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## Hemato-biochemical alterations in goats affected with diarrhoea

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### Abstract

In the present investigation blood samples were collected aseptically from 35 diarrhoeic goats from different farms of southern Rajasthan. Hematological parameters indicated significant ( $p>0.001$ ) decrease in haemoglobin, packed cell volume, total erythrocyte count, and Mean corpuscular volume and mean corpuscular haemoglobin. There was significant ( $p>0.001$ ) increase in total leucocyte count, absolute lymphocyte, neutrophil, basophil and monocyte count. Serum biochemical indices indicated significant ( $p>0.05$ ) hypoproteinemia & hypoalbuminemia. The serum level of alanine amino transferase and gammaglutamyl transferase were highly significantly ( $p>0.001$ ) as compared to control (apparently healthy) goats. It was concluded that significant ( $p>0.001$ ) haemato-biochemical changes are associated with diarrhoea in goats.

**Keywords:** haematological, biochemical, goat, diarrhoea

### Introduction

Major part of the Indian population is dependent on agriculture along with rearing livestock. According to Livestock census 2019, Goat population of India is 148.88 million and of Rajasthan is 20.84 million. Economy of rural population depends particularly on small ruminants like Goat and Sheep (Bettencourt *et al.*, 2014) [5]. Milk and meat production from goat is an important source of income particularly for farmers. Goat meat is widely consumed across the world. About 97.19 million goats were slaughtered in India during 2018-19 for meat production and amongst this 6 million goats were slaughtered from Rajasthan. Similarly, goat provides nutrition to rural people through milk (Devendra, 1999) [7]. In the year 2018-19, goat milk production of India was 12.61% of the total milk production of India and 34.75 % of the total milk production of Rajasthan (Basic Animal Husbandry Statistics, 2019). This indicates the importance of Goat as a source of milk in Rajasthan.

But the incidence of diseases and the alterations in body fluids associated with it result in either mortality or decreased growth and production of animal leading to economic loss to farmers. Amongst others diarrhoea is commonly encountered in goat. It is a complex multifactorial disease condition involving the non-infectious and infectious agents. It may be caused by pathogens, toxic substances and nutritional causes. Diarrhoea is commonly associated with pathological changes in gastrointestinal tract (Singh *et al.*, 2018) [15]. The enteric diseases are often of mixed aetiologies involving infection of bacteria, virus and parasites. Infection might leads to hemato-biochemical changes in the host body which further deteriorate the health of animal.

Therefore, the present study was conducted in goats to investigate the haemato-biochemical alterations associated with diarrhoea which could provide better knowledge about pathogenesis of diarrhoea and help us in finding proper therapy.

### Materials and Methods

#### Study area

The blood samples were collected from various organized and unorganized farms in different districts of Southern Rajasthan (viz., Dungarpur, Udaipur, Bhilwara, Rajsamand and Chittorgarh), Veterinary clinical complex of the CVAS, Navania, Udaipur and various Veterinary hospitals.

The samples for clinico-pathological parameters and parasitological studies were collected from clinically ill goats showing diarrhoea. Samples were collected from various organized

and unorganized farms in different districts of Southern Rajasthan (viz., Dungarpur, Udaipur, Bhilwara, Rajsamand and Chittorgrah), Veterinary clinical complex of the CVAS, Navania, Udaipur and various Veterinary hospitals.

### Hematological studies

#### Blood collection

Blood was collected from 10 healthy goats as control animals and from 35 diarrhoeic goats to study the changes in blood parameters due to gastrointestinal affections that are associated with diarrhoea. Two ml of blood was collected from the jugular vein of goats, in Ethylene diamine tetra acidic acid (EDTA) containing clean sterile vials.

Haematological analysis was done with the help of Autoanalyzer at Regional district diagnostic centre, Udaipur (RDDC).

The parameter which were included in this study as follows:

- Haemoglobin (Hb),
- Packed cell volume (PCV),
- Total leucocyte count (TLC),
- Total erythrocyte count (TEC)
- Differential leucocyte count (DLC).

