Journal of Animal and Veterinary Advances 7 (4): 437-440, 2008
ISSN: 1680-5593


# Evaluation of Electrolytes Normal Values in Blood of Moghani Sheep Breed

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**Abstract:** In this study, normal values of serum non-electrolytes were studied in Moghani sheep breed. A total of 240 samples from 6 age groups and each sex were selected and measured of serum electrolytes including (Calcium, sodium, potassium, copper, chloride, iron and magnesium ions). The levels of sodium and potassium were determined by flame photometric method and other parameters were measured by spectrophotometeric method. According to the results of this research, there was a significant difference between age groups concerning sodium, potassium, chloride and calcium levels ($p<0.05$) and between 2 sex with calcium level ($p<0.05$). Also, there was a significant positive correlation between age groups and sexes with calcium level and a significant negative correlation between age groups with sodium and potassium levels.

**Key words:** Serum electrolytes, sheep, Moghani breed, calcium level, sodium and potassium levels

## INTRODUCTION

The ranges of different parameters from healthy animals are commonly referred to as reference ranges or normal values. The samples must be collected from healthy animals, those no apparent illness and that exhibit behavior considered to be normal for that species. In this study, we considered to most important variation, which that affect the test results (e.g., age, breed, sex) and the serum electrolytes values including; calcium (Ca), copper (Cu), sodium (Na), chloride (Cl), iron (Fe) and magnesium (Mg) ions were determined by current methods in diagnostic laboratories. The same researches in the other breeds of Iranian sheep were carried out by Mojabi (2000).

The major and trace elements play important roles in biological systems by participation in the structure or as active sites of metalloenzymes (Seyrek *et al*., 2004). An imbalance of mineral levels either by excess or deficiency causes alterations in respective serum levels. Many pathological conditions such as bronchitis, pneumonia, rheumatic heart failure, haemolytic anemia and other infectious disease result in alterations of the trace elements levels in blood and other tissues (El-Kholy, 1990). The element Cu is an integral part of cytochrome (Griffiths and Warton, 1961). It is required for the activity of enzymes associated with Fe metabolism, elastin and collagen formation, melanin formation and integrity of nervous system and also reguired for normal blood cells formation (O'Dell, 1976).

Sodium is the principal cation in the ECF (Extra cellular fluid), also is a cofactor for some metabolic reactions. It serves predominantly as the driver behind most movements of fluid across epithelial surface in the body (Stockham and Scott, 2002; Thrall, 2004).

Potassium (K) is the principal cation of the ICF (Intra cellular fluid) and of the whole body. K is specifically central to normal cardiac rhythm and rate, renal $Na^+$ handling, acid-base metabolism and many processes in intermediary metabolism (Thrall, 2004). Magnesium (Mg) is most abundant divalent cation in ICF. It is needed in many enzymes such as alkaline phosphatase, ATPase and serves some structural role in bone formation (Bhagavan, 1992; Thrall, 2004).

Calcium (Ca) serves multiple roles in the regulation of ion gating across all, in the activation of cell secretory and contractile functions and as a cofactor for reactions during intermediary metabolism (Thrall, 2004; Chatterjea and Shinde, 2005). Chloride, which is the principal anion in ECF, functions predominantly in transport processes integral to cation and water balance and as a conjugate anion in acid-base metabolism.

Iron (Fe) is one of the most essential trace elements in the human body. Its essential is involved in the normal metabolism of heme proteins (haemoglobin, myoglobin, catalase,..) (Chatterjea and Shinde, 2005).

## MATERIALS AND METHODS

A total of 240 blood samples were taken from the jugular vein of healthy sheep according to there age groups (1-3 month, 4-6 month, 7-12 month, 13-24 month, 25-48 month, >48 month) and sex. No clinical signs had

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been noticed in any sheep used in this study. Samples were collected by using heparinized (1000 Units $mL^{-1}$) disposable syringes and serum was separated following centrifugation at 1700 g for 5 min.Tthe levels of serum Na and K ions were determined by flame photometer (Janwey, UK) apparatus and other parameters were measured by spectrophotometeric methods (Shimadzo, Japan). The results were statistically analyzed for electrolytes by using SPSS software and Duncan test was used to determine if there was any significant difference between age groups with serum electrolytes values. The mean and Standard Deviation (SD) were determined for sex and age groups. Correlation between measured parameters was detected by pearson's method and the normal range of electrolytes were calculated with "mean-SD" and "mean+SD" formula.

