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STATUS OF SOME SERUM ELECTROLYTES CONCENTRATIONS IN IRAQI AWASSI SHEEP

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ABSTRACT
The object of the present work was to evaluate serum sodium, potassium, and chloride ions in clinically normal Awassi sheep in Baghdad Governorate / Iraq. This study was conducted on 150 Awassi sheep (60 males and 90 females) aged about 7-48 months divided into males (lambs and rams), females (lambs, pregnant and lactating ewes) according to the age and physiologic status. The results showed that the range and mean ± standard error (SE) were as follows: serum sodium 101.10-191.20 mmol/L and 155.43 ± 1.46 mmol/L, serum potassium 3.20-15.10 mmol/L and 7.33 ± 0.23 mmol/L , and serum chloride 70.40-184.20 mmol/L and 110.85 ± 1.85 mmol/L respectively. However significant differences ($P<0.05$) in those serum ions levels was recorded between males and females, but there was no significance between male groups and female lambs nor among different female subgroups (except significantly higher in sodium concentration recorded in the first gestation $P<0.05$). Correlations noticed in this study in males between serum sodium and potassium ($r=0.27$, $P=0.03$), and between serum ($r=0.41$, $P=0.001$), while the females showed correlation between potassium and chloride ($r=0.54$, $P=0.0001$), as well as certain correlations either positive or negative between male and female subgroups. In conclusion, present data recorded the range reference and mean ± SE in serum levels of (Na, K, and Cl) which in general were significantly higher in males compared to females with significant differences according to physiologic status in female groups.

KEYWORDS: serum sodium, potassium, and chloride , Iraqi Awassi sheep.

INTRODUCTION

Awassi sheep is a local sheep breed in South-West Asia (common in most of the Middle East countries including Iraq, Jordan, Syria, Lebanon, Palestine and Israel. It is a fat-tailed type and is multi coloured: white with brown head and legs (sometimes black or brown) (Talafha and Ababneh, 2011; Wikipedia 2012). Many researchers studied complete blood picture and some biological serum constituents of awassi sheep to Jawasreh *et al* (2010) and others studied serum ions levels in awassi sheep at different areas of which inhabited like Abdelrahman *et al* (2006) and Abdelrahman and Hunaiti (2008) who explained lots of ions, e.g. copper, manganese, zinc, iron and calcium in fetal tissues of grazing Awassi ewes at different stages of gestation. Also, Abdelrahman (2012) studied serum levels of some ions like magnesium, copper, zinc, iron and cobalt concentrations of Awassi lambs. In Iraq, little studies were performed on serum electrolytes of Awassi sheep concerning both grazing and inbreed species. For this reason, this study was designed to give the normal serum concentration levels of three ions Na, K, and Cl which were estimated in both sex, and in different age groups, and physiologic status in healthy Iraqi Awassi sheep.

MATERIALS AND METHODS

Blood samples were collected into plain tubes from jugular vein puncture of 150 clinically healthy Awassi sheep (60 males which divided into 7-12 months as male lambs and 18-48 months as rams, and 90 females divided into female lambs 7-12 months, pregnant ewes 13-42 months and lactating ewes 18-48 months) in Baghdad Governorate / Iraq. Sera were separated after centrifugation for 5 minutes at 3000 rpm (Coles, 1986), then used directly for measurements of sodium, potassium, and chloride ions. Serum sodium was determined according to the colorimetric method (Tietz, 2006), serum potassium measured by photometric turbidity method (Tietz, 2006), and serum chloride was assayed using colorimetric (Jorg and Bertau, 2004)).
In addition, pregnant and lactating ewes were subdivided into subgroups: first, second, and third gestations and lactations. SAS program was used to analyze data statistically by using analysis of variance (ANOVA) and significant means were compared by T-test at a level ($P<0.05$).

