HAEMATO BIOCHEMICAL AND FAMACHA SCORE ALTERNATION IN GOATS SUFFERING FROM HEMATOPHAGUS NEMATODES AND ITS THERAPEUTIC MANAGEMENT BY HERBAL ANTHELMINTIC

THESIS

Submitted to the

BIHAR ANIMAL SCIENCES UNIVERSITY

PATNA, BIHAR

In partial fulfillment of the requirements

FOR THE DEGREE OF

MASTER OF VETERINARY SCIENCE
IN
VETERINARY MEDICINE

By

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2021

DEPARTMENT OF VETERINARY MEDICINE
Bihar Veterinary College, Patna-800014
(Bihar Animal Sciences University, Patna, Bihar)

CERTIFICATE-I

This is to certify that the thesis entitled "**Haemato-biochemical and FAMACHA Score alteration in Goats Suffering from Hematophagous Nematodes and its Therapeutics Management by Herbal Anthelmintic**" submitted in partial fulfilment of requirement for the award of the degree of **Master of Veterinary Science in the discipline of Veterinary Medicine** of faculty of Post-Graduate Studies, Bihar Animal Sciences University, Patna, Bihar is the bonafide research carried out by **Dr. Sudhir Kumar, Registration no. – VM0008/2018 – 19,** son/~~daughter~~ of Shri. **Ram Lakhan Ram** under my supervision and that no part of this thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been fully acknowledged.

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CERTIFICATE- II

This is to certify that the thesis entitled "**Haemato-biochemical and FAMACHA Score alteration in Goats Suffering from Haematophagous Nematodes and its Therapeutics Management by Herbal Anthelmentic**" submitted by **Dr. Sudhir Kumar,** Registration No.– **VM0008/2018-19**, son/~~daughter~~ of **Shri. Ram Lakhan Ram** to Bihar Animal Sciences University, Patna, Bihar in partial fulfillment of the requirement for the degree of **Master of Veterinary Science in the discipline of Veterinary Medicine** has been approved by the advisory Committee after an oral examination of the student in collaboration with an External examiner.

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ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude and indebtedness to my guide and major advisor, ***Dr. Pallav Shekhar,*** *Head of Veterinary clinical complex and Assistant Professor-cum Jr. Scientist Department of Veterinary Medicine, Bihar Veterinary College, Patna, for valuable guidance, keen interest, close supervision, constant encouragement and healthy criticisms during the course of investigation. His painstaking supervision of the manuscript warrants special mention, without which this research undertaking would not have completed.*

I am highly obliged to ***Dr. Arvind Kumar Das,*** *Head, Dept. of Veterinary Medicine, for his useful suggestions and needful facilitation of contrivance during the course of investigation.*

I am grateful to the other members of my advisory committee, ***Dr. Bipin Kumar,*** *Assistant Professor-cum Jr. Scientist Department of Veterinary Medicine,* ***Dr. Ajit Kumar,*** *Assistant Professor-cum Jr. Scientist Department of Veterinary Parasitology,* ***Dr. Ajeet Kumar,*** *Assistant Professor-cum Jr. Scientist Dept. of Veterinary biochemistry , and* ***Dr. G. D. Singh,*** *Assistant Professor-cum Jr. Scientist Dept. of Veterinary Surgery and Radiology,* ***Dr. Ankesh Kumar,*** *Assistant Professor-cum Jr. Scientist Department of Veterinary Gynaecology and Obstetrics, Bihar Veterinary College, Patna, for their valuable guidance, constructive suggestions and timely help during the entire period of investigation.*

My sincere thanks are also to all Assistant Professor-cum Jr. Scientist of Bihar Veterinary College, Patna for his co-operative behaviour, valuable suggestions and moral support during the research work.