## RESULTS

In Table 1, Na, k, Cl, Ca, Fe, Cu levels analysis are given in serum of Moghani sheep breed. According to the results of this research, there was a significant difference between age groups with Na, K, Cl, Ca levels ($p<0.05$). In addition, there was a significant positive correlation between age groups with Ca levels ($r = 0.291$) and a significant negative correlation between age groups with Na ($r = -0.346$) and K ($r = -0.346$) levels. In this research, a significant difference was observed only between male and female animals concerning Ca level ($p<0.05$), which this difference and the normal ranges of studied electrolytes are showen in Table 2. As the age groups, there was a significant positive correlation between 2 sex with Ca levels ($r = 0.255$).

## DISCUSSION

In the present study, the Calcium reference range in Moghani sheep breed was consistent with previous reports for sheep (Smith, 1990; Kabir and Pazdezh, 2000), but a little difference was observed with other reports for Iranian sheep breeds (Sangsar, Mehreban, Shal) (Mojabi, 2000) and other breeds (Meyer and Harvey, 2004; Blood, 1994; Duncan and Prasse, 1986; Kaneko, 1989). A significant difference was observed between age groups and sexes with Ca level ($p<0.05$). Also, a significant positive correlation was detected between age groups and sex concerning Ca level ($r = 0.291$) and ($r = 0.255$), respectively. But, this significant positive correlation between sex concerning Ca level is in contrast with previous reports for sheep (Mojabi, 2000).

Table 1: The normal values of serum electrolytes in Moghani sheep breed

| S | (M±SD) | Normal range |
|---|---|---|
| Ca (mg $dL^{-1}$) | 10.22±1.09 | 9.13-11.31 |
| Na (mEq $L^{-1}$) | 140.8±2.77 | 138.03-143.57 |
| K (mEq $L^{-1}$) | 4.13±0.45 | 3.68-4.48 |
| Cl (mEq $L^{-1}$) | 102.58±3.19 | 99.39-105.77 |
| Cu (mEq $L^{-1}$) | 77.99±21.22 | 56.77-99.21 |
| Fe (mEq $L^{-1}$) | 159.57±28.82 | 130.57-188.39 |
| Mg (mg $dL^{-1}$) | 2.57±0.67 | 1.9-3.24 |

M: Mean, SD: Standard deviation, Normal range: (M-SD)-(M+SD)

Table 2: The serum electrolytes levels and normal ranges in the Moghani sheep breed according to sex

| | Male (M±SD) | Male (normal range) | Female (M±SD) | Female (normal range) |
|---|---|---|---|---|
| Ca (mg $dL^{-1}$) | 9.93±0.94* | 8.99 -10.87 | 10.48±1.15* | 9.33-11.63 |
| Na (mEq $L^{-1}$) | 140.65±2.44 | 138.21-143.09 | 140.94±3.04 | 137.9-143.98 |
| K (mEq $L^{-1}$) | 4.23±0.48 | 3.75-4.71 | 4.05±0.41 | 3.64-4.46 |
| Cl (mEq $L^{-1}$) | 102.4±2.3 | 100.1-104.7 | 102.74±3.81 | 98.93-106.55 |
| Cu (mEq $L^{-1}$) | 80.74±23.79 | 56.95-104.53 | 75.6±18.6 | 57.0-94.2 |
| Fe (mEq $L^{-1}$) | 158.45±26.97 | 131.48-185.42 | 160.55±30.56 | 129.99-191.11 |
| Mg (mg $dL^{-1}$) | 2.4±0.67 | 1.73-3.01 | 2.64±0.68 | 1.94-3.32 |

M: Mean, SD: Standard deviation, Normal range: (M-SD)-(M+SD), *: There was a significant difference between 2 sex ($p<0.05$), Male (n) = 118, female (n) = 122

Table 3: The serum electrolytes levels in the Moghani sheep breed according to age (M±SD)

