VETERINARY RESEARCH INTERNATIONAL
Journal homepage: www.jakraya.com/journal/vri

ORIGINAL ARTICLE

Hematological Characteristics of '*Djallonke*' Sheep Reared at Ejura Sheep Breeding Station of Ghana

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Received: 08/09/2016

Accepted: 17/09/2016

Abstract

Hematological characteristics of sheep as examined in this study are essential for determining their immunity and survival. It also gives an indication of the physiological, nutritional and pathological status of the 'Djallonke' sheep. This study was conducted to determine the haematological characteristics of various sheep types reared at the Ejura Sheep Breeding Station of Ghana. The sheep types examined were lactating ewes, non-lactating ewes and rams. They were examined between the period of May 2015 - July 2015. The sheep were reared under the intensive system and were fed on the same diet. Haematological analysis showed that there were no significant differences in the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) among the sheep types examined. Total red blood cell (RBC) and packed cell volume (PCV) of non-lactating ewes were significantly higher ($P<0.05$) than that of lactating ewes and rams. Total white blood cell (WBC) of rams (12.56 $x10^3/\mu l$) and lactating ewes (12.02 $x10^3/\mu l$) were significantly higher ($P<0.05$) than non-lactating ewes (9.69 $x10^3/\mu l$). Haemoglobin (Hb) of non-lactating ewes (11.66 g/dl) and rams (11.37 g/dl) was significantly higher than lactating ewes (9.63 g/dl). The hematological parameters of the sheep examined were generally within the recommended range. Therefore, livestock farmers in Ghana can obtain healthy breeding and production sheep breeds from the Ejura Sheep Breeding Station.

Keywords: '*Djallonke*' sheep, Ewe, Haematological characteristics, Ram.

1. Introduction

The livestock industry in Ghana consists of the ruminant and non-ruminant sector. Ruminants reared in Ghana include sheep, goat and cattle. Sheep play an important role in the agricultural economy of Ghana (Adzitey, 2013). In 2014, it was reported that Ghana produced 4,335,000 live sheep (Food and Agriculture Organization (FAO), 2015). Mutton production was 254,712 tonnes in 2013 (FAO, 2015). Sheep production in Ghana increased each year between the periods of 2000 to 2014, and within the same period mutton production increased except in 2008 to 2009 where there was a decline from 220, 243 tonnes to 216, 614 tonnes (FAO, 2015). The breeds of sheep kept mainly in Ghana are the '*Djallonke*', Sahel, Nungua black head and their crosses. The '*Djallonke*' sheep, also known as the West African Dwarf, sheep is believed to have originated from western Asia, and entered Africa through the Isthmus of Suez and Bab el Mandeb (Animal Genetic Training Resource (AGTR), 2015). '*Djallonke*' sheep are white or tan in colour but usually spotted black or red colours and black belly (AGTR, 2015). This breed is small because it has a wither height of between 40-60cm and a body weight of 20-30kg (Domestic Animal Genetic Resources Information System (DAGRIS), 2005). The breed is also noted for their adaptation to the tropical hot and humid environment of West Africa, and is considered tolerant to trypanosomosis infections (Osaer, 2000; DAGRIS, 2005).

Haematology has been defined as the study of the numbers and morphology of the cellular elements of the blood that is the red cells (erythrocyte), white cells (leucocytes), and the platelets (thrombocytes) and

the use of these results in the diagnosis and monitoring of diseases (Etim *et al.,* 2013). Haematological characteristics are important for knowing the physiology and health status of sheep and other animals (Milne and Scott, 2006; Kral and Suchy, 2007; Etim *et al*., 2013). Amakiri *et al.* (2009) reported that detailed examination of the blood of animals ease the determination of the current health status of animals. The Ejura Sheep Breeding Station was established in 1965 in Bonyon, Ejura (Ministry of Food and Agriculture, Ghana (MOFA), 2016a). It is a livestock farm under the Animal Production Department of the Ministry of Food and Agriculture, Ghana. The mandate of the farm is to produce and supply genetically superior and tested progeny of the '*Djallonke*' sheep to farmers in Ghana (MOFA, 2016a). The main objective of the farm is to serve as a "Nucleus Center" for breed improvement of the '*Djallonke*' sheep in the country (MOFA, 2016a). In order to have a general idea about the health, nutritional and physiological status of lactating ewes, non-lactating ewes and rams kept in the Ejura Sheep Breeding Station we evaluated the blood of these sheep for certain haematological characteristics.