My special thanks are due to ***Dr. Sonam Bhatt,*** *Assistant Professor – cum junior scientist Department of Veterinary Medicine, ,* ***Dr. Vivek Kumar Singh,*** *Assistant Professor – cum junior scientist Department of Veterinary Medicine,* ***Dr. Anil Kumar,*** *Assistant Professor – cum junior scientist Department of Veterinary Medicine,* ***Dr. R.K. Sinha,*** *Assistant Professor – cum junior scientist Department of Veterinary Medicine* ***Dr. Parmod***

Kumar, Assistant Professor – cum junior Scientist Department of Veterinary Physiology, Dr. Anil Gattani, Assistant Professor – cum junior Scientist Department of Veterinary Biochemistry, Dr. R.K. Sharma, Assistant Professor-cum Jr. Scientist Department of Veterinary Parasitology, Dr. Kaushal Kumar, Head and Assistant Professor-cum Jr. Scientist Department of Veterinary Pathology, Dr. Dushyant Yadav, Assistant Professor-cum Jr. Scientist Department of Veterinary Gynaecology and Obstetrics, Bihar Veterinary College Patna who gave me opportunities to interact and also helps in related to our reseach.

I, with great pleasure, acknowledge my thanks to Dr. J. K. Prasad, Dean, Bihar Veterinary college, Patna-14, for providing the necessary facilities during the tenure of this investigation.

A deep sense of gratitude is expressed to Bihar Animal Sciences University (BASU), Patna, Bihar, for providing facilities to conduct this investigation.

A deep sense of gratitude is expressed to Honourable Vice Chancellor, Dr. Rameshwar Singh Sir, Registrar Sir , DRI cum Dean PGS, Dr. Veer Singh Sir, Director Research Sir, D.S.W., Mr. R.K. Trivedi Sir; Hostel Warden Sir, Hostel Superintendent Dr. Sanjay Kumar Sir and All University Officer of Bihar Animal Sciences University, Patna, Bihar, for providing facilities to conduct this investigation.

I would to thanks Dr. Ashok Kumar, ADG Animal Husbandary, ICAR, New Delhi for his untiring help and providing FAMACHA Score Card from CIRG, Makhdoom.

My thanks are also extended to all the respected seniors Dr. Rajiv Kumar, Dr. Shimpi Kumari, Dr. Ravi Ranjan Kumar, Dr. Suman Kumar, Dr. Shyamdeo Kumar, Dr. Armannullah , many colleagues like Dr. Agyey pusp, Dr. Ravi Kumar, Dr. Brajesh Kumar, Dr. Vishnu Prabhaker, Dr. Menka Kumari, Dr. Praveen Kumar, Dr. Arjun Kumar Mandal, Dr. Sourav Swami, Dr. Sanjeev Kumar, Dr. Komal, Dr. Nitu Sourya, Dr. Sunil Kumar Tudu, Dr. Shishir Kumar Thakur, Dr. Pranav Kumar, Dr. Dhiraj Kumar, Dr. Rakhi Bharti, Dr. Sumit Kumar Suman, Dr. Praveen Kumar Sinha, Dr. Sangeeta Kumari most loving junior, Dr. Pinky Rani, Dr. Nikhil Raj, Dr. Deepshikha Raj, Dr. Arun Kumar, Dr. Sweta, Dr. Kumari Prasansha Sinha, Dr. Pramod Kumar, Dr. Manish Kumar Mukherjee, Dr. Nitin

Kumar, *and* ***all other friends*** *who helped me directly or indirectly during my research work with a company of whom helped me to overcome the stressful moment of investigation and physically help from time to time during the course of study.*

I am also thankful to the Librarian and the staff-members of the library of the Bihar Veterinary College, Patna-14 for rendering their cooperation.

