

Acid-Base Balance, Rumen, hematological, and serum biochemical parameters of Healthy Egyptian Ossimi Sheep

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1. Abstract

Sheep are of great economic value in developing world and considered the mean of life for most families. The lack of information and updates related to acid-base balance, rumen, hematological and serum biochemical parameters in Egyptian Ossimi sheep creates a need for further studies in this area. Therefore, this study was designed to investigate normal acid- base balance parameters, rumen, and blood constituents in healthy Egyptian Ossimi sheep. A total of 30 apparently healthy adult Egyptian Ossimi ewes, their age 3.06 ± 1.33 years and their body weight 35.00 ± 1.19 kg have been used in this study. Blood and Rumen juice samples were collected in the morning before feeding. Blood samples were divided into three parts, the first on EDTA tubes for hematology, the second on plain tubes for serum separation and estimation of serum biochemical parameters, and the third on heparin which send immediately for blood gas analysis. Normal pH of blood and rumen were 7.45 ± 0.02 and 7.19 ± 0.16 , Total VFAs and ammonia nitrogen concentration were 58.68 ± 4.50 mmol/L and 6.49 ± 0.97 mmol/L respectively. RBCs, WBCs count were $11.44 \pm 0.72 \times 10^6$ /cmm and $8.13 \pm 0.71 \times 10^3$ /cmm. Total protein, albumin, GGT, and BUN were 6.93 ± 0.18 g/dl, 2.84 ± 0.07 g/dl, 25.16 ± 2.15 Units/ml, and 20.60 ± 1.07 mg/dl respectively. These results generally were in accordance with normal reference range of the species.

Key words: Ossimi sheep; acid-base balance; rumen, hematological; and serum biochemical parameters

1. Introduction

In developing countries, many families rely on sheep rearing as a mean of living [1]. They possess the ability to utilize low-quality forages and produce meat, wool, and milk [2]. This ability makes them major contributors to protein deficiency problems and in turn improves food security in developing countries [3]. They are the most abundant animal (other than avian species) raised in Egypt for food [4]. The current number of sheep in Egypt is 5.69 million head, and this number exceeds that of cattle (5.06 million head), goats (4.35 million head), and buffaloes (3.37 million head)

[2]. There are three major sheep breeds recorded in Egypt: Rahmani, Ossimi and Barki [5], and they represent approximately 65% of sheep population in Egypt.

Hematological tests have been widely used to diagnose various diseases and animal nutritional status. The information obtained from the blood parameters would support the physical examination and, together with the medical history, provide an excellent basis for medical judgment. In addition, it would help to determine the extent of tissue and organ damage, the response of the patient's defense mechanism [6].

Evaluations of blood gas and acid-base balance are an important tool in the

diagnosis, treatment, and prognosis of diseases affecting sheep. Various metabolic and respiratory diseases affect the composition of venous blood gas and the ovine baseline values. Therefore, the accurate estimation of these blood indices is of great importance for veterinary clinicians and researchers [7].

The aim of our study was the investigation of normal acid-base balance, rumen, and blood parameters in healthy Egyptian Ossimi sheep which help for better prophylaxis of sheep health.

2. Materials and Methods

Ethical approval

This study was granted the ethical approval (Vet CU 16072020168) from the Institutional Animal Care and Use Committee (Vet. CU. IACUC), Faculty of Veterinary Medicine, Cairo University.

Animals and study design

A total of 30 apparently healthy Egyptian Ossimi ewes, their age 3.06 ± 1.33 years and their body weight 35.00 ± 1.19 kg have been used in this study. The study was carried out during the period of 30/12/2019 to 15/3/2020. Blood and Rumen juice samples were collected in the morning before feeding.

Laboratory examination

Blood samples have been taken by puncture of jugular vein by heparin plastic syringes for acid-base balance estimation; samples should be transferred directly on ice and immediately taken to the laboratory and analyzed by using the blood gas analyzer. Additional blood samples were taken and divided into two portions. First portion collected on EDTA tubes for hematological examination, they have been examined manually by using the methods described by [8]. The second portion collected in plain tubes for serum separation. Collected sera were used to estimate total protein, albumin, Gamma-glutamyltransferase (GGT), Aspartate aminotransferase (AST), blood urea nitrogen (BUN) and serum creatinine,

using specific kits (Spectrum Company-Egypt) and APEL spectrophotometer (Japan). (Globulin and (A/G) ratio were calculated mathematically).

