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Determination of Serum Proteins and Glucose Concentrations in Clinically Normal and Anemic Awassi Sheep

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ABSTRACT

The aim of the present study was to determine the values of serum Total Proteins (TP), albumin, globulin and glucose concentrations in healthy and iron deficient anemic Awassi sheep. For this purpose, the current study has conducted on 181 normal (73 males and 108 females) and 60 anemic sheep (16 males and 44 females) both groups were subdivided and aged 7 – 48 months in Baghdad, Iraq. The samples were collected from October 2011 until March 2012. Separated sera were investigated for measured parameters. Results have showed that the means ± SE of serum values in normal and anemic sheeps were as follows; TP 61.33 ± 1.08 g/L and 52.59 ± 2.24 g/L, albumin 30.77 ± 0.61 g/L and 25.27 ± 1.15 g/L, globulin 30.55 ± 0.81 g/L and 27.31 ± 1.47 g/L, and glucose 2.36 ± 0.07 mmol/L and 1.63 ± 0.07 mmol/L respectively, with a significant differences ($P < 0.05$) between normal and anemic values. The values showed significant differences between males and females and also, between normal subgroups themselves. It was concluded that this study recorded reference values of the studied parameters in Iraqi Awassi sheep with significant differences ($P<0.05$) between normal and anemic, males and females as well as between normal subgroups.

Key words: Serum TP, Albumin, Globulin, Glucose, Awassi Sheep.

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INTRODUCTION

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 Awassi 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), also Javed et al. (2010) studied serum total protein, albumin and globulin and detected the normal levels in 36 normal Punjab sheep. While, Al-Rukibat et al. (2006); Radostits et al. (2007); Kaneko et al. (2008); Antunovic et al. (2011) and Abdelrahman and Aljumaah (2012) documented total serum proteins, albumin and glucose concentrations. Also, there are number of studies which measured serum total proteins and albumin in Awassi sheep (Piccione et al., 2009; Bonev et al., 2012; Safsaf et al., 2012).

Yokus et al. (2004) have been 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 Awassi sheep including serum minerals, some electrolytes, some elements and liver enzymes (Abdelrahman, 2012; Al-Hadithy and AL-Badawi, 2012; Al-Hadithy et al., 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 Awassi sheep, Therefore this investigation has carried out on a larger number for measured parameters in healthy and anemic Awassi sheep. Moreover, different physiologic statuses of clinically healthy were studied.

MATERIAL AND METHODS

Blood samples were collected into plain tubes from jugular vein puncture of 181 clinically normal (73 males and 108 females) and 60 diagnosed Iron Deficient Anemic (IDA) Awassi sheep in Baghdad governorate from October 2011

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until March 2012. The clinically healthy sheep were selected from Shuala station-state board for agriculture researches and college of agriculture -Baghdad university, these animals on good feeding regime with normal hemogram and serum iron (Al-Hadithy and AL-Badawi, 2012; Badawi and AL-Hadithy, 2014). While, iron deficient anemic sheep from North and North West Baghdad with poor feeding regime and revealed significantly lowered ($P<0.05$) serum iron and hematological values(Al-Hadithy and AL-Badawi, 2012; Al-Badawi, 2012).

Normal sheeps (73 males and 108 females) were divided into sub groups; normal males (36 ram lambs aged 7 – 12 months and 37 rams aged 1.5 – 4 years) while, the normal females (35 ewe lambs aged 7 – 12 months, 37 pregnant ewes aged 1 – 4 years and 36 lactating ewes aged 1.5 – 4 years). On the other hand, anemic males (11 ram lambs and 5 rams) and anemic females (4 ewe lambs, 19 pregnant and 21 lactating ewes) aged similar to the relevant normal sub groups.

Blood samples were centrifuged for 5 – 10 minutes at 3000 rpm (Coles, 1986) and separated sera were used directly for measurement of serum total protein, albumin, globulin and glucose in clinical pathology laboratory, college of veterinary medicine, Baghdad University, Iraq. Serum total protein was determined according to Biuret colorimetric method and albumin was assayed according to bromocresol colorimetric method (Johnson, 2008), while globulin was calculated according to the formula; globulin= total protein-albumin (Scimone and Rothstein, 1978). Glucose was estimated according to the colorimetric method by Sacks (2008).