2. Materials and Methods

2.1 Study Area

The study was conducted on sheep obtained from the Ejura Sheep Breeding Station, Ejura, Ghana. Ejura is located within longitudes 1˚5'W and 1˚39'W and latitudes 7˚9'N and 7˚36'N (Anonymous, 2006). Ejura has a tropical climate, lies within the transitional zones of the semi-deciduous, and has bimodal rainfall characterized by an annual rainfall of between 1,200 mm - 1,500 mm (MOFA, 2016b). Average ambient temperature is 26.1°C with a mean monthly of 21°C - 30°C (MOFA, 2016b). Relative humidity ranged from 55-90% (MOFA, 2016b).

2.2 Collection and Methods of Blood Analyses

Whole blood samples were collected from the jugular vein of lactating ewes, that is less than 1 month lactation period (n=18), non-lactating ewes (n=18) and rams (n=17) into EDTA anticoagulated tubes. These tubes were transported under 4°C to the Ashanti Regional Veterinary Diagnostic Laboratory in Kumasi for hematological analyses. White blood cell (WBC), red blood cell (RBC), packed cell volume (PCV), haemoglobin (HB) were determined by following the procedures in Coles (1986). Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated according to Jain (1986).

2.3 Data Analysis

Data obtained was analyzed using Analysis of Variance (ANOVA) of the Genstat Edition 4. Means were separated at 5% significant level.

3. Results and Discussions

The results for the hematological characteristics of sheep reared in the Ejura Sheep Breeding Station are presented in Table 1. There was no statistical difference ($P > 0.05$) in the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC). However, there were statistical differences ($P < 0.05$) in the white blood cell (WBC), red blood cell (RBC), packed cell volume (PCV), and haemoglobin concentration (Hb) of the sheep examined. The RBC of non-lactating ewes ($8.63x10^6$/µl) was significantly higher ($P < 0.05$) than the lactating ewes ($6.89x10^6$/µl) and rams ($6.93x10^6$/µl). The PCV of non-lactating ewes (31.93%) was also significantly higher ($P < 0.05$) than that of the lactating ewes (23.79%) and rams (23.79%). However, the WBC of the lactating ewes (12.02 $x10^3$/µl) and rams (12.56 $x10^3$/µl) were significantly higher ($P < 0.05$) than that of the non-lactating ewes ($9.69x10^3$/µl). The Hb levels were significantly higher ($P < 0.05$) in non-lactating ewes (11.66g/dl) and rams (11.37g/dl) than the lactating ewes (9.63g/dl).

Addass *et al.* (2010) reported Hb, PCV, WBC, RBC, MCV, MCH and MCHC to be 45.43±1.34g/dl, 29.59±1.03%, 13.61±0.23$x10^{12}$/L, 22.06±0.68 $x10^{12}$/L, 2.98±0.52fl, 2.20±0.14pg, 18.97±2.31g/dl, respectively for the 'Djallonke' sheep in Nigeria. The Hb values were lower in this study compared to that of Addass *et al.* (2010). Another study in Nigeria comparing the hematological characteristics of '*Djallonke*' sheep kept under intensive and extensive systems reported RBC ($x10^6$/µl) of 8.17±1.28 and 7.92±0.8, WBC ($x10^3$/ul) of 15.54±3.76 and 15.35±1.69, PCV (%) of 24.9±1.95 and 20.15±2.59, Hb (g/dl) of 7.38 ± 1.90 6.19±1.70, MCV (fl) of 31.71± 8.90 and 25.02± 5.36, MCH (pg) of 8.87±2.61 and 7.92±1.85, and MCHC (g/dl) of 30.20±11.12 and 30.99±5.85 (Olayemi *et al.*, 2000). The WBC values obtained in this study were lower than the values obtained by Olayemi *et al.* (2000), however, Hb, MCV, MCH and, MCHC values reported in this study were higher. The RBC values in both studies were similar. The normal hematological values for sheep have been reported to be 24-45% for PCV, 8-16g/dl for Hb, 23-48fl for MCV, 8-12pg for MCH, 31-38g/dl for MCHC, and 4-12 $x10^3/mm^3$ for WBC (Research Animal Resources, 2009) and 8.9-9.$3x10^6$/µl for RBC (Jawasreh *et al*., 2009). The PCV, WBC, Hb and MCV, values obtained in this study were within the

