Serum Electrolyte Concentration of Pregnant and Lactating Ewes

Faith, E.A[1], Owoeye, A.O[2], Anzaku, A. E[1], Jibrin, M.M[1] and Usman, T.M [3]
[1]Department of Animal Science,
College of Agriculture, Lafia,
Nasarawa State, P.M.B. 33 Lafia.
[2]Department of Agricultural Education,
Federal College of Education technology,
Gusau Zamfara,State Nigeria
[2]Department of Animal Science,
Faculty of Agriculture,
Nasarawa State University,
Keffi, Shabu-Lafia Campus,
P.M.B. 135Lafia, Nigeria.
Corresponding author: faithelijah2013@gmail.com

Abstract
Blood biochemical values are an important tool for assessment of the health status of animals and this has been shown to vary even in healthy animals. Analysis concerned biological constants (Urea, albumin, globulin and creatinine) as well as, [calcium (Ca), sodium (Na), potassium (K), and magnesium (Mg)] were performed by spectrophotometer. A total of 20 ewes were divided into two groups as thus: 10 pregnant (P) and 10 lactating (10) ewes of age ranged of 2 to 4years were weighed and serum were collected from the external jugular veins. The lowest concentration of Sodium (Na^+) was detected in the ewes in the high stage of pregnancy. K^+ concentration were significant in the serum level of both pregnant and lactating ewes at ($P<0.05$). There was a gradual increased in the K^+ concentration of pregnant ewes while the concentration was low during lactation ($P<0.05$). The pregnant ewes have had statistically higher concentration of albumin in the blood compared to the lactating ewes ($P<0.05$) due to decreased in albumin over the lactation which could be explained by a rapid extraction of immunoglobulin from the plasma during the last few months of pregnancy when colostrum's is being formed in the mammary gland. Calcium concentration of both pregnant and lactating ewes were not significant ($P<0.05$). Magnesium (Mg^{++}) concentration for both pregnant and lactating ewes were not significant ($P<0.05$) but there was an increased in the concentration of pregnant ewes while gradual decreased was observed in lactating ewes though the concentration remain within the normal range. The creatinine concentration were significant ($P<0.05$) and the highest concentration was recorded at lactating ewes. Globulin concentration were not significant ($P<0.05$) for both pregnant and lactating ewes. Although there was higher increased concentration in lactating ewe compared to pregnant ewes. This finding may be useful as physiologic reference values for reproductive flock health management.

Keywords: *Serum, electrolyte, concentration, pregnant and lactating ewes.*

INTRODUCTION

Knowing the metabolic profile of the ewes, including serum mineral and biochemical indicators,

is important to specify the feed status as well as to prevent health disorders which lead to the production and reproduction disturbance. A great deal of work has been done in studying blood constituents in ewes in late pregnancy under experimental conditions in an attempt to find some parameters which may help to explain the pathogenesis of pregnancy disease (Sigurdsson, 1988a).

The biochemical parameters are important for many body functions and their deficiency impaired these functions and causes nutritional disorders (Mcdowell, 1992). The pregnancy and lactation in sheep have led to alter metabolism in animals (Krajnicakova *et al*., 2003) and during lactation, the mammary gland secretory cells use about 80% of blood components for milk synthesis (Bonev *et al.,* 2012). However, the connection between anemia and recurrence of gestation and lactation has been reported in many studies (Lindsay, 2001). In fact, hypoglycemia (pregnancy toxemia) was the primary metabolic disorders in late pregnancy and early stage lactation period in ewes due to decrease feed supply with pregnancy and lactation complication (Radostits *et al.,* 2007). Serum glucose can be used as a diagnostic method in the early stages of the pregnancy toxemia in sheep (Kahn and Line, 2005). However, several workers of many countries reported serum levels of total proteins, albumin, globulin and glucose concentrations in sheep (Ahmad *et al*., 2000; Yokus *et al.,* 2006; Aitken, 2007; Carcangiu *et al.,* 2007; Hamadeh *et al.,* 2008; Al-Fartosi *et al.,* 2010). Yokus *et al.* (2004) have studied the effects of seasonal and physiological statues on the serum biochemical and some trace element concentrations in 34 Sakiz-Ivesi crossbreed sheep, however there are many studies about the blood constituents of sheep including serum minerals, some electrolytes, some elements and liver enzymes (Abdelrahman, 2012; AL-Hadithy *et al*., 2013a; Al-Hadithy *et al.,* 2013b) in different ages, physiologic status and for both sex. While there were few researches conducted on a small number to measure serum proteins and glucose concentrations in sheep. Therefore this study sought to investigate the serum electrolyte concentration of pregnant and lactating ewes.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the small ruminant unit of the livestock complex of Animal Science Department, College of Agriculture, Lafia (Latitude 8.33 ^{0}N and Longitude 8.33 ^{0}E at altitude 181.35m above sea level). The area lies within the Guinea savanna zone of Nigeria with an average rainfall of 1182mm annually (NIMET, 2010)

