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Hematological and Blood Biochemistry Parameters of the Mexican Sheep Kimichin

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Abstract: This research aimed to make a hematological and biochemical characterization of 30 adult sheep Kimichin of Puebla Mexico, belonging to 17 rurals farms. Blood counts of red and white series, complemented by a biochemical profile were made; the data were analyzed in the statistical program SAS 1999. The red series (erythrocytes) showed values of 5.6×10^{6} L^{-1}, makes white 91.2×10^{6} L^{-1}; 48% lymphocytes, platelets $\times10^{3}$ 0.62 L^{-1} and 60 mg cholesterol dL^{-1}. The values of the parameters studied are close to those recorded for other sheep, determined by management and poor health keep quality of this local sheep.

Key words: CBC sheep, native sheep, sheep blood, sheep hematology, statistical program

INTRODUCTION

The genetic resources available to the animal kingdom are more varied than you can imagine; this living matter put in the hands of man has been respected during the course of the centuries but the growing impact of human activities in the nature is causing a loss of biodiversity in an accelerated manner in recent years (Garcia and Cuenca, 2007). For Tamargo the biological variety is the key to the maintenance of life as we know it, being a fundamental aspect the conservation of small populations (Garcia and Cuenca, 2007). According Ojasti (1993) each species is product of a great evolution and retains an intrinsic value by their unique features, in addition as a whole are part of the natural heritage at national and universal level.

According to the FAO in 1995 was calculated that 4,000-5,000 animal genetic resources existing in the world, were in danger of disappearing which means between 1,200-1,500 species. FAO (1998) estimatedthat 30% of domestic cattle breadswere in danger of extinction, disappearing each month one of six races in the world and that more than half of these were lost in the underdeveloped countries. The foregoing leads us to consider that the extinction of the races is a big concern, coupled with genetic resources without information are being lost before studying their characteristics and evaluate their productive potential (FAO, 2007).

A race can be considered threatened when suffers some type of pressure that modify or affect their likelihood to continue to exist indefinitely or to maintain a number of individuals insufficient to preserve their genetic characteristics that distinguish them from other populations (Vallecillo, 2011). The conservation and sustainable use of animal genetic resources as a means of preservation of biodiversity has become during the past 15 years in a topic of the utmost importance (Hodges, 2002) this is due to its economic importance, scientific and cultural (Vallecillo *et al*., 2011). To Schert the conservation of animal genetic resources is the implementation of all necessary measures to ensure the proper management there of to thus be able to use the maximum time possible and to provide benefits for future generations; all as a preventive measure to premature extinction of different races. To that end, have been developed different programs that involve the in situ and ex situ conservation; the second term implies the maintenance of live animals away from their natural environment or the conservation of way germinal that in the future enables regeneration of an individual or a population (Hammond and Leitch, 1996). *Ex situ* conservation is considered as an essential activity and is complementary to the *in situ* preservation of genetic resources farm animals (FAO, 2011).

Currently attends a lot of information on hematological characterizations of sheep in the world. However, there is still lags of information with respect to

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the topic in question to Rodriguez *et al.* (2011) consider important the hematological characterization for making observations in animals clinically healthy that have not been studied and in this way increase the number of data obtained in other parts of the world. So, also Soch *et al.* (2011) determines that the sampling in blood is an important tool for diagnosis, to help identify the physiological responses of an animal; through the clinical analysis can be known about health, well being and nutritional status. Also allows exploring the evolution of the flock through the analysis of the different parameters hematic (Rodriguez *et al.*, 2011). Avellanet *et al.* (2007) considers that the study and characterization of the hematological and biochemical variables are interesting per se in the context of the knowledge of the races, it is also important to define the average parameters of each. Ramirez *et al.* (1998) considers that the parameters of concentration of erythrocytes in million/mm^3, cell volume briquette (%) and the concentration of Hemoglobin (Hb) g/100 mL, are important criteria to calculate the absolute hematimetric indices or indexes Wintrobe. These indices, called Mean Corpuscular Volume (MCV) Mean Corpuscular Hemoglobin (CHbCM) are used for the morphological classification of anemia's and are of great importance in veterinary medicine. Ndoutamia and Ganda (2005) considered that the clinical hematology constitutes an important area of study on the animals state of health. While, Couto says that the study of the hematological variables and its deviations allows to know the anomalies that can affect the different organs of the animal body. This considering that the variations in the physiological state of the animals have an impact on the hematological boxes.

