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Variation of some hematological and biochemical parameters of ewes of the Rembi breed during the peri-partum

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ABSTRACT

This study was conducted at the ruminant station of the Technical Institute of Breeding Baba-Ali on the peri-partum period in ewes of the Rembi breed. It focused on the variations of some hematological and biochemical parameters of 7 ewes during 2 months (1 month before lambing and one month after). The blood samples were taken every 15 days, which were analyzed by blood count within the hour following the blood sampling, concerning the hematological parameters. Besides, for the biochemical parameters, the blood was centrifuged and the sera were frozen until the day of analysis. The results of the analysis using logicial R revealed nonsignificant variations ($P > 0.05$) for the following parameters: White blood cells, Lymphocytes, Red blood cells, Hemoglobin, Hematocrit, and Blood platelets. These results are contradictory to the results obtained in previous studies except for a study conducted on ewes of the Lacaune breed. Regarding the biochemical parameters, the variation was significant ($P<0.05$) for cholesterol, urea, and creatinine, but not significant for calcium, glucose and triglycerides ($P > 0.05$). The results obtained are debatable from the results quoted by several authors, except for creatinine which was found to be much higher.

Keywords: Ewes Rembi breed, peri-partum, hematology, biochemical profile

INTRODUCTION

The interpretation of the results of a blood analysis is based on the values of the normal physiological state of ewes (empty ewes, non-lactating), whereas the peri-partum represents a period when depression of the immune

system is directly related to physiological state of the animal (Da Silva et al., 2003 and Nieto et al., 2003), so the organism of the ewe undergoes many changes.

Peri-partum is a critical physiological stage due to hormonal changes that occur near lambing and during lacation (Gennari et al., 2002 and Sasa et al., 2008). This is why the physiological state of the ewes during this period is necessary to study.

It is therefore important to study the variations in the blood parameters of ewes during the peri-partum, to know the influence of the physiological stage on ewes.

Studies on our local breeds generally focusing on the Ouled djellal breed, we are interested in the Rembi breed to participate to the initiation to a possible identification of the Rembi breed, and to enriching the scientific knowledge about this sheep breed.

MATERIALS AND METHODS

This study was conducted at the ruminant station of the Technical Institute of Breeding of Baba-Ali in Algiers. The 7 ewes that were the subject of the study are of the Rembi breed, with an average age of 4 years, an average weight of 51 kg, and a body score of 3.

The ewes were synchronized by a protocol based on synthetic anovulatory steroids (40mg of FGA) followed on day 14 by an injection of 400IU of PMSG.

Blood samples were taken before gestation and during the peripartum over a period of two months, with intervals of 15 days between blood samples. (d-30, d-15, d0, d+15, d+30)

The samples were taken from the jugular vein in EDTA tubes for the blood count formula (FNS) and heparin tubes for the biochemical parameters, and the tubes were transported in a cooler to the laboratory to be centrifuged and frozen in Eppendorf tubes.

The analysis of the FNS was made by a complete blood count within one hour of the samples collection, and focused on the variations of the following blood parameters: red blood cells, white blood cells, blood platelets, hematocrit as well as hemoglobin.

The analysis of the mineral and biochemical parameters was carried out by an automated hematology device, CYANHemato model of the CYPRESS brand, and related to the following parameters: Calcium, urea, creatinine, glycaemia, triglycerides, and cholesterol.

The results were subjected to an analysis of variance using Bartlett test of homogeneity of variances, and a correlation analysis, both analysis using R

logicial, "Rcmdr " package to study the effect of the peripartum stage on the parameters considered.

RESULTS AND DISCUSSION

Variation in hematological parameters

According to Cardoso et al. (2010), hematological parameters change easily and rapidly during the peripartum.

The hematological parameters analyzed (Table 1) correspond to the normal values established by Kramer (2000) for white blood cells, lymphocytes, and blood platelets. There is a slight trend towards an increase in white blood cells and lymphocytes during prepartum, and à small continuous increase in blood platelets during the peripartum.

Concerning red blood cells, the values observed are below the lower limits of normal values for all stages of the peripartum, and follow a downward trend.

The results obtained for the hemoglobin as well as the hematocrit level correspond to the normal values, only for the D-30 stage before lambing, then from the D-15 stage to the postpartum stage, the hemoglobin values as well as hematocrit follow a downward trend, deviating from the limits of normal values.