Thanks are also to the non-teaching staff members ***Mr. Manichand, Mr. Rajesh Singh, Mr. Ratnesh Kumar, Khushi Kumari, Mr. Manish Kumar, Mr. Rajeev Ranjan, Mr. Vicky, Mr. Jagat Ram, Mr. Neeraj Kumar and Sikha*** *department of Veterinary Medicine and other department for their kind help during the research work.*

Gratitude alone fails to convey my feelings which cannot be expressed in words for the affectionate care, thought fullness, moral support and encouragement constantly received from all members of my family specially my father ***Sh. Ram Lakhan Ram****, my elder brother* ***Sh. Randhir Kumar*** *and my younger brother* ***Mr. Rajeev Ranjan Kumar, Mr. Subir Kumar*** *and my younger sister* ***Ladly*** *and my lovely mother* ***Smt. Neelam Devi*** *and my nephew* ***Rishi Raj*** *and* ***Rishab Raj*** *and my niece lovely* ***Anokhi*** *for their divine support and source of inspiration during the study.*

*I thank God (****Baba Sahab Dr. B.R. Ambedkar****) for giving me patience and strength to overcome the difficulties which crossed my way in accomplishment of this endeavor.*

Last but not the least I would thank every person connected to my life here in Patna or anywhere else who couldn't find a separate mention in this acknowledgement.

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ABBREVIATIONS

@	At the rate
>	Greater than
<	Less than
=	Equal to
±	Plus Minus
℃	Degree Celsius
µg	Microgram
µl	Microliter
AR	Anthelmintic Resistance
ALT	Alanine amino Transferase
ANOVA	Analysis of Variance
aq.	Aqueous
A/G	Albumin by Globulin
BZ	Benzimidazole
BITC	Benzylisothiocynate
Ca	Calcium
Cm^2	Centimetre square
et al.	And Others
EPG	Egg per Gram
EHA	Egg Hatch Assay
etc.	Et cetera
FAO	Food and Agriculture Organisation
FECRT	Faecal Egg Count Reduction Test
FAMACHA	FAffa MAlan CHArt
FBZ	Fenbendazole
FEC	Faecal Egg Count
Fig.	Figure
ºf	Degree Farenheiht
F.S	FAMACHA Score

GIN	Gastrointestinal Nematode
gm/dl	Gram per decilitre
gm	Gram
g	Gram
GI	Gastro - Intestinal
Hrs.	Hours
IVM	Ivermectin
ILFC	Integrated Livestock Farm Complex
IU/L	International Unit per Litre
i.e.	That is
LMIA	Larval Migration Inhibition Assay
mg/kg	Milligram per kilogram
b.wt.	Body Weight
MOX	Moxidectin
ml	Millilitre
mg/dl	Milligram per decilitre
M eq/l	Mill equivalent per litre
mm	Millimetre
mg/ml	Milligram per millilitre
Na	Sodium
NSS	Normal Saline Solution
P	Phosphorus
OH^+	Hydroxyl
Hb	Haemoglobin
PCV	Packed Cell Volume
RF	Resistance Factor
RBC_S	Red Blood Cells
r.p.m	Revolution Per Minute
spp.	Species
SA	Salicylanilide

S.D	Standard Deviation
S/C	Sub Cutaneous
SGOT	Serum Glutamic - Oxaloacetic Transaminase
SGPT	Serum Glutamic Pyruvic Transaminase
S.E.M	standard Error Mean
SPSS16	Statistical product and Service Solutions 16
S.E	standard Error
TST	Targeted Selected Treatment
TLC	Total Leucocyte Cell
TEC	Total Erythrocyte Cell
TGF-ß	Transforming Growth Factor - beta
Th - 1	Tyrosine Hydrolase - 1
Th - 2	Tyrosine Hydrolase - 2
TSP	Total Serum Protein
UV	Ultra - violet
vs	Versus
viz.	Videlicet (Namely)
WAAVP	World Association for the Advancement of Veterinary Parasitology
WBC	White Blood Cell
GGT	Gamma Glutamyl Transferase
T	Control group
T1	Drug group
T2	Herbal group
%	Percentage

CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEPARTMENT OF VETERINARY MEDICINE

BIHAR ANIMAL SCIENCES UNIVERSITY, PATNA, BIHAR

Title of the Thesis : **Haematobiochemical and Famacha score alteration in goats Suffering from hematophagus nematodes and its therapeuttic management by herbal anthelmintic**

Name of the student : **Dr. Sudhir Kumar** Admission number : **VM0008/2018-19**

Major discipline : **Veterinary Medicine** Date of thesis submission : 30, June, 2021