#### Biochemical parameters

To study the changes in serum enzyme levels in diarrhoeic goats, five ml of blood was collected in clean sterile glass test tubes without anticoagulant. The blood was allowed to clot at room temperature and serum was separated and stored at -20°C till further use. The following serum enzyme levels were estimated. Biochemical parameter estimated by using single step reagent kits (I-CHEM) employing Auto Chemical Analyzer. (Thermo-chem 100 automatic) The parameter which were included in this study as follows.

**Total Protein:** Total protein concentrations in serum samples were estimated by using single step reagent kits (I-CHEM) employing Auto Chemical Analyzer

**Albumin:** Serum albumin concentration were analyzed by using single step reagent kits (I-CHEM) employing Auto Chemical Analyzer

**AST (Aspartate Amino Transferase):** Serum samples were

analyzed for levels of Aspartate Amino Transferase by using single step reagent kits (I-CHEM) employing Auto Chemical Analyzer

**ALT (Alanine Amino Transferase):** Serum samples were analyzed for levels of Alanine Amino Transferase by using single step reagent kits (I-CHEM) employing Auto Chemical Analyzer

**Alkaline Phosphatase:** Serum samples were analyzed for levels of Alkaline Phosphatase by using single step reagent kits (I-CHEM) employing Auto Chemical Analyzer  
**Gamma Glutamyl Transferase:** Serum samples were analyzed for levels of Gamma Glutamyl Transferase by using single step reagent kits (I-CHEM) employing Auto Chemical Analyzer

### Result

#### Haematological- Biochemical Study

##### Haematological Studies

Blood was collected from 35 clinical cases (Table 1) of diarrhoea and haemato-biochemical analysis was performed to assess any change in blood parameters and serum enzymes in goats affected with conditions that are clinically characterized by diarrhoea. The results of haematological analysis are presented in Table 2.

**Table 1:** Number of blood samples of Goat (*Capra hircus*) exhibiting diarrhoea collected from different districts of Southern Rajasthan.

S. No.	District	No. of clinical cases	Percentage
1.	Dungarpur	7	20
2.	Rajsamand	5	14.28
3.	Bhilwara	6	17.14
4.	Udaipur	10	28.58
5.	Chittorgrah	7	20
	Total	35	100

##### Haemoglobin

The mean haemoglobin (g/dl) values are 9.44±0.31 and 5.86±0.20 in healthy and diarrhoeic goats, respectively. There was statistically significant decrease in haemoglobin concentration in diarrhoeic goats as compared to healthy goats.

**Table 2:** Mean corpuscular haemoglobin (Hb), Packed cell volume (PCV), Total Erythrocyte count (TEC), and Total Leukocyte count (TLC) in apparently healthy and diarrhoeic Goats (*Capra hircus*)

S. No.	Parameter	Goat		
		Healthy	Diarrhoeic	
		Mean±SE	Mean±Se	
1.	Hb (g/dl)	9.44 0.38	5.87±0.20	***
2.	PCV (%)	25.02±0.66	18.49±0.60	***
3.	TEC (x10 <sup>6</sup> /cu mm)	11.46±0.75	4.87±0.16*	***
4.	TLC (x10 <sup>3</sup> /cu mm)	7.9±0.54	12.5±0.47	***

##### PCV

The mean packed cell volume (%) was 25±0.66 in healthy and 18.4±0.60 in diarrhoeic goats. There was statistically significant decrease in packed cell volume in diarrhoeic goats as compared to healthy goats.

##### TEC

The Mean total erythrocyte count (million/cu mm) values were 11.4±0.75 in healthy and 4.86±0.16 in diarrhoeic goats. There was significant decrease in total erythrocytes count in

diarrhoeic goat as compared to healthy goats.

##### TLC

The Mean total leukocyte count (x10<sup>3</sup>/cu mm) values were 7.9±0.54 in healthy and 12.5±0.47 in diarrhoeic goats. The result showed statistically significant increase in total leukocyte count in diarrhoeic goat as compared to healthy goats.

The mean percentage of different leukocytes in healthy and diarrhoeic goats are presented in Table-4.

