

EVALUATION OF BIOMETRIC PARAMETERS AND SOME MINERALS IN THE SPLEEN OF KARADI MALE LAMBS

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Abstract

The purpose of this study was to identify gross morphology, biometric measurement, histological, mineral structural content, and the correlation between them in the spleen of Karadi male lambs. This study was conducted in the Animal Science field, department of Animal Science, College of Agricultural Engineering Sciences, University of Sulaimani. A total of fifteen 15 spleen of Karadi male lambs used in this study. Spleen samples used to histological study and determined some macro mineral concentration. Results indicated the mean value of weight was 46.50 gm and its mean values length, width, and thickness in spleen lamb were 11.07, 6.81, and 1.38 cm, respectively. Results showed a positive correlation between most of the parameters in this study, but; the negative correlation between lamb initial wt. and Ca was $r=-0.552$, $p= 0.098$, spleen wt. and Ca was $r= 0.104$, $p= 0.775$, spleen length and spleen thickness was $r=-0.427$, $P=0.218$, spleen length and P was $r= -0.117$, $p= 0.748$, spleen thickness and Na was $r = - 0.081$, $P=0.825$, spleen thickness and Ca was $r= -0.618$, $P=0.057$, Ca and P was $r = -0.496$, $P=0.145$. Also, our result showed spleen gross anatomy (parietal and visceral) surfaces and spleen components (red pulp, white pulp, central artery, trabecular) in spleen karadi male lamb.

Keywords: Karadi Lambs, Spleen, Red Pulp, White Pulp, Macro Minerals.

تقييم القياسات البيومترية وبعض المعادن في الطحال ذكور الحملان الكرادي

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الملخص

الهدف من هذه الدراسة هو تحديد الشكل العام، القياسات الحيوية، والمحتوى النسيجي والمعدني، والترابط بينهما في طحال ذكور الحملان الكرادية. اجريت هذه الدراسة في حقول العلوم الحيواني، قسم العلوم الحيوانية، كلية علوم الهندسة الزراعية، جامعة السليمانية. يستخدم خمسة عشر 15 طحال من ذكور الحملان الكرادية في هذه الدراسة. تستخدم عينة الطحال لدراسة الانسجة وتحديد بعض تركيز المعادن الكبرى. أظهرت النتائج أن متوسط القيمة للوزن 46.50 ومتوسط القيمة للطول والعرض والسماك في طحال الحملان كان 11.07، 6.81 و 1.38 سم، على التوالي. أظهرت النتائج ان معامل الارتباط الإيجابي بين معظم المعلمات في هذه الدراسة، ولكن يوجد العلاقة السلبية بين الوزن الأولي للحملان و Ca كان $p= 0.098$ ، $r= -0.552$ ، بين وزن الطحال و Ca كان $r=-$ $p= 0.775$ $p= 0.104$ ، بين طول الطحال وسمك الطحال كان $P= 0.218$ ، $r= -0.427$ ، بين طول الطحال و P كان $p= 0.748$ ، $r= -0.117$ ، بين سمك الطحال و Ca كان $P= 0.057$ ، $r= -0.618$ ، وبين P و Ca كان $P= 0.145$ ، $r= -0.496$. أيضا، أظهرت النتائج تشريح العام للطحال الجداري، الحجابي والحشوي ومكونات الطحال اللب الأحمر، اللب الأبيض، الشريان المركزي والتربقي في طحال ذكور الحملان الكرادي.

كلمات مفتاحية: الحملان كردي، طحال، اللب الأحمر، اللب الأبيض ومعادن كبيرة.