SAS program (2008) was used for statistical analysis. Data were subjected to analysis of variance (ANOVA) and means were compared by Least Significant Difference (LSD). Also T – test were used to compare means at a significant level ($P<0.05$).

RESULTS

The serum values of the measured total protein, albumin, globulin and glucose concentrations for healthy and anemic Awassi sheep independent of any subdivision were as follows; Serum total protein 61.33 ± 1.08 g/L and 52.59 ± 2.24 g/L, serum albumin 30.77 ± 0.61 g/L and 25.27 ± 1.15 g/L, serum globulin 30.55 ± 0.81 g/L and 27.31 ± 1.47 g/L and serum glucose 2.36 ± 0.07 mmol/L and 1.63 ± 0.07 mmol/L respectively with a significantly ($P<0.05$) higher values in serum total protein, albumin and glucose of normal compared to anemic sheeps (Table 1).

The serum proteins and glucose values according to gender are presented in (Table 2). Serum total protein in normal sheeps found to be 56.52 ± 1.20 g/L in males and 64.57 ± 1.54 g/L in females, while in anemic was 57.30 ± 3.73 g/L in males and 50.88 ± 2.71 g/L in females. Serum TP was significantly ($P<0.05$) higher in normal females compared to normal males and anemic females. Serum albumin in normal sheeps was 32.38 ± 0.92 g/L and 29.69 ± 0.79 g/L in males and females respectively and in anemic sheeps was 27.93 ± 2.42 g/L and 24.31 ± 1.29 g/L in males and females respectively. Serum albumin values of normal males and females were significantly ($P<0.05$) higher than of anemic females. Serum globulin is 24.14 ± 1.02 g/L and 34.88 ± 0.97 g/L in normal males and females respectively. On the other hand, it was 29.36 ± 2.21 g/L and 26.57 ± 1.84 in anemic males and female respectively. In normal females serum globulin is significantly ($P<0.05$) higher compared to that of other groups.

Serum glucose concentration in normal sheep was 2.56 ± 0.11 mmol/L in males and 2.23 ± 0.09 mmol/L in females with no significant differences between them, while in anemic sheeps, it was1.70 ± 0.15 mmol/L in males and 1.60 ± 0.08 mmol/L in females, however serum glucose concentrations in anemic sheeps was significantly ($P<0.05$) lower in comparison with normal sheeps.

Serum proteins and glucose concentrations according to physiologic status are presented in Table 3. Serum TP in ram lambs, rams, ewe lambs, pregnant and lactating ewes were as follows: 57.76 ± 1.21 g/L, 55.31 ± 2.06 g/L, 74.40 ± 1.89 g/L, 70.75 ± 1.26 g/L and 48.67 ± 2.42 g/L respectively. Serum TP was significantly ($P<0.05$) higher in ewe lambs and pregnant ewes compared to other groups, also, serum TP in lactating ewes was significantly lower ($P<0.05$) than ram lambs . Serum albumin was 32.35 ± 0.98 g/L, 32.40 ± 1.57 g/L, 32.96 ± 0.99 g/L, 33.72 ± 0.91 g/L and 22.36 ± 1.31 g/L in ram lambs, rams, ewe lambs, pregnant and lactating ewes respectively. Serum albumin in lactating ewes was significantly lower ($P<0.05$) than other groups. While serum globulin was 25.40 ± 0.99 g/L in ram lambs, 22.91 ± 1.76 g/L in rams, 41.43 ± 1.43 g/L in ewe lambs, 37.03 ± 1.19 g/L in pregnant ewes and 26.30 ± 1.33 g/L in lactating ewes. Serum globulin in ewe lambs was significantly higher ($P<0.05$) than all groups; also serum globulin of pregnant ewes was significantly higher ($P<0.05$) than ram lambs, rams and lactating ewes.