The intensity of the immune response is linked to productive parameters, such as the reproductive efficiency, the shearing of the sheep and the milk, in addition the effects on blood parameters as the MCV chipboard (VCA) or Hematocrit (Hto), Concentration of Hemoglobin (Hb) Mean Corpuscular Hemoglobin (MCH) are indicators of quality and animal welfare (Azab and Abdel-Maksoud, 1999; Cuperlovic *et al.*, 1978; Dally *et al.*, 1980).

It has been reported that the food, stress, pregnancy, birth, lactation, age, race, the breeding system and climatic factors influence the blood values of goats and sheep (Mbassa and Poulsen, 1991). Viana *et al.* (2003) highlighted the existence of certain factors, possibly related to the nutritional management of goats that could be responsible for the recovery of the values of hemogramas during the puerperium. Given the increasing demand for meat products of sheep, it is necessary to know in depth the reference values of the main parameters from the blood and biochemical vessels; both crucial for a good technical management of the exploitation, as well as health and have the ability to diagnose conditions present or latent.

The genetic resources of indigenous animals are the basis of the modern livestock, to be the source from which depends the breeders to obtain improved varieties and breeds that provide quality products; contribute to maintain systems of exploitation respectful with the environment and to preserve the traditions, at the same time that allows to respond to the new demands of society to promote development and to meet human needs. That is why, Garcia considers that constitute an example of the multifunctionality of agricultural activity and its strategic value must be used and maintained by future generations. For this reason, the characterization of livestock breeds must be pursued in the first instance, the greatest possible profit through the obtaining of animals, semen, ova or embryos of high genetic value and on the other hand, the exploitation of the advantages that they can exercise both in the field of environmental preservation such as services and social benefits to the dependent population.

As mentioned above the present work can contribute to the study on the hematic and biochemical values in sheep Kimichin through the realization of a hemogram and blood chemistry to set values of bibliographic reference. This considering that there are no data concerning this animal in any part of the world, therefore, this research will contribute to the generation of information of the local sheep preserved by indigenous communities in Puebla, Mexico.

MATERIALS AND METHODS

To perform the haematological analysis and clinical biochemistry, blood samples were collected from 30 sheep Kimichin adults (>3 years) with complete dentition, belonging to 17 farms located in the municipalities of Tetela de Ocampo, Zacatlan, Cuautempan and Tepetzintla, all of them of the northern sierra of the State of Puebla, Mexico. The Sierra Norte is a mountainous area that has an approximate length of 100 km and up to 50 km wide; the climates between municipalities differ from a temperate climate humid in Tepetzintla and Tetela de Ocampo and a temperate climate that is the one that presents Zacatlán (INEGI, 2010).

Blood extractions: The blood samples of the studied animals were obtained from the jugular vein as recommended by Gregg using vacuum tubes vacutainer of 4 and 9 mL with anticoagulant EDTA.

Table 1: Biochemical parameters

Parameters	Unit*	Parameters	Unit
Aspartate aminotransferase (AST)	U L^{-1}	Uric acid	mg dL^{-1}
Lactate Dehydrogenase (LDH)	U L^{-1}	Albumin (ALB)	g dL^{-1}
Gamma Glutamyl Transferase (GGT)	U L^{-1}	Total protein	mg dL^{-1}
Cholesterol (COL)	mg dL^{-1}	Total bilirubin	mg dL^{-1}
Triglycerides (TG)	mg dL^{-1}	Direct bilirubin	mg dL^{-1}
Creatinine (CREA)	mg dL^{-1}	Alkaline phosphatase	mg dL^{-1}
Urea	mg dL^{-1}	Glucose	mg dL^{-1}

*U/L Units per Liter; mg dL^{-1} = milligrams per deciliter; g dL^{-1} grams per deciliter

Acid Methyl in Diamine Tetra Acetic and gel promoter of the coagulation with silicon. Each animal was apparently healthy and was immobilised for a short period of time in order to be able to perform the extraction of blood. The collected samples were processed in the Laboratory of Analysis of the Faculty of Veterinary Medicine (BUAP) but the minimum possible time (<24 h) between the date of collection and analysis of the samples which were transported with a temperature >10° C.