Introduction

Spleen described by (15) as the biggest and most effective secondary lymphatic organ, it acts as a blood filter and preserves iron for use in hemoglobin synthesis, also according to (16) in the defense mechanism, it has a significant role against the micro-organism. Spleen for defense structurally specialized to filter, retain, and deal with the blood-borne antigens, reported by (12). The region between the capsule and the splenic pulp trabeculae split into 2 parts, hematogone red pulp and lymphoid white pulp divided by marginal zone (12). Major minerals (Ca, P, Mg, Na, K, Cl and S) constitute more than 100 mg/kg, while micro minerals or trace elements (Fe, Zn, Cu, Mb, Se, I, Mn, F, Co, Cr, Al, As, Si, V, Ni and Sn) are present in lower amounts in the animal body, reported by (19). Also, (19) and (23) published the minerals elements content of some organs and tissues. Critical minerals that are physiologically and specifically required for growth and energy production are Ca and phosphorus (P) (22). Spleen has been studied rarely in histological and mineral structure content, therefore; The purpose of

this study to identify gross morphology, biometric measurement, histological, mineral structural content, and the correlation between them in the spleen of Karadi male lambs.

Materials and Methods

This study was conducted in the Animal Science field, Animal science department, College of Agricultural Engineering Sciences, University of Sulaimani.

Experimental Animals, A total of Fifteen 15 clinically healthy local Karadi male lambs, 6-7 months of age, with an average live body weight 25 -30 kg used in this study. Collection of Sample, Spleen samples used in this study would be taken from each lamb, after the slaughtering, all samples of the spleen collect and immediately transported with cool box to the laboratory. Gross Examination of the Specimen, Grossly, the weight (in gm) with the help of an electric balance (SARTORIUS AG GOTTINGEN BL 1500S 13702608), length, width, and thickness of the spleens were using an electronic digital caliper 0-150mm 6, color and shape were observed and measured.

- Spleen length: Between two opposite highest vertical spleen points.
- Spleen width: Between two mid-points of spleen opposite.
- Spleen thickness: Recorded at mid-point of the spleen.

Histological Specimen Analysis, Histological preparations, (20) defined the procedure for the histological preparations. Shortly, the spleen was cut loose, sliced from the hilus to the middle to create samples 3-4 mm thick and put in Petri dishes containing 10 percent neutral formalin buffered. Those were set in 10 % formalin by immersion. The tissues were dehydrated at rising ethanol concentrations, washed in xylene, and coated in paraffin. The embedded in paraffin were sectioned with a 5um thick microtome and mounted on slides that were used for hematoxylin and Eosin stain to investigate general histological patterns.

Microscopic measurement, the light compound microscope which was used for the microscopic measurement power objective (x10 objective, x40 eyepiece).

Spleen Tissue Preparation, around 2 gm per spleen specimen had been taken and destroyed manually (homogenizing) with 5 ml (distilled water) and immigrate for about 8 min, then centrifuge had been done for about 15 min, after centrifuging, the supernatants are separate and keep until biochemical analysis have been done. The supernatants used to determine some mineral concentration in the spleen: Calcium Ca, Sodium Na, phosphorus P, and Magnesium Mg.

Data analysis, all the data generated was presented as Mean, Standard deviation, and analyzed by using XLSTAT (24) Correlation between parameters was done using Pearson's correlation test.

Results and Discussion

The present study showed that the initial and finish weight, biometrical measurements, and concentration of some macro mineral of the spleens of karadi male lambs are presented in Table 1. Results show that the initial and final weight of lambs were (23.64 and 29.46) Kg, respectively. Spleen weight was 46.5 gm. Also, the mean value of spleen lambs in weight, width, and thickness were 11.07, 6.81, and 1.38 cm, respectively. On other mammals, (21) showed the results of morphometric study and mass of this organ. The values reported in this research for lamb spleen differed from those previously stated by (14) in karadi sheep, the mean length and width values for spleen sheep were (13.72 and 9.05) cm, respectively; these different values are a result of the variation of spleen normal size in ruminant return to differences in age, since in our study we used