Table 1: Hematological parameters of sheep at Ejura Sheep Breeding Station

Blood Parameter	Sheep type				
	Lactating ewes	Non-lactating ewes	Rams	SEM	P-value
RBC($x10^6$/µl)	6.89^b	8.63^a	6.93^b	0.536	0.002
PCV (%)	23.79^b	31.93^a	23.79^b	2.008	0.001
WBC($x10^3$/µl)	12.02^a	9.69^b	12.56^a	0.965	0.010
Hb (g/dl)	9.63^b	11.66^a	11.37^a	0.801	0.029
MCV (fl)	36.33	37.00	35.95	0.833	0.448
MCH (pg)	14.26	14.11	16.11	1.279	0.236
MCHC(g/dl)	39.36	38.13	44.66	3.331	0.129

Means within the same row with different supers are significantly different (P < 0.05)

normal reported ranges, suggesting that the health, nutritional and physiological status of the '*Djallonke*' sheep examined were acceptable. The MCH values were higher in this study. The MCHC values of non-lactating ewes (38.13 g/dl) were similar to the reported normal range while the values for lactating ewes (39.36 g/dl) and rams (44.66 g/dl) were higher. Etim (2010) reported that a low level of MCH and MCHC is an indication of anemia while a high level indicates a normal condition. The RBC of non-lactating ewes (8.63 $x10^6$/µl) were also similar to the reported normal ranges while the values for lactating ewes (6.89 $x10^6$/µl) and rams (6.93 $x10^6$/µl) were lower as compared to the reported normal ranges. Red blood cells aid in respiration by transporting of oxygen and carbon dioxide in the body.

Hematological characteristics have been used to know the health, nutritional and physiological status of animals (Jawasreh *et al*., 2009; Etim, 2015). Hematological characteristics have also been used in monitoring feed toxicity especially with feed constitutions that affect the blood as well as the health status of farm animal (Oyawoya and Ogunkunle, 2004). Differences in these characteristics have been attributed to a number of factors including age, breed, coat colour, feeding level, management, method of blood collection, hematological techniques used, ambient temperature, and health and physiological status of the animal (Sherman and Mary, 1994; Forhead *et al.*, 2002). In this study, sex and physiological condition of the '*Djallonke*' sheep had influence on blood parameters such as RBC, PCV, WBC and HB. The MCV, MCH and MCHC were not influenced by sex or the physiological condition of the '*Djallonke'* sheep.

4. Conclusions

The blood parameters of the '*Djallonke*' sheep reared in Ejura farm were generally within the normal ranges. Therefore, the health, nutritional and physiological status of the sheep was acceptable. The hematological parameters were affected by sex or the physiological condition of the sheep type. Livestock farmers in Ghana can obtain healthy breeding stock from the Ejura Sheep Breeding Station.

References

Addass PA, Perez IKA, Midan A, Lawan AU and Tizhe MA (2010). Haemato-biochemical findings of indigenous sheep breeds in Mubi Adamawa State, Nigeria. *Global Veterinaria*, 4: 164-167.

Adzitey F (2013). Animal and meat production in Ghana - an overview. *The Journal of World's Poultry Research*, 3: 01-04.