RESULTS

The sera values of measured sodium, potassium, and chloride for sheep independent of any subdivision are presented in (table 1), while the values of these electrolytes according to sex, age, and physiologic status are presented in (tables 2 and 3).
Serum sodium concentration in healthy Awassi Iraqi sheep was found to be 155.43±1.46 mmol/L, ranged from 101.10 – 191.20 mmol/L. It was ranged 160.11±2.25 mmol/L in males (101.5 – 191.20 mmol/L), and 152.30±1.85 mmol/L

(108.8 – 190.4 mmol/L) in females with certain significant differences between them (P<0.05).

On the other hands, the recorded mean values of serum potassium concentra-tion was found to be 7.33±0.23 mmol/L, ranged 3.2–15.1 mmol/L. The serum potassium was significantly (P<0.05) higher in males 8.76±0.31 mmol/L ranged 4.5 – 15.7 than in females 6.38±0.28 mmol/L ranged 3.2–15.1 mmol/L.

TABLE 1: Serum sodium, potassium, and chloride concentrations for 150 Iraqi Awassi sheep.

Electrolytes	Range	Mean±SE
Serum sodium (mmol/L)	101.10 – 191.20	155.43 ± 1.46
Serum potassium (mmol/L)	3.20 – 15.10	7.33 ± 0.23
Serum chloride (mmol/L)	70.40 – 184.00	110.85 ± 1.85

M±SE = Mean ± Standard Error

TABLE 2:. Serum sodium, potassium, and chloride concentrations according to sex in Iraqi Awassi sheep

Electrolytes	N	Gender	Range	Mean±SE
Serum sodium	60	Males	101.5 – 191.2	160.11± 2.25 a
mmol/L	90	Females	108.8 – 190.4	152.30± 1.85 b
Serum potassium	60	Males	4.5 – 15.1	8.76± 0.31 a
mmol/L	90	Females	3.2 – 14.2	6.38± 0.28 b
Serum chloride	60	Males	79.9 – 184.0	119.71± 2.61 a
mmol/L	90	Females	70.4 – 174.5	104.93± 2.35 b

The different small letters vertically refers to presence of significant values (P<0.05).

According to sex, age, and physiologic status of subdivisions (table 3), serum sodium concentrations were as follows: male lambs 157.36±4.00 mmol/L ranged 101.5 – 191.20 mmol/L ; rams 162.68±2.01 mmol/L ranged 130.6–183.3 mmol/L ; female lambs 157.1±2.57 mmol/L ranged 124 – 174.4 mmol/L ; pregnant ewes 155.53±4.17 mmol/L ranged 101.1 – 190.4 mmol/L and lactating ewes 144.25±2.08 mmol/L ranged 126.3 – 180.1 mmol/L respectively. The serum sodium concentration was significantly lower in lactating group compared to other groups (table 3).

According to the data presented in (table 3) serum potassium concentrations in male (lambs and rams), female lambs, pregnant and lactating ewes were as follows : 8.98 ±0.51 ranged 4.5 – 14.9 mmol/L , 8.54 ±0.35 mmol/L ranged 6– 15.1 mmol/L , 9.03 ±0.49 mmol/L ranged 4 – 14.2 mmol/L , 4.57 ± 0.17 mmol/L ranged 3.2 – 7 mmol/L and 5.54 ±0.24 mmol/L ranged 3.3 – 9.7 mmol/L respectively. It has been shown that serum potassium concentrations in males as well as female lambs were significantly higher than those of pregnant and lactating ewes (P<0.05). In addition, serum potassium levels did not differ in the first, second and third gestations or lactations (table 4). Moreover, the same way was presented in serum chloride as mentioned in serum potassium levels (tables 3 and 4).

The effect of the first, second, and third gestation and lactation on serum sodium concentrations was significantly higher (P<0.05) at the first gestation compared to second and third gestation (table 4).

TABLE 3: Serum sodium, potassium, and chloride concentrations according to sex, age, and physiologic status of Iraqi Awassi sheep.