lambs. (13) founded that the minimum value of spleen length was 4.54 cm and the maximum value was 11.67 cm, while minimum and maximum width values were 3.29 and 8.32 cm, respectively. (7) Recorded that the age has significant variation and also it has a progressive increase of mass and revealed while founded that the sex has no influence on its development. The diagnostic information and the progression of gastrointestinal and hematological diseases can be obtained from the splenic size (11). The mean value of concentrations of sodium Na, calcium Ca, phosphate P and Magnesium Mg in spleen karadi male lambs were 6.2 mmol/L, 1.42 mg/dL, 18.31mg/dL and 3.59 mg/dL, respectively. The association (r), P-value, and determination coefficient R^2 is shown in table 2 between initial and finish weight of male karadi lambs, biometric measurement and some macro mineral Na mmol/L, Ca mg/dL, P mg/dL and Mg mg/dL in the spleen karadi male lambs.

Table 1 Mean value \pm SD of initial weight, finish weight (kg), Spleen biometric parameters and some macro mineral in karadi male lambs

Parameters	Mean \pm SD
Initial body weight (Kg)	23.64 \pm 1.11
Final body weight (Kg)	29.46 \pm 2.04
Spleen Wt.(gm)	46.50 \pm 10.01
Spleen Length (Cm)	11.07 \pm 1.18
Spleen width (Cm)	6.81 \pm 0.86
Spleen thickness (Cm)	1.38 \pm 0.33
Na (mmol/L)	6.20 \pm 0.78
Ca (mg/dL)	1.42 \pm 0.22
P(mg/dL)	18.31 \pm 2.47
Mg(mg/dL)	3.59 \pm 0.62

Results showed that the positive correlation between lamb initial wt. and final wt. was $r=0.327$, $p=0.357$, between lamb initial wt. and spleen weight was $r=0.590$, $p=0.073$, but; negative correlation between lamb initial wt. and spleen length was $r=-0.068$, $p=0.851$, because the spleen size was affected by body weight. Correlation between lamb initial wt. and spleen width was $r=0.479$, $p=0.161$ and between lamb initial wt. and spleen thickness was $r=0.408$, $p=0.242$. Coefficient of determination R^2 between lamb initial wt. and final wt. was $R^2=0.107$, between lamb initial wt. and spleen weight was $R^2=0.348$, between lamb initial wt. and spleen length was $R^2=0.005$, between lamb initial wt. and spleen width was $R^2=0.229$ and between lamb initial wt. and spleen thickness was $R^2=0.166$. Positive correlation between lamb initial wt. and Na was $r=0.368$, $p=0.295$, But; the negative correlation between lamb initial wt. and Ca $r=-0.552$, $p=0.098$, this is because Ca and P concentrations increased and Mg, Na, and K concentrations decreased as kid BWs increased according to (5). Positive correlation between lamb initial wt. and P $r=0.714$, $p=0.020$, the amount of P decreased as body weight increased according to (9), lamb initial wt. and Mg was $r=0.383$, $p=0.274$. Coefficient of determination (R^2) between lamb initial wt. and Na was $R^2=0.135$, between lamb initial wt. and Ca $R^2=0.305$, between lamb initial wt. and P was $R^2=0.510$ and lamb initial wt. and Mg was $R^2=0.147$. Positive correlation between lamb final wt. and spleen weight was $r=0.088$, $P=0.810$ and between lamb finish wt. and spleen length was $r=0.141$, $P=0.698$, lamb finish wt. and spleen width were

$r=0.220$, $P=0.542$, between lamb finish wt. and spleen thickness was $r=0.060$, $P=0.868$, this happens because the weight and size of the spleen is increasing with body weight gain and age in lamb. Our result is similar to (17) that reported; the weight of the spleen correlated positively with body weight in humans. Negative correlation between lamb final wt. and Na was $r=-0.153$, $P=0.673$, According to (1) Na concentrations usually decline with age. Positive correlation between lamb final wt. and Ca was $r=0.007$, $P=0.984$, this is similar to a previous study by (4) which observed an increase in the concentration of Ca in German Merino Land sheep as the animals increased in BW. correlation between lamb final wt. and P was $r=0.042$, $P=0.909$, but; the negative correlation between lamb final wt. and Mg was $r=-0.590$, $P=0.073$. Coefficient of determination R^2 between lamb finish wt. and spleen weight was $R^2=0.008$, lamb finish wt. and spleen length were $R^2=0.020$, lamb finish wt. and spleen width were $R^2=0.048$, lamb finish wt. and spleen thickness were ($R^2=0.004$), lamb finish wt. and Na were $R^2=0.023$, lamb finish wt. and Ca was $R^2=0.000$, lamb finish wt. and P was $R^2=0.002$, and lamb finish wt. and Mg was $R^2=0.348$.