Finally serum glucose concentration in ram lambs, rams, ewe lambs, pregnant and lactating ewes were as follows 2.77 ± 0.17 mmol/L, 2.35 ± 0.14 mmol/L, 2.72 ± 0.15 mmol/L, 1.76 ± 0.10 mmol/L and 2.22 ± 0.15 mmol/L respectively. Serum glucose concentration in ram lambs was significantly higher ($P<0.05$) than rams, pregnant, and lactating ewes.

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Table 1. Serum proteins and glucose concentrations in clinically normal and anemic Awassi sheep (range and mean ± SE).

Parameters	Normal (n=181)	Anemic (n=60)
Serum total protein	23.4 – 93.3	22.9 – 80.1
g/L	61.33 ± 1.08 A	52.59 ± 2.24 B
Serum albumin	9.3 – 49	10.1 – 42.4
g/L	30.77 ± 0.61 A	25.27 ± 1.15 B
Serum Globulin	11.6 – 55.8	9 – 45.9
g/L	30.55 ± 0.81 A	27.31 ± 1.47 A
Serum Glucose	0.4 – 4.84	0.69 – 2.77
mmol/L	2.36 ± 0.07 A	1.63 ± 0.07 B

Different letters horizontally mean significantly different at (P<0.05).

Table 2. Serum proteins and glucose concentrations of males and females in normal and anemic Awassi sheep (range and mean ± SE).

Parameters	Males (n=73)	Females (n=108)	Anemic males (n=16)	Anemic females (n=44)
Serum total protein	23.4 – 77.3	25.6 – 93.3	30.0 – 75.1	22.9 – 80.1
g/L	56.52 ± 1.20 B	64.57 ± 1.54 A	57.30 ± 3.73 AB	50.88 ± 2.71 B
Serum albumin	11.5 – 45.7	9.3 – 49	12 – 42.3	10.1 – 42.4
g/L	32.38 ± 0.92 A	29.69 ± 0.79 A	27.93 ± 2.42 AB	24.31 ± 1.29 B
Serum Globulin	11.1 – 43.9	13 – 55.8	16.3 – 45.9	9 – 44.6
g/L	24.14 ± 1.02 B	34.88 ± 0.97 A	29.36 ± 2.21 B	26.57 ± 1.84 B
Serum Glucose	1.07 – 4.84	0.4 – 4.34	0.69 – 2.7	0.74 – 2.77
mmol/L	2.56 ± 0.11 A	2.23 ± 0.09 A	1.70 ± 0.15 B	1.60 ± 0.08 B

Different letters horizontally mean significantly different at (P<0.05).

Table 3. Serum proteins and glucose concentrations according to the physiologic status in normal Awassi sheep (range and mean ± SE).

Parameters	Ram lambs (n=36)	Rams (n=37)	Ewe lambs (n=35)	Pregnant ewes (n=37)	Lactating ewes (n=36)
Serum total	40.4 – 71	23.4 – 77.3	51.9 – 93.3	55.3 – 87	25.6 – 78.7
protein g/L	57.76 ±1.21 B	55.31 ± 2.06 BC	74.40 ± 1.89 A	70.75 ± 1.26 A	48.67 ± 2.42 C
Serum albumin	16 – 43.4	11.5 – 45.7	24.8 – 45.4	21.6 – 49	9.3 – 37.1
g/L	32.35 ± 0.98 A	32.40 ± 1.57 A	32.96 ± 0.99 A	33.72 ± 0.91 A	22.36 ± 1.31 B
Serum Globulin	11.6 – 34.7	11.1 – 43.9	25.9 – 55.8	16.3 – 48.6	13 – 43
g/L	25.40 ± 0.99 C	22.91 ± 1.76 C	41.43 ± 1.43 A	37.03 ± 1.19 B	26.30 ± 1.33 C
Serum Glucose	1.07 – 4.84	1.07 – 3.92	0.96 – 4.34	1.17 – 3.02	0.4 – 3.59
mmol/L	2.77 ± 0.17 A	2.35 ± 0.14 AB	2.72 ± 0.15 AB	1.76 ± 0.10 C	2.22 ± 0.15 B

Different letters horizontally mean significantly different at (P<0.05).