Rumen juice samples were collected from animals via stomach tube, and immediately examined for pH, odor, color, consistency, and protozoal activity according to method described by [9]. Total volatile fatty acids (TVFAs) estimated by steam distillation method [10]. Rumen ammonia nitrogen was estimated by specific kits (Biodiagnostics Company- Egypt). 2ml of rumen juice samples have been fixed and stained with methylene green formal saline for total protozoal count [11].

Statistical analysis

Statistical analysis was carried out by SPSS program version 21, using (Mean, Minimum, and Maximum value). Results were expressed as mean value \pm standard error.

3. Results

Results of acid-base parameters are shown in table 1.

Results of rumen fluid analysis are shown in table 2, physical examination of samples showed aromatic odor, yellowish brown color, slimy consistency, and +++ protozoa activity.

Hematological parameters are shown in table 3 and Serum biochemical constituents are shown in table 4

4. Discussion:

Analysis of blood gases and acid-base balance is an important diagnostic tool that can complement clinical findings in assessing the extent and severity of lung function disorders, estimating prognosis, and taking treatment. It may help to decide on the start of treatment and its effectiveness, thereby contributing to the reduction of therapeutic costs in animals with poor prognosis [12]. The average values of acid-base balance parameters in Egyptian Ossimi sheep were higher than

values recorded by [13] in Polish Longwool sheep, Tuj breed sheep [14], and Baladi ewes [7], while PCO₂ value was lower than that reported by [7, 13,14]. These variations in different parameters may be due to age, sex, diet, reproductive status, stress, season, and geographical distribution.

In our study, rumen constituents analysis revealed aromatic odor, yellowish brown color, and slimy consistency and these findings are in accordance

with other reports in Awassi Saudi Arabian sheep [15] and in healthy Egyptian sheep [1,16,17]. Rumen fluid pH mean was in agreement with other reports [18,19] in Sanjabi sheep, and [20], while [21] recorded lower value in Marino sheep, [15] in Awassi Saudi Arabian sheep, [22] in Small Tail Han sheep, and [23] in clinically healthy wether Santa Ines sheep. Maintaining rumen pH is very important for persistence and stability of the gut microbiota. Rumen ciliated protozoa are sensitive to changes in rumen pH and they cannot survive if the pH goes up above 7.8 or goes down below 5.0. Animals without rumen protozoa often show an increase in bacterial numbers, a decrease in ammonia and volatile fatty acid (VFA) productions, and a decrease in organic matter digestibility [24]. Protozoa activity was +++ in agreement with other reports [15, 16,17,18,]. The mean value of total protozoa count was higher than other studies performed on other breeds [1, 25,26,27,28], the difference in breeds could be implicated. The average of total VFAs was similar to [17], while higher values have been reported in Texel wethers sheep [25], in Marino sheep, [21], and in Small Tail Han sheep [22], and lower than those reported in Egyptian sheep [1, 16, 28], and in Santa Ines sheep [23]. The mean of ammonia concentration was in agreement with other studies [17], though lower than other reports [16,19,25,26,28], and higher than [1]. [29] Found that difference in nitrogen source may affect degradation rate of the nitrogenous compounds and ammonia

liberation in the rumen causing the differences in free ammonia nitrogen concentration in sheep.

Hematologic parameters recorded in this study were generally in accordance with other reports [16,17]. RBCs mean value similar to [16,17], while [30,31,32] reported higher values, and lower values recorded by [33] in healthy Egyptian sheep, [34] in Ossimi sheep, [35] in Awassi ewes, and [3] in Ossimi and Barki non pregnant ewes. Hemoglobin concentration mean was in agreement with other reports [16, 30, 31, 32, 33, 36,], and lower than other reports [1,3, 34,37]. PCV average was in agreement with [30,31,32,17], while [1, 16, 33, 34, 36, 37] reported lower values, and [35] reported higher value. The averages of erythrocyte indexes (MCV, MCH and MCHC) were lower than values recorded by [18, 32, 33]. The mean of WBCs count was in agreement with [18, 30, 32, 38], while [3, 33, 36] recorded higher values, and [1, 16, 34] reported lower values. The neutrophil and Lymphocytes mean values were lower than values reported by [1, 37].