Amakiri AO, Owen OJ and Jack DO (2009). Effects of refined petroleum product (kerosene) flame and fumes on haematological characteristics of broiler chickens. *Proceedings of the 34th Annual Conference of the Nigeria Society for Animal Production*, Uyo, pp. 41-44.

Animal Genetic Training Resource (AGTR) (2015). *Djallonke*. [monograph on the Internet]. [Cited 2016 Aug 23]. Available from: http://agtr.ilri.cgiar.org/index.php?option=com_ contentandview=articleandid=134andItemid=148.

Anonymous (2006). Ejura Sekyedumase District Assembly. [monograph on the Internet]. [cited 2016 Aug 23]. Available from: http://www.ejurasekyedumase.ghanadistricts.gov.gh/.

Coles EH (1986). Veterinary Clinical Pathology (4th Eds.), Philadelphia, W. B. Saunders.

Domestic Animal Genetic Resources Information System (DAGRIS) (2005). Djallonke. [monograph on the Internet]. [cited 2016 Aug 23]. Available from: http://dagris.ilri.cgiar.org.

Forhead AJ, Gilmour RS, Dauncey MJ and Fowden AL (2002). Thyroid hormones and the mRNA of the GH receptor and IGFs in skeletal muscle of fetal sheep. *American Journal of Physiology and Endocrinology Methods*, 282: E80-E86.

Etim NN (2015). Reference values for haematological parameters of sheep: a review. *The American Journal of Innovative Research and Applied Sciences*, 5: 14-21.

Etim NN, Enyenihi GE, Williams ME, Udo MD and Offiong EEA (2013). Haematological parameters: indicator of the physiological status of farm animals. *British Journal of Science*, 10: 33-45.

Etim NN (2010). Physiological and reproductive responses of rabbit does to Aspilia africana. MSc Thesis, *Michael Okpara University of Agriculture, Umudike, Abia State.*

Food and Agriculture Organization (FAO) (2015). Food and Agriculture Organization of the United Nations Statistics Division. [monograph on the Internet]. [cited 2016 Aug 23]. Available from: http://faostat3.fao.org/browse/Q/QA/E.

Kral I and Suchy P (2007). Haematological studies in adolescent breeding cocks. *Acta Veterinari Brno*, 69: 189-194.

Jain NC (1986). Haemotological techniques, in: *Schalmis Veterinary Heamatology*. Lea and Febiger Philadelphia, pp. 20-86.

Jawasreh K, Awadeh F, Bani-lsmail Z, Al-Rawashed O and Al-Majalli A (2009). Normal haematology and selected serum biochemical values in different genetic lines of Awassi Ewes in Jordan. *International Journal of Veterinary Medicine*, 7.

Merck Manual (2012). Hematological reference ranges. Merck Veterinary Manual. [monograph on the Internet]. [cited 2016 Aug 23]. Available from: http://www.merckvetmanual.com/mvm/appendixes/reference_guides/hematologic_reference_ranges.html.

Milne E and Scott P (2006). Cost effective biochemistry and hematology in sheep. *Farm Animal Practice*, 28: 454-461.

Ministry of Food and Agriculture, Ghana (MOFA) (2016a). Ejura sheep breeding station. [monograph on the Internet]. [cited 2016 Aug 23]. Available from: http://dofard-gov.org/indexb443.html?page_id=4152.

MOFA (2016b). Ejura-Sekyeredumase. [monograph on the Internet]. [cited 2016 Aug 23]. Available from: http://mofa.gov.gh/site/?page_id=857.

Olayemi FO, Farotimi JO and Fagbohun OA (2000). Haematology of the West African dwarf sheep under two different management systems in Nigeria. *African Journal of Biomedical Research*, 3: 197-198.

Osaer S, Goossens B, Eysker M and Geerts S (2000). The effects of prophylactic anthelmintic treatment on the productivity of traditionally managed '*Djallonké*' sheep and West African dwarf goats kept under high trypanosomosis risk. *Acta Tropica*, 74: 3-24.

Oyawoya BM and Ogunkunle HN (2004). Biochemical and haematological reference values in normal experimental animal. *Masson, New York*, pp. 212-218.