DISCUSSION

The values of serum proteins and glucose concentration were obtained from clinically normal and anemic Awassi sheep independent of any subdivision are presented in table 1, according to sex in table 2 and the normal physiologic subgroups in table 3.

The results of the present study indicated significant differences between healthy and anemic values that confirm the findings by Radostits et al. (2007) of low or normal serum proteins concentration in anemic animal. Also, red blood cells have a higher concentration of protein (hemoglobin) than plasma (Smith, 2012). On the other hand, low hematological values (anemia) may have influence on serum protein concentrations (Alton, 2005). The plasma contain a higher water percent and the glucose dissolved in this water, anemia results in decreased blood mass compared to liquid mass (plasma) and this may lead to decrease dissolved glucose concentration (Tooley, 2003; David et al., 2008). Also, the IDA sheep fed on poor feeding regime with low proteins and carbohydrate and this may be attributed to the environment and type of breeding (AL-Badawi, 2012). However, according to gender, data showed differences between males and females in normal and anemic males and females for measured parameters. Different physiologic statuses gives better pictures about serum proteins and glucose concentration reference values and have the opportunity to compare with available similar researches (Jacob and Vadodaria, 2001; Chiba, 2009; Abdelrahman and Aljumaah , 2012). The data in present study records some significant variation within subgroups. However, ewe lambs showed higher serum proteins and glucose values perhaps due to the increased interest of sheep breeders in terms of nutrition to reach more than 65% of their mature body weight at the start of the reproduction season (Chiba, 2009). Moreover, pregnant ewes revealed low serum globulin and glucose concentrations which are associated with fetus development and mobilization of ewes glucose to fetal blood (Jacob and Vadodaria, 2001), while lactating ewes were significantly lower (P<0.05) in serum proteins, this may be required for colostrum and milk production (Abdelrahman and Aljumaah ,

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2012). Furthermore, decrease blood glucose in lactating ewes may be attributed to the necessary energy for milk production, milk lactose synthesis and the low essential nutrition (Pambu-Gollah et al., 2000).

The reference ranges of the serum total proteins, albumin, globulin and glucose in this study are extended into both lower and higher limits. Therefore, the global reference ranges documented by Aitken (2007), Radostits et al. (2007) and Kaneko et al. (2008) were within our ranges. However, Javed et al. (2010) reported non-significant higher serum protein. The wide ranges of the present study may be attributed to the individual variation or nutrition quality. Al-Fartosi et al. (2010) have reported serum proteins and glucose concentration in males and females lambs and their results were to some extent similar to this study except our higher glucose concentration in males, while in females our finding showed higher serum total protein and globulin. Also, Ahmed et al. (2000) evaluated serum total proteins in lambs of both sex, their results showed higher serum proteins in males and increased serum albumin in females compared to our observations. Our results of serum total proteins are higher in ewe lambs and lower in lactating ewes than those recorded by Bonev et al. (2012).

Furthermore, the serum proteins and glucose concentration in lactating ewes showed a non-significant increase in serum total proteins and a significant increase in serum glucose (Carcangiu et al., 2007). A significant increase in total protein and albumin in lactating ewes were noted by (Piccione et al. (2009) and Antunovic et al. (2011) and a non-significant increase in total protein and albumin by (Abdelrahman and Aljumaah, 2012).

On the other hand, Piccione et al. (2009) reported a similarity in total proteins value and a significant decrease ($P<0.05$) in serum albumin of pregnant ewes compared to that of the present study. While, our results are slightly higher than the total proteins and albumin reported in pregnant and non-pregnant ewes of both primparous and multiparous groups by Safsaf et al. (2012).

The differences in results of the present study compared to other findings could be attributed to the type of feeding, absence of scientifically feeding program, geographical region or perhaps it refers to genetic factors.

CONCLUSION

This study records reference ranges and means ± SE of serum proteins and glucose levels in Iraqi Awassi sheep, also reveals significant increase ($P<0.05$) in serum total protein, albumin and glucose of normal compared to anemic sheep. Moreover, the present work indicated the effect of gender, normal females shows a significant increase ($P<0.05$) in most of the values in comparison with other groups. Also, normal physiologic statues were studied and significant differences ($P<0.05$) were registered in different subgroups.

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