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Deepa Pathipati
Research Associate, SERB DST Project, Department of Veterinary Physiology, College of Veterinary Science, SVVU, Tirupati, Andhra Pradesh, India

Supriya B
Assistant Professor, Department of Veterinary Anatomy, College of Veterinary Science, SVVU, Tirupati, Andhra Pradesh, India

AVN Siva Kumar
Associate Professor, Department of Veterinary Physiology, College of Veterinary Science, SVVU, Tirupati, Andhra Pradesh, India

B Rambabu Naik
Professor and Head, Department of Veterinary Physiology, College of Veterinary Science, SVVU, Tirupati, Andhra Pradesh, India

Corresponding Author:
Deepa Pathipati
Research Associate, SERB DST Project, Department of Veterinary Physiology, College of Veterinary Science, SVVU, Tirupati, Andhra Pradesh, India

Comparitive effects of slaughter stress on different haematological parameters in sheep and goat

Deepa Pathipati, Supriya B, AVN Siva Kumar and B Rambabu Naik

Abstract
The effect of slaughter stress on different blood parameters were studied in Nellore breed of sheep and Beetal breed of goats. A total of 108 sheep and goats almost of same age and weight were randomly selected. Two groups were divided and collection of blood samples was carried out – i.e., pre slaughter period and during exsanguinations. The blood parameters were calculated in both the species within one hour of collection. The wide variation was observed in between the groups for each blood parameter studied. It was observed that slaughter stress significantly affects the blood parameters in the sheep and goats with respect to white blood cells (WBC), red blood cells (RBC), haemoglobin concentration (HGB), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and RBC distribution width (RDW) but no significant difference was noted in mean corpuscular haemoglobin concentration (MCHC) between samples.

Keywords: Blood parameters, sheep, goat, slaughter stress

1. Introduction
Stress during slaughter is a combination of physical and psychological stimuli that adversely affects the animals. Sheep and goats play an important role in providing meat and wool. The meat production in these two species has been enhancing during the last few years due to increased consumption and better availability of marketing strategies. However, the final step in the meat production process i.e., Slaughter and the factors associated with it is gaining importance nowadays due to two reasons: One is increasing competitive market with an eye on the quality of final product and other is economic losses incurred by poor handling and stress before slaughter. In animal production, animal welfare needs to be considered apart from profitability (Mejdell, 2006) [12]. Stress during slaughter had a negative influence on the different blood parameters and meat quality. The production animals are exposed to variety of stressors before slaughter *viz*., during transportation, in lairage and pre slaughter handling (Grandin, 1997; von Borell, 2001; Terlouw *et al*., 2008) [7, 19, 18]. This might result in alterations in the biochemical and haematological variables (Miranda-de la Lama *et al*., 2010) [13]. Elbers *et al*., (1991) [3] reported the remarkable differences in the haematological parameters between farm and slaughter prone blood samples. Fear, excitement and pain were the key elements of stress that affects the blood parameters and meat quality (Heinz and srisuvan, 2001) [8]. In cattle, pigs and sheep reports are available indicating the effects of stress in and around slaughter that alters different blood parameters and also meat quality (Mitchell *et al*., 1988; Cockram and Corley, 1991; Jarvis and Cockram 1994; Jarvis *et al*., 1996; Tadich *et al*., 2005; Miranda-de la Lama *et al*., 2010) [14, 2, 10, 11, 13]. The evaluation of blood parameter provides valuable information and opens the door to assess physiological changes that occurs in response to stress during slaughter. Accordingly, an attempt was made in the present study to identify the changes in the different blood parameters in sheep and goats with respect to stress experienced during slaughter.

2. Materials and Methods
2.1 Animal sampling
The blood samples were randomly collected in 2 ml K_3EDTA (Xinle company) anti coagulant vials from two species of animals i.e., sheep and goats (n=54 each) brought to the local slaughter house in Tirupati. The study included collection of blood samples one day before slaughter (first group) and 30 seconds prior to exsanguination (Second group) which were maintained in cold chain until analysis. The haematological analysis was made within one hour after collecting the samples from both the groups. The entire experiment was repeated three times in both species.

2.2 Blood haematological analysis
The blood parameters (white blood cells, red blood cells, haemoglobin concentration, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, platelet distribution width, mean platelet volume, platelets count and RBC distribution width) were studied using Mindray 2800 vet auto haemoanalyser. The haemoanalyser is provided with embedded software that contains range of reference values for different species of animals and for various blood parameters.

2.3 Statistical analysis
Haematological parameters were described by descriptive statistics (Mean and standard deviation). The statistical analysis between the samples was analysed by using paired t-test. P values less than 0.05 were considered significant.

3. Results and Discussion
The mean values and standard errors for blood haematological parameters of the goat samples are shown in table 1 and for sheep in table 2. From the table 1 it is apparent that there was significant difference between the pre slaughter and prior to exsanguination blood samples. The statistically significant difference was noted in terms of white blood cells, red blood cells, haemoglobin concentration, mean corpuscular volume, mean corpuscular haemoglobin, and RBC distribution width but no significant difference was noted in mean corpuscular haemoglobin concentration between samples.

