ± ١١.٣ , ٢٠٣.٠٥ ± ١.٧ , ١٦١.٦ ± ١.٦ , ٠.٨٩ ± ٠.٠١ , ٠.٥٥ ± ٠.٠١ , ١.١ ± ٠.٠١ و ٠.٥١ ± ٠.٠١ مليجرام/لتر) على التوالي. أوضحت الدراسة الحالية أن تركيز الصوديوم , البوتاسيوم, النحاس و الزنك في اللبن و بلازما الدم كانت أعلى في الأغنام العواسي والماعز البور بالمقارنة بالأغنام والماعز البلدية. بالإضافة إلى ذلك سجل تركيز العناصر المدروسة مستويات منخفضة في اللبن والدم خلال فصل الصيف بالمقارنة بفصل الشتاء في كلا من النوعين الأغنام والماعز على السواء. توصى الدراسة بإضافة مخلوط الأملاح المعدنية إلى علائق الحيوانات أثناء فصل الصيف وذلك للمحافظة على تركيز المعادن في المستوى الطبيعي سواء في اللبن أو الدم. بناء على النتائج الحالية يمكن استخدام طريقة تقدير العناصر المدروسة في اللبن كطريقة أسهل مقارنة بالدم كما أنها دقيقة في الأغنام والماعز.