Data Collection

Total of 20 ewes were sampled of which they were grouped into two. Group 1constitute 10 pregnant ewes and were designated as thus: P1, P2, P3, P4, P5, P6, P7, P8, P9, P10 while group 2 constitute 10 lactating ewes designated as L1, L2, L3, L4, L5, L6, L7, L8, L9, L10 respectively.

Sampling and analysis of blood samples

Blood samples were taken from the external jugular veins of each of the animal group using 5ml syringe into dry and heparinized tubes. Analysis concerned biological constants (Urea, albumin, globulin and creatinine) as well as, [calcium (Ca), sodium (Na), potassium (K), and magnesium (Mg)] were performed by spectrophotometer (BOEHINGER 5010).

Statistical Analysis

Statistical Packages for Social Sciences (SPSS 17.0) and GENSTAT was used for this analysis. Descriptive statistics were computed for mean, and standard deviation. One way analysis of variance (ANOVA) was also used and where significance difference occurred between the mean, Duncan Multiple Range Test (DMRT) was used as described by Steel and Torrie (1980) to separate them.

RESULTS AND DISCUSSION

Results

Table .1: Descriptive statistics of the body weight of pregnant and lactating ewes

EWE	MEAN	STD	SEM	CV%
Pregnant	45.88	4.48	0.92	9.76
Lactating	40.13	5.01	1.02	12.38

STD- Standard deviation,
SEM- Standard error of mean,
CV- Coefficient of variation.