Table 1: Haemogram of goat blood samples

S. No	Blood parameter	Reference Range	Pre slaughtered samples (Mean ± S.E)	Just before Exsanguination (Mean ± S.E)
1	White Blood Cells (WBC; 10^3/µl)	5.0-14	5.8 ± 3.26^a	15.7 ± 3.43^b
2	Red Blood Cells (RBC; 10^6/µl)	8.3-17.9	8.18 ± 1.71^a	18.84 ± 2.76^b
3	Haemoglobin (HGB; g/dl)	8.0-11.5	7.54 ± 0.93^a	12.92 ± 3.45^b
4	Haematocrit (HCT; %)	23-35	22.8 ± 2.87^a	37.3 ± 1.53^b
5	Mean Corpuscular Volume (MCV; fL)	14-25	16.1 ± 0.81^a	25.8 ± 1.91^b
6	Mean Corpuscular Haemoglobin (MCH;Pg)	5.2-8.0	5.54 ± 0.25^a	9.67 ± 1.22^b
7	Mean Corpuscular Haemoglobin Concentration (MCHC; g/dl)	30-39	30.3 ± 1.52^a	31.2 ± 1.52^a
8	RBC Distribution Width (RDW; %)	10-20	11.1 ± 1.45^a	21.5 ± 2.95^b

From table 2 it was observed that the Haemogram of preslaughter and prior to exsanguination blood samples from sheep also differ statistically according to paired t-test at 5% level of significance (P≤0.05). The significant difference is noted in terms of white blood cells, red blood cells, haemoglobin concentration, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, platelet distribution width, mean platelet volume, platelets count and RBC distribution width.

Table 2: Haemogram of Sheep blood samples

S. No	Blood parameter	Reference Range	Pre slaughtered samples (Mean ± S.E)	Just before Exsanguination (Mean ± S.E)
1	White Blood Cells (WBC; 10^3/µl)	5.0-14	7.12 ± 1.78^a	15.32 ± 1.92^b
2	Red Blood Cells (RBC; 10^6/µl)	7.8-13.8	9.59 ± 1.66^a	16.99 ± 1.32^b
3	Haemoglobin (HGB; g/dl)	9.0-15.5	8.41 ± 1.40^a	17.77 ± 1.08^b
4	Haematocrit (HCT; %)	26-45	25.2 ± 4.30^a	46.9 ± 2.80^b
5	Mean Corpuscular Volume (MCV; fL)	25-38	23.9 ± 0.81^a	39.3 ± 0.78^b
6	Mean Corpuscular Haemoglobin (MCH;Pg)	8.0-13.0	7.55 ± 1.02^a	14.64 ± 0.13^b
7	Mean Corpuscular Haemoglobin Concentration (MCHC; g/dl)	32-38	31.7 ± 1.22^a	33.7 ± 1.05^b
8	RBC Distribution Width (RDW; %)	13-18	16.7 ± 0.46^a	19.3 ± 1.57^b
9	Platelets (PLT; 10^3/µl)	180-680	255.5 ± 148.4^a	729.8 ± 172.4^b
10	Mean Platelet Volume (MPV; fL)	3.8-6.0	3.7 ± 0.25^a	7.95 ± 0.39^b
11	Platelet Distribution Width (PDW; %)	---	15.28 ± 0.27^a	19.35 ± 0.15^b

Blood haematological parameters are vital components in evaluating the response of animals to different physiological situations (Etim *et al*., 2014) [5] and also the regular markers of the stress experienced before slaughter (Giammarco *et al*., 2012) [6]. The wide species variation was observed quantitatively in between the groups for each blood parameter studied. In case of white blood cells there was significant increase in the count in samples collected just prior to exsanguination in both the species. Haematological parameters are important to assess the physical and physiological condition of the animals which can represent the physiological reaction to stress (Etim *et al*., 2013) [4]. Since pre slaughter stress is the key cause for rapid glycogen breakdown which in turn affects the meat quality and the cell damage during handling may be responsible for the increased WBC count in the blood.

In the analysis of red blood cell count and haemoglobin percentage we observed significant increase in RBC count, Haematocrit, HGB and RDW in the blood samples from both sheep and goat collected few seconds prior to exsanguination but this significant increase was higher in sheep. The mean values of WBC count were higher in the blood samples collected during slaughter in both sheep and goats. This might have been due to stress prior to slaughter. This observation of increased WBC count was parallel with the findings of Giammarco *et al*., 2012 [6] and Adenkola *et al*., 2009 [1]. Also stress increases the release of white blood cells in to peripheral circulation through its effect on the anterior pituitary gland and adrenal cortex.

In terms of mean corpuscular volume a slight decrease was seen in blood samples taken just before exsanguination from goats but a slight increase in the same parameter was noted in sheep. In both sheep and goat in the blood samples collected before exsanguination there was slight increase in the MCH

value. No significant difference in the mean corpuscular haemoglobin concentration between the groups was noticed in both sheep and goat. In sheep the other parameters analysed were the platelet count, mean platelet volume and platelet distribution width, which were significantly higher in the blood samples from the sheep immediately before exsanguination.

However, the elevated values of haemoglobin concentration and erythrocyte count in this study showed that such increase might result from a shift of water from the plasma to the intra- and intercellular spaces due to the accumulation of lactate in muscles and therefore resulting in higher tissue osmolality and haemoconcentration (Heinze and Mitchell., 1989) [9]. With respect to the increase in the proportion in the slaughtered blood samples variables including haematocrit, MCV, MCH, MCHC, MPV, RDW and PDW this study agrees with the previous reports (simensen *et al.*, 1980; Smeets *et al.*, 1990) [15, 16].

In conclusion it is observed that all the blood parameters of the Haemogram analysed for both sheep and goat were significantly higher in samples prior to exsanguination than pre slaughter (one day before slaughter) samples.

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