Groups	n	Na (mmol/L) Range and Mean±SE	K (mmol/L) Range and Mean±SE	Cl (mmol/L) Range and Mean±SE
Male lambs	30	101.5 – 191.2	4.5 – 14.9	79.9 – 180.4
7-12 months		157.36 ± 4.00 a	8.98 ± 0.51 a	119.21 ± 4.28 a
Rams	30	130.6 – 183.3	6.0 – 15.1	93.9 – 184.0
18-48 months		162.86 ± 2.01 a	8.54 ± 0.35 a	120.27 ± 3.06 a
Female lambs	30	124.0 – 174.4	4.0 – 14.2	78.2 – 181.7
7-12 months		157.12 ± 2.57 a	9.03 ± 0.49 a	115.19 ± 5.57 a
Pregnant ewes	30	101.1 – 190.4	3.2 – 7.0	72.1 – 148.8
13-42 months		155.53 ± 4.17 a	4.57 ± 0.17 b	100.47 ± 2.74 b
Lactating ewes	30	126.3 – 180.1	3.3 – 9.7	70.4 – 126.1
18-48 months		144.25 ± 2.08 b	5.54 ± 0.24 b	99.15 ± 2.36 b

The different small letters vertically refers to presence of significant values (P<0.05).

TABLE 4: The effect of first, second, and third gestation and / or lactation on serum electrolytes concentrations of Awassi ewes.

Subgroups	n	Na (mmol/L) Range and Mean±SE	K (mmol/L) Range and Mean±SE	Cl (mmol/L) Range and Mean±SE
1st Gestation	15	108.8 – 190.4 162.39 ± 6.14 a	3.2 – 5.7 4.23 ± 0.17 a	83.3 – 148.8 101.70 ± 4.42 a
2nd and 3rd Gestation	15	101.1 – 179.3 148.68 ± 5.26 b	3.2 – 7.0 4.90 ± 0.28 a	72.1 – 114.9 99.24 ± 3.39 a
1st Lactation	15	126.3 – 180.1 145.62 ± 3.66 a	4.5 – 9.7 6.04 ± 0.34 a	70.4 – 126.1 103.28 ± 3.72 a
2nd and 3rd Lactation	15	127.2 – 160.7 142.88 ± 2.08 a	3.3 – 8.4 5.04 ± 0.31 a	76.1 – 123.7 95.02 ± 3.52 a

The different small letters vertically refers to presence of significant values ($P<0.05$).

There were some correlations among Na, K, and Cl studied in this research (table 5). Serum Na concentrations have strong positive correlation with Cl in female lambs, but it was shown negative correlation with Cl in rams. Also, other correlation was recorded between K and Cl which was strongly positive in male lambs, female lambs, and lactating but not in pregnant ewes. Another correlation was negatively recorded between Na and Cl in rams. There was certain positive correlation between Na and K levels in male lambs.

TABLE 5: The correlations between serum sodium, potassium, and chloride concentrations.

Groups		K	Cl
Males	Na	0.27 0.03	0.12 0.32
	Cl	0.41 0.001	
Females	Na	0.12 0.25	0.18 0.07
	Cl	0.54 0.0001	
Female lambs (n=30)	Na	0.17 0.35	0.42** 0.01
	Cl	0.55** 0.001	
Ewes in Lactation (n=30)	Na	0.11 0.54	-0.08 0.64
	Cl	0.51** 0.003	
Pregnant ewes (n=30)	Na	-0.23 0.20	-0.08 0.66
	Cl	0.03 0.85	
Male lambs (n=30)	Na	0.27 0.13	0.30 0.10
	Cl	0.48** 0.006	
Rams (n=30)	Na	0.35* 0.05	-0.35* 0.05
	Cl	0.27 0.14	

* = good correlation.
** = strong correlation.