Positive correlation between spleen weight and spleen length was $r=0.213$, $p=0.554$, spleen wt. and spleen width were $r=0.824$, $p=0.003$, spleen wt. and spleen thickness were $r=0.533$, $p=0.113$. Coefficient of determination (R^2) between spleen weight and spleen length, spleen Wt. and spleen width, and spleen wt. and spleen thickness were $R^2=0.045$, $R^2=0.678$ and $R^2=0.284$, respectively. Positive correlation between spleen weight and Na was $r=0.450$, $p=0.192$, The values for lamb spleen obtained in this study differ from those previously recorded in sheep by (14) which found the negative correlation between spleen weight and Na^+ $r=-0.161$, $P=0.509$. The negative correlation between spleen wt. and Ca was $r=-0.104$, $p=0.775$, spleen wt. and P was $r=0.416$, $p=0.23$ and between spleen wt. and Mg was $r=0.444$, $p=0.198$. Coefficient of determination (R^2) between spleen weight and Na, spleen wt. and Ca, spleen wt. and P, and between spleen wt. and Mg were $R^2=0.203$, $R^2=0.011$, $R^2=0.173$ and $R^2=0.197$, respectively. (14) found the coefficient of determination (R^2) between spleen weight and Na^+ was $R^2=0.026$. The positive correlation between spleen length and spleen width was $r=0.257$, $P=0.474$, but; the negative correlation between spleen length and spleen thickness was $r=-0.427$, $P=0.218$. The positive correlation between spleen width and spleen thickness was $r=0.251$, $P=0.485$. The coefficient of determination (R^2) between spleen length and spleen width was $R^2=0.066$, between spleen length and spleen thickness was $R^2=0.183$, between spleen width and spleen thickness was $R^2=0.063$.

The positive correlation between spleen length and Na was $r=0.537$, $p=0.110$, our result in this study was higher to those previously reported in sheep by (14) spleen length and Na^+ $r=0.147$, $P=0.549$. Positive correlation between spleen length and Ca was $r=0.485$, $p=0.155$, But, the negative correlation between spleen length and P $r=-0.117$, $p=0.748$. Positive correlation between spleen length and Mg was $r=0.047$, $p=0.897$, also between spleen width and Na was $r=0.484$, $p=0.156$, our result in this study was differ to those previously reported in sheep by (14) spleen width and Na^+ $r=0.201$, $P=0.410$. Positive correlation between spleen width and Ca was ($r=0.238$, $P=0.509$), spleen width and P was $r=0.352$, $P=0.319$, spleen width and Mg was $r=0.404$, $p=0.247$. Coefficient