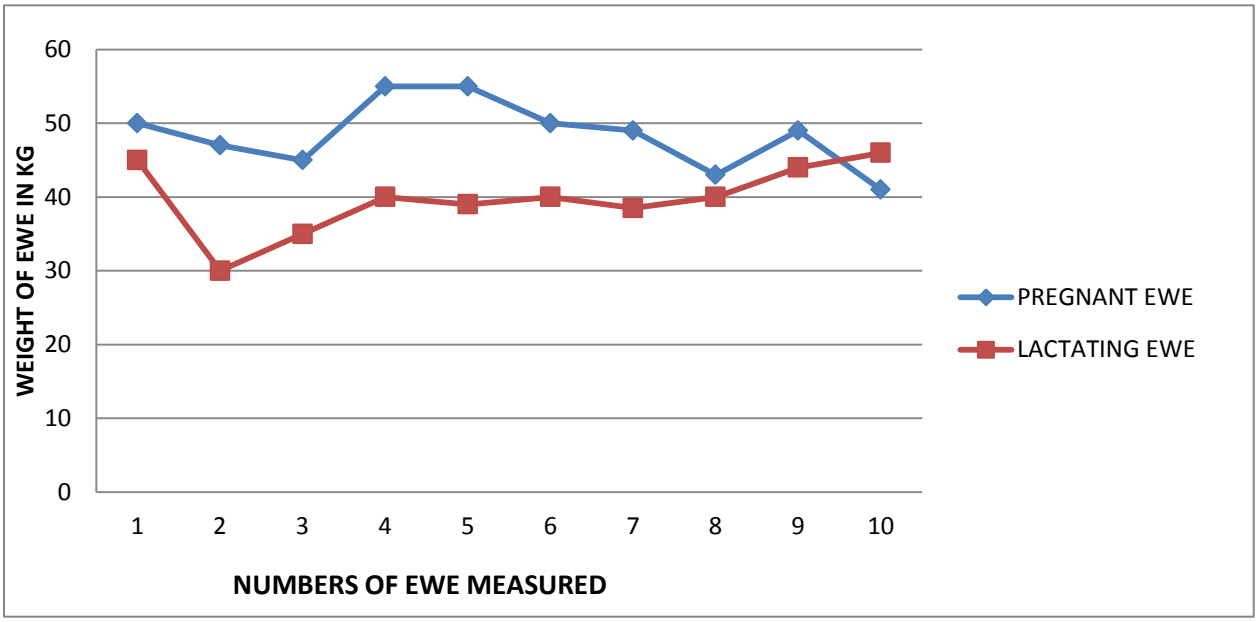

Figure 1. Line graph showing the weight of pregnant and lactating ewes

Table.2: Mean and standard error concentration of K, Ca Na and Mg in the serum of pregnant and lactating ewes.

Parameters	Pregnant Ewes	Lactating Ewes	
	Mean ± SD	Mean ± SD	Sig
Potassium(K^+) mmol/L	6.28 ±0.53	6.04±0.24	NS

Calcium (Ca^{++}) mmol/L	2.30±0.27	2.30±0.29	NS
Sodium (Na^{+}) mmol/L	154.20±4.90[a]	157.70±5.29[b]	**
Magnesium (Mg^{++}) mmol/L	1.12±0.28	0.98±0.10	NS

ab= means with different superscirpts at the same row are significantly different at (P<0.05).
NS= not significant at 0.05,
** = significance at 0.05
SD= Standard deviation

Table .3: Mean and standard error concentration of Urea, Creatinine, Albumin and Globulin in the serum of pregnant and lactating ewes.

Parameters	Pregnant Ewes	Lactating Ewes	
	Mean ± SD	Mean ± SD	Sig
Urea mmol/L	6.89±1.16	7.47±1.22	NS
Creatinine mmol/L	73.90±11.46[a]	82.50±12.20[b]	**
Albumin g/L	30.00±4.67	26.00±3.74	NS
Globulin g/L	19.80±3.77	20.90±3.07	NS

ab= means with different superscirpts at the same row are significantly different at (P<0.05).
NS= not significant at 0.05,
** = significance at 0.05
SD= Standard deviation,

In this study, the serum electrolyte profile of both pregnant and lactating ewes were investigated systematically. The mean and standard deviation of the serum indices of both the pregnant and lactating ewes were as follows:- Pregnant ewes- Potassium (K^{+} = 6.28±0.53), Calcium (Ca^{++} = 2.30±0.27), Sodium (Na^{+} =154.20±4.96), Magnesium (Mg^{++} = 1.12±0.28), Urea (6.89±1.16), Creatinine (73.90±11.46), Albumin (30.00±4.67) and Globulin (19.80±3.77) as presented in table 2 and 3 while for lactating ewes-Potassium (K^{+} = 6.04±0.26), Calcium (Ca^{++} = 2.30±0.29), Sodium (Na^{+} =157.20±5.29), Magnesium (Mg^{++} = 0.98±0.10), Urea (7.47±1.22), Creatinine (82.50±12.20), Albumin(26.00±3.74) and Globulin (20.90±3.07) as presented in table 2 and 3 respectively.
The weight of the pregnant ewes were slightly higher than those of the lactating ewes and this could be as a result of the weight of the foetus carried by the ewe as presented in the line graph in figure 1.

Discussion

Changes in the concentration of electrolytes in blood of ewes, particularly in the lactating ewes were partly different from the reference values for ewes (Kaneko *et al*., 2008). These differences could be associated with an increased requirement for intensive growth of foetus in high pregnancy due to increased synthesis of milk in lactation.
The lowest concentration of Sodium (Na^{+}) was detected in the ewes in the high stage of

pregnancy and it confirmed with the work of Antunoviae *et al.*, (2004). Azab and Abdel-Maksoud (1999) reported that concentration of Na^+ increased ($P<0.05$) in goat blood at 3 and 4weeks post partum as well as decreased of Potassium (K^+) concentration during late pregnancy . K^+ concentration were significant in the serum level of both pregnant and lactating ewes at ($P<0.05$). There was a gradual increased in the K^+ concentration of pregnant ewes while the concentration was low during lactation and it disagree with the report of Azab and Abdel-Maksoud (1999) who reported that K^+ concentration decreased during late pregnancy.