DISCUSSION

There are many factors concerning variation in serum ions Na, K, and Cl studied in this research related to multiple factors, one of them sex, and here we found significant differences in all ions measured (values in males were higher than those in females) and this might be due to certain hormones as well as exhaustion of those ions in pregnancy and lactation in ewes. Another factor is age of the ewe and its status (number of pregnancies and lactations) as we noticed that there were stress factors due to multiple pregnancies and lactations affect serum levels of those ions (generally they decline with age progressing), another thing could be added to those etiologic notes that the quality of water and feed introduced to the sheep in Iraq is poorly managed, that's why the whole body weight and physiologic status not surely enough to give a chance to compensate loss of ions. Many of those ions were got out the body via milk (during lactation) and this is what we noticed in minimizing levels of measured ions, so that it should be compensate the minerals deficiency by supplying minerals to sheep when milking. Other factors affect metabolic rate were varied with the size of the animal, age, sex and reproductive condition, nutritional status, and season.

In general, the serum concentrations of Na, K, and Cl measured in this work were accepted by many researchers like (Radostits *et al*., 2007 ; Aiello, 2008 ; Kaneko, 2008) who registered the normal levels of serum ions in many animals including sheep. Others, such as Piccione *et al*. (2011) study the seasonal concentrations of Na, K, and Cl ions all over a year and he found somehow variation in those levels.

As we recorded relative decline in the serum ions due to multiple lactations as mentioned by Mayer and Fiechter (2012) who studied the milk constituents in sheep and they supposed that milk contains Na, K, and Cl, and those may be decreased by milking. Weaning time was an important factor as mentioned by Lepherd *et al*. (2009) who described many properties related to weaned Merino lambs (9-16 weeks), they analyze serum ions of Na, K, and Cl as well as complete blood picture, enzymes, and other nutrients, they found the effect of weaning on their dams and there were an important correlation between age of the dam and times of newborns.

Food supplements were necessary for sheep nutrition to maintain certain levels of ions and to facilitate their absorption and metabolism, so that Ghanem *et al*. (2008) suggested that vitamin C administration to Awassi sheep and found that this orally supplemented vitamin C was also effective in alleviating stress and prevent further loss of salts and minerals. Also, Abbeddou *et al*. (2011) found that feeding awassi sheep on certain agro-industrial byproducts and forages has side-effects on physicochemical properties of milk with increase the ions levels such as Na, K, Ca, Mg, and P or maintain their values within normal even in milking awassi ewes and did not affect milk or its products.

One of the causative agents to keep Na an Cl in definite concentrations that the plants who lived in saline water (well water) or in saline soil, it was proved by Al-Khalasi *et al*. (2010) who used salt tolerant sorghum irrigated with saline water and in saline soil where sodium, potassium, calcium or magnesium found as chlorides, sulfates or bicarbonates. Sodium and chloride are usually in the highest proportions.

Another important cause of decreased ions values in awassi sheep during lactation is hot weather and poor water intake, the awassi males resist thirst for long time but not females; this was evidenced by many investigators like (Jaber *et al*., 2004 ; Hamaden *et al*., 2006 ; Stockman, 2006) whom proposed that Awassi rams developed significant change in physiological variables when exposed to excess heat. On the other side, a research to Gunes *et al.* (2008) who proposed that erythrocyte Na and K concentrations may be included in the metabolic profile testing parameters and they found positive correlation between birth rate and mean Na and K concentrations.

Another study on awassi sheep performed by Hamadeh *et al*. (2009) who discussed the role of vitamin C on restricted water awassi sheep, they noticed elevated serum protein, albumin, globulin urea, creatinine, and ions (Na, K, and Cl) concentrations in all water restricted sheep; their results were slightly near the results obtained in our work concerning Na, K, and Cl ions.

In contrast, a study to Michałek (2010) who expressed blood plasma concentrations of Na, K and Cl ions in goats, they found no significant differences in pregnant and non-pregnant goats, and remained within the reference values. They implicated changes to varied levels of aldosterone and progesterone and their mutual proportions differing between the groups.

Finally, Sendag *et al*. (2011) recorded data analysis of excretion of certain ions with urine as an acid base balance, so they check normal levels of Na, and K levels secreted in ovine urine.

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