of determination (R^2) between spleen length and Na was $R^2=0.288$, spleen length and Ca was $R^2=0.235$, spleen length and P $R^2=0.014$, between spleen length and Mg was $R^2=0.002$, spleen width and Na was $R^2=0.234$, spleen width and Ca was $R^2=0.056$, spleen width and P was $R^2=0.124$, spleen width and Mg was $R^2=0.163$. Negative correlation between spleen thickness and Na was $r=-0.081$, $P=0.825$, spleen thickness and Ca was $r=-0.618$, $P=0.057$. Positive correlation between spleen thickness and P was $r=0.378$, $P=0.281$ and between spleen thickness and Mg was $r=0.076$, $P=0.835$. Positive correlation between Na and Ca was $r=0.229$, $P=0.524$, Na and P were $r=0.053$, $P=0.885$ and between Na and Mg were $r=0.402$, $P=0.249$, but; the negative correlation between Ca and P was $r=-0.496$, $P=0.145$, according to (18) Ca: P ratio affects the absorption and excretion of both minerals. Negative correlation between Ca and Mg was $r=-0.100$, $P=0.784$ this is similar to the result by (6) which described apparent absorption of Mg in the rate was reduced by an increase in dietary Ca from 0.34 to 0.68 but positive correlation between P and Mg were $r=0.672$, $P=0.033$. Coefficient of determination (R^2) between spleen thickness and Na, between spleen thickness and Ca, between spleen thickness and P, spleen thickness and Mg, between Na and Ca, between Na and P and between Na and Mg, between Ca and P, between Ca and Mg and between P and Mg were ($R^2=0.006$, $R^2=0.382$, $R^2=0.143$, $R^2=0.006$, $R^2=0.053$, $R^2=0.003$, $R^2=0.162$, $R^2=0.246$, $R^2=0.010$ and $R^2=0.451$).

Gross Anatomy and Histological result of the spleen in Karadi male lamb, gross anatomy, the spleen of sheep is a reddish-brown and triangular, it consists of both parietal and visceral surfaces (16), these findings were in agreement with our result that showing in figure 1, spleen gross anatomy (parietal and visceral) surfaces in karadi male lambs. Also, according to (8) spleen have two surfaces, parietal (convex) and visceral (concave), this surface also has a hilus, in the spleen of sheep there are two ends, dorsal end and ventral end, the latter end appears narrower and thinner, while the former end appears thick and as abroad.

The histological and microscopic structure of the spleen, the splenic pulp consists of red and white pulp, the red pulp found to consist of the sinusoid that appear irregularly distributed and meandering through the pulp cord which appears as a cellular tissue, according to (8), these findings were in agreement with our result that showing in figure 2 and 3 and, (10) described in mammals and bovines, respectively mentioned that the principal structure of fetal spleen composed of capsule, trabaculae, white and red pulp, and blood vessels. In figure 2 show that some photomicrograph of spleen components (red pulp, white pulp, central artery, trabecular) in karadi male lambs. (2) measured the average diameter of white pulp in the spleen of goat as 0.35 ± 0.03 mm and 0.35 ± 0.05 mm in a cow.

Table 2 Correlation(r), P-value, and coefficient of determination (R²) between (initial and finish) weight, biometric measurement, and some macro in the spleen karadi male lambs.