Greater urea concentration in lactating ewes can also be as a result of catabolizing muscles protein when large amount of body reserves are mobilized. This is in accordance with body condition score and body weight of ewes. Caldeira *et al.*, (2007) concluded that ewes with lower body condition scores can have greater urea concentration. The pregnant ewes have had statistically higher concentration of albumin in the blood comparing to the lactating ewes (Whitney *et al.*, 2009). Decreased in albumin over the lactation could be explain by a rapid extraction of immunoglobulin from the plasma during the last few months of pregnancy when colostrum's is being formed in the mammary gland (Kaneko *et al.*, 2008). Lactation in many species is associated with marked loss of energy through the milk which cannot be fully compensated by feed intake (Maeajova *et al.*, 2004). The concentration were not significant for both pregnant and lactating ewes ($P<0.05$), this indicate that Calcium concentration of both pregnant and lactating ewes were normal and intact as reported by other literatures. Statistically, Magnesium (Mg^{++}) concentration for both pregnant and lactating ewes were not significant but there was an increased in the pregnant ewes while gradual decreased was observed in lactating ewes though the concentration remain within the normal range as reported previously by other workers (Munoz *et al.*, 2010). The creatinine concentration were significant ($P<0.05$) and the highest concentration was recorded at lactating ewes. Albumin concentration ($P<0.05$) was not significant for both pregnant and lactating ewes but concentration values were higher in pregnant ewes compared to lactating ewes. Globulin concentration was not significant for both pregnant and lactating ewes. Although there was higher increased concentration in lactating compared to pregnant ewes. Increased in albumin concentration during pregnancy confirms the result of E-Sharif and Assad (2001).

Conclusion

Blood biochemical values are an important tool for assessment of the health status of animals and this has been shown to vary even in healthy animals. The serum electrolyte concentration of the pregnant and lactating ewes showed significant statistical differences in some cases where as the result of this findings may be useful as physiologic reference values for reproductive flock health management.

References

Abdelrahman, M.M. (2012). Status of some minerals of growing Awassi lambs fed calcium salt fat and protected sulfur amino acid. *Journal of Animal & Plant Sciences*, Vol. 13, Issue 1: 1698-1703.

Ahmad, R., Khan, A., Javed, M.T and Hussain, I .(2000). The level of immunoglobulins in relation to neonatal lamb mortality in Pak-Karakul sheep. Pakistan. Veterinarski Arhiv. 70: 129-139.

Aitken, I.D.(2007). Diseases of sheep. 4th Ed. , Oxford, Blackwell Garsington Road. PP: 602-603.

Al-Fartosi, K.H.G., Talib, Y.J and Ali, S.H.(2010).Comparative study of some serum biochemical parameters of cattle and sheep of the marshes in the south of Iraq. *AL-Qadisiya Journal of Veterinary Medical Science.* 9: 78-84.

AL-Hadithy, H.A.H., Badawi, N.M and Mahmood, M.M.(2013a). Concentrations of some serum elements in clinically healthy and anemic Iraqi Awassi sheep. *International Journal of Science and Technology*. 8: 72-78.

AL-Hadithy, HAH., Badawi, N.M and Mahmood, M.M. (2013b). Estimation of serum liver enzymes activities in Awassi sheep. *The Iraqi Journal of Veterinary Medicine*. 37: 115-120.

Antunović, Z., Speranda, M and Steiner, Z .(2004). The influence of age and the reproductive status to the blood indicators of the ewes. *Arch. Tierzucht Dumm.*, 47: 265-273.

Azab, M. E. and Abdel-Maksoud, H. A. (1999). Changes in some hematological and biochemical blood constituents in ewes in late pregnancy under field conditions. *Journal of Veterinary Medicine* A35: 417–423

Bonev, G., Slavov, R., Georgieva, S., Badarova, P and Omar, S. (2012). The effects of productive status and age on some blood serum parameters before oestrous synchronisation in Awassi and Awassi crosses sheep breed. Trakia University, Stara ZagoraBulgaria. *Journal of Agricultural Science and Technology*. 4: 117 - 119.

Caldeira, R. M., Belo, A. T., Santos, C. C., Vazyues ,V and Portugal, M. I. (2007). The effect of body condition score on blood metabolites and hormonal profiles in ewes. *Small Rum. Res.*, 68: 233-241.