The mean percentage of Neutrophils in healthy goat was  $40.7 \pm 1.38$  and  $38.5 \pm 0.99$  in diarrhoeic goat. The mean percentage of Lymphocytes was  $55.6 \pm 1.16$  in healthy and  $55.4 \pm 1.03$  in diarrhoeic goats. There was non-significant difference in mean percentage of Neutrophils and Lymphocytes in healthy and diarrhoeic goats.

The mean percentage of Eosinophils was found to be  $1.70 \pm 0.213$  in healthy and  $2.97 \pm 0.18$  in diarrhoeic goats. There statistically significant decrease in eosinophils in diarrhoeic goats as compared to healthy ones. The mean percentage of Monocytes was found to be  $1.40 \pm 0.221$  in healthy and  $2.23 \pm 0.148$  in diarrhoeic goat. The result showed statistically significant increase in monocytes in diarrhoeic goats. The mean percentage of Basophils was found to be  $0.60 \pm 0.163$  in healthy and  $0.80 \pm 0.99$  in diarrhoeic goat. The results depicted statistically non-significant increase in basophils in diarrhoeic goats.

**Table 3:** Mean Erythrocytic indices (MCV, MCH and MCHC) in apparently healthy and diarrhoeic goats (*Capra hircus*)

S. No.	Parameter	Goat (avg.)		
		Healthy Mean $\pm$ SE	Diarrhoeic Mean $\pm$ SE	
1.	MCV	$22.39 \pm 1.01$	$34.53 \pm 0.92^*$	***
2.	MCH	$8.50 \pm 0.55$	$10.89 \pm 0.16^*$	***
3.	MCHC	$37.77 \pm 1.25$	$32.06 \pm 0.75^*$	**

**Table 4:** Mean Differential Leukocyte Count (DLC) in apparently healthy and diarrhoeic goats (*Capra hircus*).

S. No.	Parameter	Goat		
		Apparently Healthy Mean $\pm$ SE	Diarrhoeic Mean $\pm$ SE	
1.	Neutrophil	$40.7 \pm 1.375$	$38.5 \pm 0.988$	NS
2.	Lymphocyte	$55.6 \pm 1.16$	$55.4 \pm 1.03$	NS
3.	Eosinophil	$1.70 \pm 0.21$	$0.80 \pm 0.99$	***
4.	Monocyte	$1.40 \pm 0.22$	$2.23 \pm 0.15^*$	**
5.	Basophil	$0.60 \pm 0.16$	$2.97 \pm 0.18^*$	***

**Table 5:** Mean Absolute Count of leukocytes in apparently healthy and diarrhoeic goats.

	L	N	B	E	M
N	$4.46 \pm 0.35$	$3.22 \pm 0.19$	$0.05 \pm 0.01$	$0.14 \pm 0.02$	$0.11 \pm 0.02$
D	$7.01 \pm 0.32^*$	$4.80 \pm 0.18^*$	$0.37 \pm 0.03^*$	$0.10 \pm 0.01$	$0.29 \pm 0.02^*$
	***	***	***	NS	***

P < 0.001

### Serum biochemical Studies

#### Total protein

The mean total protein (gm/dl) levels recorded from healthy and diarrhoeic goats were  $6.85 \pm 0.12$  and  $5.21 \pm 0.16$ , respectively. The result showed statistically significant decrease in protein levels in diarrhoeic goats.

#### Albumin (gm/dl)

The mean value of Albumin was found to be  $2.81 \pm 0.13$  in healthy and  $2.13 \pm 0.92$  in diarrhoeic goats. The result depicted statistically significant decrease in albumin level in diarrhoeic goats.

#### ALT (IU/L)

The mean value of Alanine Amino Transferase (ALT) was found to be  $28.42 \pm 1.94$  in healthy and  $22.0 \pm 2.52$  in diarrhoeic goats. The result showed non-significant difference in diarrhoeic goats.

#### AST (IU/L)

The mean value of Aspartate Amino Transferase (AST) was found to be  $157.62 \pm 4.138$  in healthy and in  $120.6 \pm 15.797$  diarrhoeic goats. The result showed significant decrease in diarrhoeic goats.