	Lamb initial Wt. (Kg)	Lamb Finish Wt. (Kg)	Spleen Wt (gm)	Spleen length (Cm)	Spleen width (Cm)	Spleen thickne ss (Cm)	Na (mmol/L)	Ca (mg/dL)	P (mg/dL)	Mg (mg/dL)
Lamb initial Wt. (Kg)	r=1 P=0 R2=1	r= 0.327 P= 0.357 R2=0.107	r=0.59 0 P= 0.073 R2=0.348	r=-0.068 P=0.851 R2=0.005	r=0.479 P=0.161 R2=0.229	r=0.408 P=0.242 R2=0.166	r=0.368 p=0.295 R20.135	r=-0.552 P=0.098 R2=0.305	r=0.714 P=0.020 R2=0.510	r=0.383 P=0.274 R2=0.147
Lamb finish Wt. (Kg)		r=1 P=0 R2=1	r=0.08 8 P=0.81 0 R2=0.008	r=0.141 P=0.698 R2=0.020	r=0.220 P=0.542 R2=0.048	r=0.060 P=0.868 R2=0.004	r= - 0.153 P=0.673 R2=0.023	r=0.007 P=0.984 R2=0.000	r=0.042 P=0.909 R2=0.002	r= -0.59 P=0.073 R2=0.348
Spleen Wt. (gm)			r=1 P=0 R2=1	r=0.213 P=0.554 R2=0.045	r=0.824 P=0.003 R2=0.678	r=0.533 P=0.113 R2=0.284	r=0.450 P=0.192 R2=0.203	r=-0.104 P=0.775 R2=0.011	r=0.416 P=0.231 R2=0.173	r=0.444 P=0.198 R2=0.197
Spleen length (Cm)				r=1 P=0 R2=1	r=0.257 P=0.474 R2=0.066	r=- 0.427 P=0.218 R2=0.183	r=0.537 P=0.110 R2=0.288	r=0.485 P=0.155 R2=0.235	r=-0.117 P=0.748 R2=0.014	r=0.047 P=0.897 R2=0.002
Spleen width (Cm)					r=1 P=0 R2=1	r=0.251 P=0.485 R2=0.063	r=0.484 P=0.156 R2=0.234	r=0.238 P=0.509 R2=0.056	r=0.352 P=0.319 R2=0.124	r=0.404 P=0.247 R2=0.163
Spleen thickness (Cm)						r=1 P=0 R2=1	r= - 0.081 P=0.825 R2=0.006	r= - 0.618 P=0.057 R2=0.382	r=0.378 P=0.281 R2=0.143	r=0.076 P=0.835 R2=0.006
Na (mmol/L)							r=1 P=0 R2=1	r=0.229 P=0.524 R2=0.053	r=0.053 P=0.885 R2=0.003	r=0.402 P=0.249 R2=0.162
Ca (mg/dL)								r=1 P=0 R2=1	r=-0.496 P=0.145 R2=0.246	r=-0.100 P=0.784 R2=0.010
P (mg/dL)									r=1 P=0 R2=1	r=0.672 P=0.033 R2=0.451
Mg (mg/dL)										r=1 P=0 R2=1

r: correlation coefficient, R²: coefficient of determination, correlation is a significant at P < 0.05



Figure 1 Photograph of spleen of karadi male lamb showing Parietal surface and visceral surface.

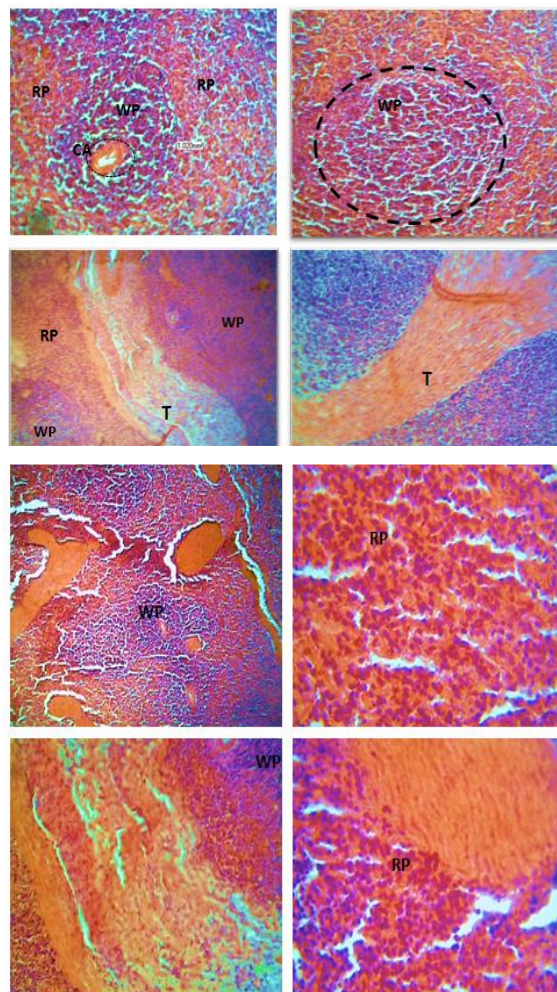


Figure 2 Photomicrograph of spleen of karadi male lambs showing red pulp (RP), white pulp (WP), central artery (CA), trabecular (T)

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