Hematological parameters

Erythrocyte series:

- Erythrocytes (ERI) ($\times 10^6 \mu L^{-1}$)
- Hemoglobin (HEM) (g dL^{-1})
- Volume of Hematocrit (HEV) (%)

Erythrocyte index:

- Mean Corpuscular Volume (MCV) (fL)
- Mean Corpuscular Hemoglobin Concentration (CCMH) (g dL^{-1})
- Mean Corpuscular Hemoglobin (MCH) (pg)

Leukocyte series:

- Leukocytes (LEU) (10^3 μL^{-1})
- Lymphocytes (LIN) (10^3 μL^{-1})
- Monocytes (MON) (10^3 μL^{-1})
- Segmented Neutrophils (NESE) (10^3 μL^{-1})
- Eosinophils (Eos) (10^3 μL^{-1})
- Basophils (Bas) (110^3 μL^{-1})
- Platelets (PLAQ) (10^5 μL^{-1})

Hemogram: The count of items in the red formula (erythrocytes, hemoglobin, hematocrit, globular volume means, globular hemoglobin average, average concentration of hemoglobin globular and distribution rate of red blood cells) and the corresponding to the white formula (leukocytes, neutrophils totals, segmented neutrophils, in-band neutrophils, lymphocytes, basophils and eosinophils and monocytes) as well as the platelet count were performed by the hematologic automated computer HEMA X MAX® that works under the method of electrical impedance.

Biochemistry and analytical technique: The biochemical parameters analyzed (Table 1) of blood samples of 30 sheep Kimichin adults were examined by an autoanalyzer SPINLAB®. The autoanalyzer consists in a spectrophotometer of discontinuous flow that analyzes the samples individually, through a system of centrifugation which mixes the reactive with the sample.

Statistical analysis: All parameters, both haematological and biochemical were analyzed using descriptive statistics with the statistical package SAS, estimating their mean, standard deviation, the coefficient of variation, the minimum and the maximum.

RESULTS AND DISCUSSION

The average values of the red and white formula, respectively of adult animals Kimichin, show differences with sheep of different race obtained in several other investigations. For erythrocytes (Table 2) the average obtained was 5.68×10^6 L^{-1}, 8.73 g dL^{-1} of hemoglobin and a 24.5% of the value of the hematocrit were lower than those reported by Avellanet (2006) where the average for the sheep of the breed Xisqueta was 8.30×106 L^{-1}, 11.27 g dL^{-1} and 27.5%, respectively. Ramirez *et al.* (1998) presents values of 7.68×106 L^{-1} for the erythrocytes and 9.2 g dL^{-1} for the Hemoglobin (Hb) for sheep without defined breed, Prieto (1987) obtains values of 8.57×10^6 L^{-1} for the erythrocytes and 29.20% for the hematocrit in breed Xisqueta.

This may be due to various factors such as: The stress that may suffer the animal at the time of the sampling differences according to the physiological status because these values are reduced in pregnancy or the initiation of breast (Valle *et al.*, 1983; Kappel *et al.*, 1984) in the case of ovine Kimichin, despite being very docile animals are not accustomed to be traumatized for the removal of blood and neither to the management by persons outside the exploitation, the mating regularly is not controlled and we do not discriminate by gestational state; it is important to consider that lower values of erythrocytes may also lead us to a diagnosis of anemias.