Serum biochemical constituent showed total protein and albumin averages similar to other reports [18, 30,31], while higher values observed by [26] in faunated Indian sheep and in Ossimi sheep [34], and lower values reported by others [33, 35,39]. Serum globulin and A/G ratio similar to other reports [40]. BUN mean value was lower than that recorded by [19, 34,36,39], while [16,17,18,30] reported lower values. Creatinine value was similar to other reports [15, 20, 30, 40], while lower values observed by [41] in adult healthy Najdi sheep, [42] in three different sheep breeds, Rambouillet, Suffolk and Dorper-cross, [43] in Baluchi sheep, and [19]. GGT average was similar to [30], while higher values reported by [44] in Dubrovnik breed sheep, [45] in Tsigai breed sheep, [46] in Dalmatian Pramenka sheep, and [42], and lower value recorded by [47] in Deccani sheep. The mean value of AST was lower than that observed by [34,37], and higher

than [3,19].

5. Conclusion

The present study was in generally in accordance with normal reference range. Though breed variation was evident in difference in results from other reports dealing with other breeds. All these variations in different parameters may be due to age, sex, diet, reproductive status, stress, season, and geographical distribution. This study gives a baseline reference range for acid-base balance, rumen, hematological, and serum biochemical parameters which help for better prophylaxis of Egyptian Ossimi sheep health.

6. References

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Table 1: Acid-base balance parameters of apparently healthy Egyptian Ossimi sheep

Variables	Min	Max	Mean	Mean \pm SE
pH	7.36	7.51	7.448	7.45 \pm 0.02
PCO ₂ (mmHg)	32	48	41.53	41.53 \pm 1.77
PO ₂ (mmHg)	40	96	52.86	52.87 \pm 6.63
HCO ₃ ⁻ (mmol/l)	22	32	28.2	28.20 \pm 1.24
BE(mmol/l)	-1.6	8.1	3.76	3.76 \pm 1.34

SE= Standard error, Min= Minimum, Max= Maximum.

Table 2: Physical, cellular and biochemical constituents of rumen fluid in apparently healthy Egyptian Ossimi sheep

Variables	Min	Max	Mean	Mean \pm SE
pH	6.4	7.9	7.186	7.19 \pm 0.16
TPC($\times 10^4$ /ml)	10	85.5	44.66	44.67 \pm 9.94
TVFAs (mmol/L)	44	75.2	58.67	58.68 \pm 4.50
Ammonia N ₂ (mmol/L)	3.1	10.71	6.49	6.49 \pm 0.97

SE= Standard error, Min= Minimum, Max= Maximum.

Table 3: Hematological parameters of apparently healthy Egyptian Ossimi sheep

Variables	Min	Max	Mean	Mean \pm SE
RBCs ($\times 10^6$ /cmm)	9.16	14.23	11.44	11.44 \pm 0.72
Heamoglobin (mg/dl)	9.7	14.2	11.74	11.75 \pm 0.59
PCV (%)	25	44	34.8	34.80 \pm 2.57
WBCs ($\times 10^3$ / cmm)	6.2	11.8	8.12	8.13 \pm 0.71
Neutrophils (%)	18	34	23.6	23.60 \pm 1.60
Lymphocytes (%)	16	68	41.4	41.40 \pm 7.91
MCV (fl)	27.2	32.6	30.0	30.05 \pm 0.73
MCH (pg)	6.6	12	9.8	9.81 \pm 0.77
MCHC (mg/dl)	22	34	30.29	30.29 \pm 1.52

SE= Standard error, Min= Minimum, Max= Maximum.

Table 4: Serum biochemical constituents of apparently healthy Egyptian Ossimi sheep

Variables	Min	Max	Mean	Mean \pm SE
AST(units/ml)	60	79	66.93	66.93 \pm 2.36
GGT(Units/ml)	20.4	38	25.16	25.16 \pm 2.15
Total protein(g/dl)	6.3	7.5	6.93	6.93 \pm 0.18
Albumin (g/dl)	2.51	3	2.84	2.84 \pm 0.07
Globulin (g/dl)	3.48	4.99	4.09	4.09 \pm 0.18
A/G	0.50	0.84	0.70	0.70 \pm 0.04
Creatinine (mg/dl)	1.01	1.99	1.62	1.62 \pm 0.17
BUN (mg/dl)	15	25	20.6	20.60 \pm 1.07

SE= Standard error, Min= Minimum, Max= Maximum.