#### GGT (IU/L)

The mean value of Gamma glutamyl transferase was found to be  $31.24 \pm 2.195$  in healthy and in  $40.52 \pm 0.615$  diarrhoeic goats. The result showed statistically significant increase in diarrhoeic goats.

#### ALP (IU/L)

The mean value of Alkaline phosphate was found to be  $166.59 \pm 9.537$  in healthy and in  $323 \pm 75.820$  diarrhoeic goats. The result showed statistically significant increase in diarrhoeic goats.

**Table 6:** Mean Serum biochemical Parameter values in Healthy & Diarrhoeic Goats (*Capra hircus*) (Mean  $\pm$  S.E.)

S. No.	Biochemical Parameter	Goat		
		Healthy Mean $\pm$ SE	Diarrhoeic Mean $\pm$ SE	
1.	Total Protein	$6.85 \pm 0.12$	$5.21 \pm 0.16^*$	***
2.	Albumin	$2.81 \pm 0.13$	$2.39 \pm 0.92^*$	*
3.	ALT	$28.94 \pm 1.95$	$46.08.0 \pm 1.86^*$	***
4.	AST	$157.62 \pm 4.14$	$210.95 \pm 16.88^*$	**
5.	GGT	$31.24 \pm 2.19$	$40.52 \pm 0.62^*$	***
6.	Alkaline Phosphate	$166.59 \pm 9.54$	$323.2 \pm 75.82^*$	*

### Discussion

#### Haematological study

Analysis of blood parameters of Goat having diarrhoea revealed significant decrease in mean haemoglobin ( $5.87 \pm 0.20$ ), PCV ( $81.49 \pm 0.60$ ) and TEC whereas significant increase in mean TLC ( $4.87 \pm 0.16$ ) in diarrhoeic goats. The reduction of Hb, PCV and TEC might be due to severe damage caused by parasites. (Moudgil *et al.*, 2017; Bhat *et al.*, 2004, Amulya *et al.*, 2014 and Zaki *et al.*, 2010, Kumar *et al.*, 2015) [13, 6, 4, 17, 11]. Moreover, significantly higher values of MCV and MCH also indicated anemia in goats. The increase in total number of leukocytes might be due to an increase in immune response of goat against parasitic, bacterial or viral infection. There was significant increase in neutrophils, lymphocytes, monocytes and basophils which might be due to concurrent mixed infections. Similar observations of anemia and leukocytosis have been reported by other workers like Singh *et al.*, (2016) [14] in goats, Hassan *et al.*, (2013) [9] and Zain-Eldin *et al.*, (2013) [16] in sheep. Moreover, Ahmed *et al.*, 2015 [1] also reported anemia and leukocytosis in goats affected with gastrointestinal parasites indicating that the diarrhoea in goats might be due to parasitic infection of gastrointestinal tract. This is also supported by the results of our study which showed presence of helminths, and protozoan infection on faecal examination.

#### Biochemical study

The significant decrease in serum total protein, albumin along with increased levels of ALT and AST in diarrhoeic goats might be due to damage to intestinal mucosa and liver in concurrent gastrointestinal infections. Damaged liver is unable to synthesize normal levels of albumin and damaged intestinal mucosa results in protein malabsorption. Similar

results have been reported in sheep and goats by Aly *et al.*, (1996) [2] and kumar *et al.*, (2015) [11]. Zain-Eldin *et al.*, (2013) [16] also reported significant increase in serum ALT and AST and non-significant decrease in total protein and albumin in diarrhoeic sheep.

### Conclusion

In the haematological profile indicated the anemia, lymphocytosis, and neutrophilia and basophilia condition in diarrhoeic goat. In the absolute count show the higher concentration of neutrophils and lymphocytes and eosinophils count is lower, basophil & monocyte count slightly increase than the healthy goats. The biochemical study show reduction in total protein & albumin as hypoproteinaemia and hypoalbuminemia. The alanine amino transferase showed non-significant difference, aspartate amino transferase was reduction and gammaglutamyl transferase, alkaline phosphatase slightly increase the concentration.

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