Table 2: Blood values of reference for the red formula in sheep Kimichin

Variables	No. of observations	Mean	SE	Max.	Min.	CV
ERIT (10^6 L^{-1})	30	5.687	0.2570	7.5	3.04	24.753
HEMOG (g dL^{-1})	30	8.733	0.3547	11.2	4.10	22.247
HEMAT (%)	30	24.520	0.9436	30.7	13.00	21.077

Table 3: Descriptive statistical analysis of the indexes in sheep Kimichin hematimetric

Variables	No. of observation	Mean	SE	Max.	Min.	CV
HCM (g dL^{-1})	30	38.433	0.8152	44.6	29.0	11.617
VCM (fL)	30	39.380	0.3216	43.1	36.8	4.474
CCMH (pg)	30	15.000	0.2591	17.2	12.1	9.461

The decrease of the hemoglobin could be attributed to the hemodilution resulting from the increase in the plasma volume which may have a physiological importance due to the reduction of the blood viscosity; this increases the flow of blood to the small blood vessels (Guyton *et al*., 2006). Mbassa and Poulsen (1991) indicate that foraging, stress, the breeding system and climatic factors influence the blood values of sheep and goats.

In this sense Moreno disclose the utility of hematocrit method for estimating the degree of anemia independent of alterations in size, in shape and thickness of erythrocytes also describes the utility value of the concentration of hemoglobin to determine anemic syndromes in goats. For the hematocrit, Dooleya and Williams (1975) commented that have been detected diurnal variations related to food. So also may vary according to the breed (Vallejo *et al*., 1975) the nutritional status health and environmental conditions (Rowlands *et al*., 1979) and even are reports of differences between individuals of the same species and race.

In which corresponds to the erythrocytic indices as the Mean Corpuscular Volume (MCV) the Mean Corpuscular Hemoglobin (MCH) and the Mean Corpuscular Hemoglobin Concentration (CCMH) (Table 3) were 39.38±3.1 fL, 38.43±7.8 g dL^{-1} and 15.0±2.0 pg, respectively. These values are greater than those reported by Avellanet *et al.* (2007) who report values of 33.31±2.73 fL, 32.73±2.20 g dL^{-1} and 13.69±3.28 pg for the same rates.

The data presented by Ramirez *et al.* (1998) show a higher value in sheep with defined breed with regard to VCM to be 42.0 fL but lower for HCM 30.0 g dL^{-1} and the CCMH with 13.0 pg. Fasano and Micheli (1982) reports values in races not defined for VCM from 41-44.6 fL HCM of 31.4-33.4 g dL^{-1} and for CCMH 13.1-15.2 pg. As regards to the white formula, values are shown in Table 4 where we can observe that the concentrations of leukocytes are elevated with respect to values submitted by other sheep studied by Avellanet (2006).

The presence of neutrophils in the leukocyte formula can indicate certain bacterial infectious problems clinicallythis increase of young cells receives the name of deviation to the left because is fighting an acute inflammatory process. The increased value of the eosinophils could also indicate that these cells are present to counteract the effects of some inflammation. The eosinophilia or increase in eosinophils occurs when there is organic decomposition of protein which indicates a function antitoxic. In the case concerning the sheep Kimichin, the concentration of white blood cells found may be due to the enormous resistance that they have to the parasitosis or resistance to other diseases of respiratory type. The samples were taken in February, winter month when the weather is cold in most of northern Puebla, many lambs had nasal runoff caused by these sudden changes in temperature which at the same time causes stress generating with it an increase of white blood cells that are available to protect the animal organism.

The average value of the platelets concentration was 0.620×10^5 L^{-1}, the thrombocyte of sheep Kimichin is within the range reported in other sheep and very close to what is reported in the sheep Xisqueta (Avellanet, 2006). These results can be directly influenced by the type of sheep as well as the analytical methods, the number of animals studied, the supply type, age, handling conditions, the time of year, race, etc. The average concentration of total protein presented similar data to those found in the literature and coincide with those of Avellanet *et al*. (2007) it is important to mention that the total protein is also influenced by different factors between which it emphasizes the stress at the time of the sampling (Gohary and Bickhardt, 1979). Likewise, total protein also increases in relation to age (Green *et al*., 1982; Sawadogo and Thouvenot, 1987) therefore, the value of total protein can be considered within the ranges for sheep. In addition, you can observe the average values for lipids where cholesterol presented a concentration of 60.07 mg dL^{-1} and triglycerides 70.07 mg dL^{-1} (Table 5) these values are greater than those reported by Avellanet *et al*. (2007) but are within the ranges reported by Gomes that present values ranging from 60-150 mg dL^{-1}.