Table 1. Hematological parameters observed during the peripartum in ewes of the Rembi breed

Parameters	**Values observed**				**Normal values ***
m ± s	**D-30**	**D-15**	**D+15**	**D+30**	
WB $x10^9$ /L	6.94±1.2	8.62±1.7	6.81±2	6.44±1.3	4-12
LYM $x10^9$ /L	3.06±1.2	3.89±1.4	2.70±1.3	2.93±0.5	2-9
RB $x10^{12}$ /L	8.73±2.5	7.23±2.4	6.46±2.6	6.66±2.1	9-15
HB g/dL	9.43±1.8	7.92±1.7	7.45±2	7.28±1.4	9-15
HT %	29.82±4.8	25.01±5.2	23.16±6.5	23.41±3.7	27 - 45
PLT $x10^9$ /L	248.33±132.7	265.33±1322	308.17±70.5	321.16±97.3	100 - 800

(WB): white blood cells, (LYM): lymphocytes, (RB): red blood cells, (Hb): Hemoglobin, (HT): Hematocrit (PLT): platelets, (m): mean, (s): standard deviation, (*) According to Kramer (2000)

According to the Bartlett test, Table 2 shows that the variation in white blood cells, lymphocytes, red blood cells, hemoglobin, hematocrits, and blood

platelets, is not less than the significance level of 0.05. This means the null hypothesis cannot be rejected that the variance is the same for all the stages.
These results are in contradiction with the results obtained by David et al. (2020) on a study conducted in Brazil on the Santa Ines sheep breed where the values of red blood cells and hemoglobin increased during pari-partum, and the values of white blood cells and lymphocytes decreased. These same results were observed in Egypt by Soliman (2014) on ewes of the Ossimi breed in Egypt and by Antunovic et al. (2011a) on ewes of the Tsigai breed.
On the other hand, no variation was detected for hematological parameters in ewes of the Lacaune breed during the stages of non-gestation, gestation, and lactation (Brito et al., 2006).

Table 2. Variations in haematological parameters during the peripartum in ewes of the Rembi according to Bartlett test

Parameters	P value
WB	0.6765
LYM	0.2134
RB	0.9675
HB	0.8987
HT	0.7012
PLT	0.5245

P: degree of significance (P<0.05)

Variation in mineral and biochemical parameters

Calcium

Calcium values of Rembi ewes (Table 3) did not vary significantly during the peri-partum (P>0.05). These variations are in contradiction with the results observed by Bouzenana (2015), where he reported that the calcium levels in pregnant ewes are lower than in lactating ewes.
The average values vary between 0.05 and 0.08 g/l. These values are consistent with the usual values, except for the d-30 stage where a minimum value of 0.05g/l was observed. According to Yokus et al. (2004), as well as Elnageeb and Abedalatif (2010) the decrease in serum calcium in ewes at the end of gestation would be due to the migration of calcium to the fetus for skeletal bone mineralization.
In lambing, there is a slight increase, the calcium level stabilizes around 0.08 g/L for the D+15 and D+30 stages. According to Mainoya (1975), prolactin is involved in calcium metabolism during lactation because this hormone increases the intestinal absorption of calcium.
Our results are in contradiction with those obtained in Brazil with ewes of the SANTA INES breed by David et *al.* (2020) revealed that calcium levels increase during gestation and then decrease during peak lactation, which could be related to lactation needs.

According to Gonzalez (2010), calcium would not be a good nutritional indicator, since this element is closely associated with metabolism during the peripartum period.

Table 3. Biochemical parameters observed during the peri-partum in ewes of the Rembi breed in comparison with the usual values and with the values obtained in the Ouled Djellal

Parameters m ± s (g/L)	Values observed					Common Values	Ouled Djelal peri-partum values
	D-30	D-15	D0	D+15	D+30		
Calcium	0.05±0.02	0.08±0.02	0.07±0.01	0.08±0.01	0.08±0.01	0.080-0.096[a]	0.060-066[g]
Urea	0.43±0.15	0.46±0.56	1.12±0.13	0.70±0.17	0.43±0.24	0.53[b]	0.29-0.32[h]
Creatinine	0.05±0.01	0.14±0.13	0.25±0.08	0.28±0.03	0.35±0.07	0.012-0.029 [c.d]	0.01-0.09[h]
Glycemia	0.58±0.12	0.82±0.26	0.76±0.1	0.74±0.2	0.69±0.11	0.41-0.76[d.e]	0.39-0.41[h]
Triglycerides	0.30±0.09	0.38±0.18	0.30±0.24	0.25±0.08	0.32±0.29	0.36[f]	0.34-0.35[h]
Cholesterol	0.68±0.13	0.71±0.26	0.59±0.12	0.61±0.15	0.61±0.09	0.51-0.75[d]	0.49-0.51[h]

(m): medium , (s): standard deviation, (a) : Antunovic et al.,(2004) , (b) : Ndoutamia.G et Ganda K,(2005) , (c) : Baumgartner W., Pernthaner A,(1994),(d) : Dubreuil P et al.,(2005),(e): Radostits O.M et al.,(2000), (f): Carlos, et al.,(2015), (g): Haffaf S et al.,(2013) (h): Deghnouche et al.,(2011).