| | 1-3 (month) | 4-6 (month) | 7-12 (month) | 13-24 (month) | 25-48 (month) | > 48 (month) |
|---|---|---|---|---|---|---|
| Ca (mg $dL^{-1}$) | 10.0±0.95$^{a,b}$ | 9.75±0.75$^{a}$ | 10.16±1.01$^{a,b}$ | 10.01±0.92$^{a,b}$ | 10.72±1.19$^{b}$ | 10.75±1.37$^{b}$ |
| Na (mEq $L^{-1}$) | 142.15±2.56$^{b}$ | 140.31±2.21$^{a,b}$ | 141.68±3$^{b}$ | 140.66±1.91$^{b}$ | 141.13±3.44$^{b}$ | 138.7±2.14$^{a}$ |
| K (mEq $L^{-1}$) | 4.24±0.52$^{b,c,d}$ | 4.37±0.46$^{d}$ | 4.28±0.35$^{c,d}$ | 4.04±0.42$^{a,b,c}$ | 3.9±0.45$^{a,b}$ | 3.9±0.26$^{a}$ |
| Cl (mEq $L^{-1}$) | 102.2±0.95$^{a,b,c}$ | 103.25±2.78$^{b,c}$ | 101.41±2.99$^{a,b}$ | 100.91±3.97$^{a}$ | 103.33±2.51$^{b,c}$ | 104.32±3.87$^{c}$ |
| Cu (mEq $L^{-1}$) | 71.9±12.23 | 76.19±22.11 | 83.76±21.56 | 79.98±21 | 79.94±22.05 | 78.0±14.87 |
| Fe (mEq $L^{-1}$) | 158.58±29.75 | 168.83±34.67 | 162.43±27.99 | 157.57±30.95 | 156.49±23.28 | 153.83±26.83 |
| Mg (mg $dL^{-1}$) | 2.43±0.63 | 2.49±0.66 | 2.53±0.78 | 2.48±0.86 | 2.63±0.7 | 2.67±0.48 |
| | n = 40 | n = 40 | n= 40 | n = 40 | n = 40 | n = 40 |

M: Mean, SD: Standard deviation, There was a significant difference between age groups with different code (a, b, c, d) ($p<0.05$)

The normal values of Na and K in this study were a little lower than the other reports by Mojabi (2000), Blood (1994), Coles (1986) for sheep, but the amount of Na is consistent with previous reports for various breed of sheep (Kaneko, 1989; Duncan and Prasse, 1986; Smith, 1990). In addition, a significant difference were detected between age groups with Na and K levels ($p<0.05$). A significant negative correlation was also found in the present study between age groups with Na ($r = -0.346$) and K ($r = -0.346$) levels. This correlation is consistent with previous reports for various breeds of Iranian sheep (Mojabi, 2000) and camels (Nazifi *et al*., 2000).

The chloride levels of Moghani sheep breed in our study were consistent with previous reports by others (Mojabi, 2000; Meyer and Harvey, 2004; Blood, 1989; Kabir and Pazdezh, 2000; Kaneko, 1989; Duncan and Prasse, 1986; Coles, 1994). A significant difference was observed between age groups concerning Cl level ($p<0.05$), these results are in contrast with other reports in sheep and horses (Mojabi, 2000).

The normal values of serum Fe in our studied breed were a little lower than in previous reports for sheep Meyer and Harvey, 2004; Blood, 1994; Kabir and Pazdezh, 2000; Mohri *et al*., 2005).

This reference range of Cu in the present research was near to the previous reports for sheep (Kabir and Pazdezh, 2000; Seyrek *et al*., 2003), whereas in comparison to the other breeds of Iranian sheep, the amount of serum Cu is lower (Mohri *et al*., 2005).

Furthermore, there were no significant difference between sex and age groups with Cu level.

The Mg levels in our study were near to reports of Mojabi (2000), Kaneko (1989), Duncan and Prasse (1986), Smith (1990) and Blood (1994). In the present study, we showed that there were no significant difference between sex and age groups concerning Mg levels.

According to the results of this study, there were no significant correlation between sex and age groups with Mg and Cu levels. This finding is in contrast with other reports in sheep and horses (Mojabi, 2000), also in camels (Nazifi *et al*., 2003).

Probably, the observed differences for Cu, Ca, Na, K, Fe, Mg levels in our research are related to breed, season, feed and water content of these elements, which that needs to further study for determination of effects these factors on the values of serum electrolytes in sheep.

## CONCLUSION

A significant difference was observed between age groups with Ca, Na, Cl, K levels and between sex and Ca level ($p<0.05$). Also, a significant positive correlation was detected between age groups and sex concerning Ca level $r = 0.291$ and $r = 0.255$, respectively. A significant negative correlation was also found between age groups with Na ($r = -0.346$) and K ($r = -0.346$) levels. There were no significant difference and correlation between age groups and sex with other electrolytes.

## ACKNOWLEDGMENT

We wish to express our sincere thank to Dr. Elanaz Afruze, Negin Eshratkhah and Babak Eshratkhah for his kind assistance.

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