There are many factors that can influence the concentration of cholesterol and triglycerides as the gestation (Rawal *et al*., 1987) lactation (Kappel *et al*.,

Table 4: Values of the white formula in sheep Kimichin

Variables (%)	No. of observations	Mean	SE	Max.	Min.	CV
LEUC (10^6 L^{-1})	30	91.267	6.0474	143.10	34.2	36.292
LINF	30	48.667	1.8994	65.00	32.0	21.377
EOSI	30	1.800	0.5996	10.00	0.0	182458
MONOC	30	0.467	0.1642	3.00	0.0	192761
BASOF	30	0.467	0.1642	3.00	0.0	192761
BASSEG	30	47.733	2.2959	67.00	20.0	26.344
BASSEGB	30	0.600	0.1894	3.00	0.0	172873
NEUTOT	30	48.600	2.3565	67.00	20.0	26.558
RDW	30	20.613	5.4872	131.10	11.3	145802

Table 5: Platelet values of the sheep Kimichin

Variables	No. of observations	Mean	SE	Max.	Min.	CV
PLAQ (10^3 L^{-1})	30	0.62	41.3200	799	175.0	44.708
PROTO	30	7.06	0.3001	11	4.1	23.270
COLES (mg dL^{-1})	30	60.07	2.6587	84	38.0	24.240
TRGLES (mg dL^{-1})	30	72.07	4.6577	134	45.0	35.400

Table 6: Concentration of metabolites in sheep Kimichin

Variables	No. of observations	Mean	SE	Max.	Min.	CV
CREAT	30	0.76	0.0390	1.02	0.41	28.05
UREA (mg dL^{-1})	30	32.40	1.9509	55.00	20.00	32.98
BILIRR (mg dL^{-1})	30	0.54	0.0243	0.80	0.40	24.61
BILIRD (mg dL^{-1})	30	0.15	0.0112	0.30	0.10	41.06
AUR (mg dL^{-1})	30	0.78	0.0648	1.39	0.21	45.40
ALBU	30	3.03	0.1389	5.50	2.03	25.13
GLUC	30	59.80	1.5074	72.00	45.00	13.81

1984) the age (Sawadogo and Thouvenot, 1987) the feeding (Gaal *et al*., 1993) and seasonality, since the cholesterol increases in the winter (Cotrut *et al*., 1978).

The values of the creatinine 0.76 mg dL^{-1}, direct bilirubin 0.15 mg dL^{-1} and the total 0.54 mg dL^{-1} as well as urea 32.4 mg dL^{-1} are slightly lower than those reported by other authors such as Ramos *et al*. (1993) and Avellanet *et al*. (2007). In the case of the albumin, the concentration found in Kimichin sheep was 3.02 g dL^{-1}, a concentration very similar to the one found by Avellanet *et al*. (2007) who reports values of 3.48 g dL^{-1} and Ramos *et al*. (1993) with 3.52 g dL^{-1}. For the case of glucose (Table 6) the concentration found in sheep Kimichin was 0.59 g dL^{-1} for this variable, we did not find literature in order to make a comparative analysis however, glucose was slightly low this is probably to the animals were in fasting at the time of the sampling. The Kimichin sheep eat only during the grazing in the afternoon are not supplemented in any form, presenting more of 14 h of starvation or fasting.

It is important to remember that the results may vary depending on different factors such as the method of analysis (Trumel *et al*., 2005) the TGP increases when the conditions of handling of the animals are not good (Meli *et al*., 1984). The lactate dehydrogenase presented higher concentration to that reported by Saez *et al*. (1996) in sheep of the Aragonese and Ojalada race. This is probably due to the Kimichin sheep may present a greater physical wear and increased stress at the time of sampling.

CONCLUSION

The present resaerch exposes the obtaining of the main blood parameters and biochemical for the local Kimichin sheep of the Northern Sierra of Puebla-Mexico, as first reference of parameters indicative of hematology and blood biochemistry. Put the most relevant of all parameters like this in the summary besides because they the sheep are anaemic by the management or something similar highlights the rural conditions and livelihood for the sheep.

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