Total page of the thesis: 81 Major Advisor : **Dr. Pallav Shekhar**

ABSTRACT

The present study was conducted on the topic Haematobiochemical and Famacha Score alteration in goats suffering from Hematophagus nematodes and its therapeutic management by herbal anthelmintic. The work was conducted in the Department of Veterinary Medicine and the field study was done in the two districts of Bihar viz. Patna and Muzzafarpur. 200 faecal sample of goats, 100 each from two district were collected and studied in the department for the screening of goats suffering from parasitic infestation. Endoparasites like Trichuris, Amphistomes, *Fasciola hepatica* and *Haemonchus contortus* were found in faecal examination. The overall prevalence of Haemonchus parasite in goats of two districts of Bihar i.e. Patna and Muzzafarpur were found to be 30 and 28 % respectively. The screening of goats with Famacha score card reveals mean Famacha score to be 3.015.The Egg per gram (EPG) of faecal samples were done and it was found to be 834.00.Strong negative correlation was found between Hb and EPG, F.S and Hb and strong positive correlation was found between F.S and EPG. Closantel and *Carica papaya* seed extract (aq.) were found to be effective in In – vitro and In – vivo trial. *Carica papaya* extract concentration 15 mg/ml efficacy found to be similar to closantel in In – vitro trial. On the basis of Bio – chemical and haematological examination, it was found that herbal anthelmintic (*Carica papaya* seed extract) can be good alternative of chemical anthelmintic for controlling Haemonchosis in goats. Use of chemical anthelmintic is not a solution for the control of haemonchosis in goats. Planned grazing, high plain of nutrition, early diagnosis by Famacha technique and use of herbal anthelmintic can prevent drug resistance and help in preventing mortality in goats from *Haemonchus contortus*.

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1

INTRODUCTION

India occupies first position in terms of goat population and Bihar being the 5th largest state of India in terms of goat population. It contributes about 7.63% of Indian total goat population. Chevon is the most preferred and widely consumed red meat in the state. The importance of goats in Bihar is well known as it supplies the human high quality animal protein in the form of meat and milk. Goat farming is providing a means of livelihood to economically weaker section in the society thus referred as poor's man cow. It is providing livelihood option to millions of landless labourers, marginal, semi-marginal and small farmers.

The productivity of goat in Bihar state is very low due to loss in production, reproduction and heavy mortality. The productivity potential of small ruminants is limited by several factors and parasitism is one of the major factors. Gastrointestinal parasitism had the highest global index as an animal health constraint to the poor. Chronic nature of gastrointestinal nematodes infestations resulted in high morbidity and huge loss of production. Parasitic gastroenteritis from helminth infestation affects the productivity in goats due to anaemia. Hematophagus nematodes are cause of serious production losses in small ruminants in the form of lowered meat, milk production. The prevalence of the disease is so serious that we cannot imagine the ideal management conditions where one can think of keeping the problem at way and losses free. Although the estimate of the economic loss by the parasites is not well known. Haemonchus spp. infection has been described widely as the most common and economically important strongyle nematode infection in sheep and goats (Brahma *et al.* 2015, Singh *et al.* 2015). The disease is more rampant and has been reported from all over the world where sheep and goats are reared (Hossain *et al.* 2004, Odeniran *et al.* 2016, Futagbi *et al.* 2015). Hematophagus helminth like Haemonchus or non-hematophagus ones such as Trichostrongylus and Strongyloides, depleting endogenous and exogenous protein sources of the animal, it may cause acute or chronic haemorrhagic anaemia or anaemia related to protein deficiency.

The grazing activities of the goats increase during the hot and humid condition because of the availability of pasture and forage. The climatic condition of Bihar is favourable to the ecological conditions suitable for parasites of which the helminth parasite predominates. It is posing the greatest challenge to goat health and production. In goats and sheep the prevalence may be as high as 100 per cent over a period of time in monsoon season though it may range 24 -70.0 percent as reported from various part of the world (Futagbi *et al.* 2015).