Urea

Uremia values (Table 4) varied significantly in Rembi ewes during the peripartum ($P<0.05$). These results are in agreement with the results obtained by Deghnouche et al. (2011**)** in the Ouled Djellal breed, and by Antunovic (2002, 2004) where high values were observed during late gestation and early lactation.

Table 4. Variations in biochemical parameters during the peripartum in ewes of the Rembi according to Bartlett test

Parameters	P value	Significance
Calcium	0.4483	>0.05
Urea	0.002225	<0.05
Creatinine	0.000001131	<0.05
Glycemia	0.1384	>0.05
Triglycerides	0.01301	<0.05
Cholesterol	0.1213	>0.05

P: degree of significance ($P<0.05$)

Soliman (2014) through his study conducted in Egypt on the Ossimi breed, also observed significant differences in uraemia, with values at the end of gestation higher than those observed at the start of lactation. On the other hand, Meziane (2001) and Scott and Robinson (1976) did not observe any variation in uremia in ewes during gestation.

According to Friot and Calvet (1973), uraemia is subject to large fluctuations linked to the importance of the protein intake of the ration and especially to the protein efficiency in small ruminants, these variations could then influence the results obtained. When studying differences in the physiological stages of females.

The average values obtained in the Rembi breed (table 3) vary between 0.43 and 1.12 g/l. The minimum value is observed at the D-30 stage as well as at the D+30 stage. A peak in uraemia is observed on the day of lambing when the urea level reaches 1.12 g/L, thus exceeding the values observed by the authors cited above. This peak during parturition was also reported by El Sherif and Assad (2001) and Durak and Altinek (2006), respectively, for the Barki and Chios breeds. According to Piccione et *al.* (2009), the increase in serum urea levels in pregnant ewes is due to their high energy requirements.

Creatinine

Mean creatinine values in Rembi (Tables 3 and 4) varied significantly during the different stages of the peripartum. ($P<0.05$).

These results are in contradiction with the results obtained on Santa Inés ewes in Brazil by David et al. (2020) who report that the variation in creatinine is not linked to different physiological stages. Soliman (2014) also reported that there was no significant difference in creatinine concentrations during his study. The minimum value is observed at the end of gestation, at the D-30 stage. The creatinine level follows an increasing curve during the peripartum to reach 0.35g/l at stage D+30. The creatinine concentration follows the opposite trend of what has been reported by several authors (El Sherif and Assad, 2001; Meziane, 2001; Deghnouche et al., 2011). According to these authors, the creatinine of pregnant ewes is higher than that of empty ewes. These differences would be the result of the intensification of thyroid activity during gestation (El Sherif and Assad, 2001). A study conducted in Cameroon by Obidike et al. (2009) revealed a significant increase in creatinine during the peripartum.

The values observed in the Rembi ewes are well above the usual values as well as the values obtained in the Ouled Djellal breed by Deghnouche et al. (2011).

High creatinine values could result from increased muscle mass, according to Caldeira et al. (2007) and Piccione et al. (2009), the amount of

creatinine formed each day depends on the body's creatine content which in turn depends on food intake, the creatine synthesis rate and muscle mass.

Glycemia

The variations in glycaemia during the peri-departum were not significant (P>0.05). These results are in disagreement with Deghnouche et al. (2011) on the Ouled Djellal breed as well as with Hamadeh et al. (1996).

The average values observed vary between 0.58 and 0.82 g/l (table 3). These values are comparable to the higher limits of the usual values. These high values could be the result of an energy-rich diet during the experiment. Similar results were observed on the Ouled Djellal breed by Bounab (2016). The minimum value is observed at the D-30 stage. This value increases rapidly to 0.82g/L at the end of gestation. According to Borjesson et al. (2000), the concentration of glucose in ruminants is easily altered by stress and excitement due to the release of catecholamines. There is a downward trend in blood sugar at the end of gestation and the beginning of lactation, the decrease in glucose is due to its mobilization for the synthesis of lactose during lactation (Roubies et al. 2006; Antanovic et al. 2011b and Gonzalèz-Gracia et al. 2015), which contradicts Sobeich et al. (2008), who report that glucose levels increase due to a decrease in the tissue response to insulin during lactation.

Triglycerides

Mean triglyceride values (Tables 3 and 4) varied significantly during the peripartum (P <0.05). These results are in contradiction with the results obtained on the Ouled Djellal breed in the study conducted by Lamraoui et al. (2016), and Deghnouche et al. (2011) where the concentration of triglycerides increased significantly.

The values observed in the Rembi ewes are in agreement with the usual values and are close to the results obtained by the Ouled Djellal breed. The minimum value is observed at D+15 after lambing, and the maximum value at the end of gestation. High triglycerides at the end of gestation have been observed by Hamadeh et al. (1996).