Carcangiu, V., Vacca, G.M., Mura, M.C., Dettori, M.L., Pazzola, M., Fioro, M and Bini, P.P .(2007). Blood parameters during lactation and dry period in sarda sheep breed. In Proceed Atti XV Congress, Kusadasi, Turkey. PP: 15-20.

El-Sherif, M. M. A. and Assad, F. (2001). Changes in some blood constituents of Barki ewes during pregnancy and lactation under semi arid conditions. *Small Rum. Res.*, 40: 359-730.

Hamadeh, S.K., Hanna, N., Barbour, E.K., Abi-Said, M., Rawda. N., Chedid, M and Jaber, L.S. (2008). Changes in physiological and blood parameters in water restricted Awassi ewes supplemented with different levels of Vitamin C. Beirut, Lebanon; Session S.26 Abstract No. 3175.

Javed, M.T, Ahmad, L., Irfan, M., Ali, I., Khan, A., Farooqi, M., Latif, A and Cagiola, M.(2010). Haematological and serum protein values in tuberculin reactor and non-reactor water buffaloes, cattle, sheep and goats. *Pakistan Veterinary Journal*. 30: 100-104.

Kahn, C.M and Line, S.(2005). Pregnancy toxemia in Ewes. In The Merck Veterinary Manual. 9th Ed., Merck and Co White house Station. PP: 828-830.

Kaneko, J.J., Harvey, J.W and Bruss, M.L. (2008).Veterinary Clinical Biochemistry of Domestic Animals. 6th Ed., San Diego, Elsevier. PP: 904.

Krajnicakova, M., Kovae, N.S., Kostecky, M., Valocky, I., Maraeek, I., Sutiakova, I and Lenhardt, L .(2003). Selected clinicobiochemical parameters in the puerperal period of goats. Bulletin veterinary Research. 47: 177-182.

Lindsay, H.A.(2001). Biological mechanisms that might underlie iron's effects on fetal growth and preterm birth. Department of Nutrition, University of California, Davis, CA, Journal of Nutrition. 131: 581-589.

Macajova,M.,.Lamosova, D and Zeman, M .(2004). Role of leptin in farm animals .A review . J.*Vet.Med. 51:157- 166.*

Mcdowell, L.R. (1992). Minerals in animal and human nutrition. Academic press Inc. Harcourt Brace Jovanovich. Publishers, approach. 2nd ed. McGraw –Hill Kogakusha, Ltd. Tokyo. pp. 187-190.

Munoz, A., Riber, C., Trigo, P and Castejon, F. M.(2010). Acciones biológicasy factores determinantes de las concentraciones del factor de crecimiento similar a la insulina tipo I (IGF-1) en el caballo (Biological cations and determinant factors of the circulating concentrations of insulin-like growth factor type 1, IGF-1 in the horse). RedVet 11:1-17.

NIMET (2010). Nigerian metrological Agency Lafia, Nasarawa state.

Radostits, O.M., Gay, C.C., Hinchcliff, K.W and Constable, P.D .(2007). Veterinary Medicine a textbook of the diseases of cattle, horses, sheep, pigs and goats. 10th Ed., Saunders, Elsevier. PP: 454, 2048-2050. Sacks DB (2008). Carbohydrates. Tietz fundamentals of clinical chemistry, 6th Ed., Saunders, Elsevier. PP: 390-391.

Sigurdsson, H .(1988b). The effect of flock, number of fetuses and age on some biochemical

SPSS. (2010).Statistical Package for Social Sciences. SPSS Inc., 444 Michigan Avenue, Chicago, IL60611.

Steel, R.G.D and Torrie, J.H. (1980). In: Principles and procedures of statistics.

Whitney, T. R., Waldron, D.F and Willingham, T.D .(2009). Evaluating nutritional status of Dorper and Rambouillet ewes in range sheep production. *Sheep Goat Res. J.*, 24: 10-16.

Yokus, B., Cakir, D.U and Kurt, D.(2004). Effects of seasonal and physiological variations on the serum major and trace element levels in sheep. Biological Trace Element Research. 101: 241-255.

Yokus, B., Cakir, D.U., Kanay, Z., Gulten and Uysal, E .(2006). Effects of seasonal and physiological variations on the serum chemistry, vitamins and thyroid hormone concentrations in sheep. Journal of veterinary medicine. A, Physiology, pathology, clinical medicine. 53: 271-276.