Control of the gastro-intestinal nematodes particularly *Haemonchus contortus* and *Trichostrongylus* species is a prerequisite for profitable small ruminant production (FAO). However, control of Haemonchus infection in small ruminant is still a challenge and it continues to cause serious production losses in small ruminant production system.

Clinically acute haemonchosis in sheep and goats has been described with dark coloured faeces with blood and sudden death of affected animals (Bhatia *et al.* 2004, Kandasamy *et al.* 2013). Bottle jaw, anaemia and diarrhoea were the other important clinical findings in goats affected gastrointestinal nematodes.

Presently only effective way to control this infection is chemotherapy. But, it has been used so rampantly and indiscriminately in many goats rearing countries and there are various reports describing anthelmintic resistance from different parts of the world. The situation is so grave that resistance in parasite has been described against all the available anthelmintic groups. This emphasizes the judicious use of these chemicals and in inevitable conditions only as no new drug for last more than three decade has been invented. Further, people awareness towards organic and chemical free animal products discourages the frequent use of such chemical anthelmintic and prompts scientists to work on non-chemical approach for control of Haemonchosis and other gastrointestinal nematodes (GIN).

The prevalence of anthelmintic resistance is a serious problem to goat production. The use of suitable integrated parasite control system using non-chemical methods and limited use of drugs are the demand of the present time.

Selective treatment involves treating only animals that are susceptible to parasite infection. Animals like females that are about to kid (2-4 weeks before kidding), young growing animals, and that are showing symptoms of infection based on visual observation or the FAMACHA system are treated. Selective treatment is probably the best program out of the three in the long- run because uses the least amount of anthelmintics by leaving some animals untreated while still maintaining a healthy herd. It is the best approach especially to slow the rise of anthelmintics resistance.

There is dearth of report and literature regarding the status of gastrointestinal nematodiasis in goats of Bihar, its impact on health status of goats. Also, there is need to develop a newer herbal anthelmintic for goats. A large number of diverse range of herbal

dewormer are used throughout the world, particularly for Asian Countries. However, there is lack of Scientific Validation of anthelmintic effect.

The successful avoidance of gastrointestinal nematodiasis relies on the early recognition of risk situations, the periodic monitoring of parasitic burdens and preventive programs with nonchemical measures, in addition to anthelmintic treatments. Thus the treatment should be carried out with some recent anthelmintic because they have advantages over traditional anthelmintic, also a new indigenous anthelmintic should be tried with the idea that it will be cheaper easily available and less anthelmintic resistant.

Keeping above points in view this research was proposed with the following objectives in view:

Objectives:

1. To study the prevalence of gastrointestinal nematodes in two districts of Bihar.
2. To Establish Correlation of hematobiochemical parameters in goats with Egg per gram of gastrointestinal nematodes.
3. To compare the effect of *Carica papaya* aqueous seed extract as herbal anthelmintic with standard anthelmintic.

2.0 PREVALENCE OF PARASITES

- Adediran *et al.* (2015) study on effectiveness Evaluation of Levamisole, albendazole, and Ivermectin & *Vernonia amygdalina* in West African Dwarf goats. Thus their study reviled low resistance to ivermectin & Levamisole & susceptibility to albendazole while *Vernonia amygdalina* has great potentials that could be explored for the treatment of helminth diseases in goats.
- Ajit *et al.* (2014) study on emergence of AR in an organised goat flock in Bihar and his result was indicated prevalence of anthelmintic resistance (Morantel citrate, Levaminsole hydrochloride, Ivermectin and fenbendazole) in *Haemonchus contortus* infected goats managed under oraganised farm.
- Akhtar *et al*. (2014) study was In - vivo and In- vitro studies on the efficacy of anthelmintic against *Haemonchous contortus* in goats revealed that all the three anthelmintic used in present study showed reduced efficacy against *Haemonchus contortus* in goats than WAAVP level of 95%. Therefore, the present study was designed to investigate the efficacy of various anthelmintic under local conditions. In this study, efficacy of three most commonly used anthelmintics i.e., Valbazen, Levamisole, Dectomax was evaluated. Present study suggested that compared to Valbazen and Levamisole, Dectomax was more effective against *Haemonchus contortus*. However, the efficacy of all three anthelmintics used was lower than the WAAVP recommended level of 95%, which may indicate resistance.
- Alcala Canto Y. *et al.* (2016) Study on status of gastrointestinal nematodes of sheep to the single or combined administration of benzimidazoles. In this study the different treatment was evaluated for the reduction of the percentage of eggs per gram of faeces (EPG) shed by nematodes (GIN) from sheep on 3 different sheep-breeding farms in Mexico. In these farms, Ivermectin & benzimidazole derivatives had been for two consecutive years. To determine whether drugs with different pharmacological properties decreased on, the treatment closantal albendazole & fenbendazole were administered alone & clos +ABZ & Clos + FBZ, to five group of sheep AR was determined by using FECRT. The use of Anthelmintic closantal plus