Our results are in agreement with those of Gonzalez-Garcia et al. (2015), who reported that the plasma concentration of triglycerides drops sharply after lambing, thereafter its level remains stable and increases at the end of lactation. Nazifi et al. (2002) observed a significant decrease in serum triglycerides at the start of lactation, and that the minimum values were observed during the 2nd and 3rd week after lambing. This decrease would be the result of the effect of the decrease in lipogenesis and the increase in lipolysis at the level of the mammary gland (Holtenius and Hjort, 1990).

Cholesterol

Variations in the cholesterol level of Rembi ewes during the peripartum (tables 3 and 4) were not significant (P>0.05), David et al. (2020) reported a small variation in cholesterolemia in their study with low values during the peripartum and at the end of lactation. The values observed are in agreement with the usual values and are close to the results obtained for the Ouled Djellal breed by Deghnouche et al. (2011). The average values observed vary between 0.59 and 0.71 g/l. The minimum value is observed on the day of lambing, and the maximum value at the end of gestation on D-15. After lambing, the values are stable around 0.61g/L. There is a drop in cholesterol levels during the last two weeks of gestation. This drop in cholesterolemia at the end of gestation has also been reported by several authors such as Piccione et al. (2009) and E.B. Soliman (2014). According to Peixto et al. (2010), the formation of steroid hormones during gestation causes part of the reabsorption of cholesterol in the blood, decreasing its level at this stage. Similarly, Sejian et al. (2010) report that the increase in cholesterolemia in the mother is due to the rapid growth of the fetus during the last third of gestation, which leads to hyperactivity of its thyroid and at the same time to maternal hypothyroidism.

Correlation Analysis

In order to calculates the level of change in the biochemical parameters of the ewes during the peri-partum due to the change in the day of blood collection, the age of the ewes, their weights and their body scores and the type of gestation (double or simple), a correlation analysis was performed. The results are reported in the following matrix.

Table 5. Correlation matrix between the biochemical parameters of Rembi ewes during the peri-partum and the day of blood collection, the age of the ewes, their weights and their body scores and the type of gestation

	Age	**W**	**B.S**	**T.G**	**D.B.C**	**Ca**	**Ur**	**Crea**	**Gly**	**TriG**	**Chol**
Age	1										
W	0.88	1									
B.S	0.54	0.54	1								
T.G	0.61	0.39	0.28	1							
D.B.C	0.02	0.01	0.04	0.01	1						
Ca	-0.22	-0.11	0.09	-0.09	0.42	1					
Ur	-0.04	-0.05	-0.06	-0.06	0.08	-0.23	1				
Crea	-0.04	-0.08	0	-0.04	0.82	0.28	0.28	1			
Gly	-0.12	-0.09	-0.19	-0.06	0.12	0.32	0.18	0.32	1		
TriG	-0.3	-0.42	-0.27	-0.37	-0.05	0	0.02	0.21	0.23	1	
Chol	-0.21	-0.13	0	-0.34	-0.21	-0.16	-0.11	0	0.05	0.25	1

(w) : Weight of the ewes , (B.S) : Body score , (T.G) : Type of gestation , (D.B.C) : Day of blood collection , (Ca) : Calcium , (Ur): Urea , (Crea) : Creatinine , (Gly) : Glycemia , (TriG) : Triglycerides , (Chol): Cholesterol.

Table 5 shows that the weight of the ewes, their body scores, and the type of gestation are positively and significantly correlated with the age of the ewes. Their coefficient of correlation are respectively r= 0.88, r= 0.54 , r= 0.61.

Apart from creatinine, none of the biochemical parameter levels are correlated with the day of blood collection, nor with the age of the ewes, their weights, their body condition scores or the type of pregnancy.

The average creatinine level is strongly correlated (r= 0.82) on the day of blood collection, ie at the peri-partum stage. Indeed, as mentioned above mean creatinine values in Rembi varied significantly during the different stages of the peripartum. ($P<0.05$).

These variations in serum creatinine during gestation and lactation could result from a dietary protein deficit (Valtonen et al., 1982) or an intensification of thyroid activity during gestation (El Sherif and Assad, 2001), resulting in an amplification of muscle protein catabolism and a production increased creatinine. (Deghnouche et al., 2011).

CONCLUSION

The results of our study indicate that the hematological and biochemical parameters obtained from the Rembi breed are debatable from the values quoted in the literature, except for creatinine which is much too high. These results revealed that physiological changes during the peripartum were typically more biochemical than hematological. Serum concentrations of urea, creatinine, and triglycerides varied significantly according to the physiological stage of Rembi ewes.

However, this study remains a preliminary study regarding the hematological and biochemical profile of the Rembi breed. Additional work with larger numbers with larger numbers is to be carried out to be able to establish reference values in Rembi breed ewes.

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