albendazole may reduce the development of AR in gastrointestinal nematodes. Means + SD of the percentage reduction in egg count on days 14 & 21 after treatment of sheep.

- Amit *et al.* (2013) Study on emergence of ivermectin resistance in gastrointestinal nematodes of goats in a semi organised farm of Mathura District India. They work on different in vivo & in vitro test have been employed to detect anthelmintic resistance. Among the in-vivo test, FECRT can best be used to evaluate anthelmintic efficacy in commercial flocks & herds. The results revealed that GI nematodes were found to be resistant to fenbendazole, but susceptible to levamisole, while they were suspected to be resistant to ivermectin. This seems to be the first documentation of ivermectin induced AR against gastro intestinal helminth in goats in the Indian Sub-continent.
- Amulya *et al.* (2015) Study that therefore undertaken to screen the gastrointestinal nematodes in sheep to know the development of resistance against the drug fenbendazole, one of the commonly used anthelmintic. Coproculture studies revealed the mixed infection with strongyle larvae viz. *Haemonchus contortus*, trichostrongylus sp. And Oesophagostomum spp., Bunostomum sp. And Cooperia sp. With the higher percentage of *Haemonchus contortus* in all the four sheep farms under study.
- Arora *et al*. (2003) noted 49.46% prevalence of gastrointestinal parasitism in goats in Mathura, Uttar Pradesh (India). This study revealed that bursate worm (*Haemonchus contortus*) was most prevalent parasite.
- Arunachalam *et al.* (2002) conducted a survey to find out the sheep structure and its income in Tamilnadu. They concluded that large number of prefers sheep farming structure, in combination with poultry or buffalo or bullock or cattle or goat considering the profitability.
- Bhojane *et al.* (2002) noted 70% prevalence of helminthic infection in goats in Nagpur, India and revealed that simple infection of strongylus (16.57%) and Haemonchus spp. (12.23%) were significantly higher than mixed infection Oesophagostomum spp. *Fasciola hepatica* and Amphistomes were also accounted. Sex, season and year had a significantly effect on parasitaemia.
- Chaudhri *et al*. (2000) studied the helminth parasites most affecting sheep and goat in Haryana were Haemonchus spp., Trichostrongylus spp., Paramphistomes spp.
- Christain *et al.* (2019) study was anthelmintic resistance (AR) in gastrointestinal nematodes in sheep raised under mountain farming condition in northern Italy. They use oral administration of macrocyclic lactone, Benzimidazole (BZ) partly in combination with salicylanilide (SA) or a combination of imidazothiazole and SA were applied under

controlled condition on his study. Their consideration that under dosing might have affected results of the routine treatments, a high prevalence of the AR was found in sheep under mountain farming condition.

- Depali *et al.* (2019) study was conducted to determine the efficacy of closantel against Benzimidazole resistant *Haemonchus contortus* infection in sheep. The result of the study suggested that closantel can be used for targeted selective treatment (TST) in sheep primarily infected with Haemonchus. Since closantel is highly efficacious against Haemonchus its use as an alternative to Benzimidazoles group may be helpful to decrease pasture contamination. Overall control of gastrointestinal nematodiasis may therefore be possible by use of closantel along with benzimidazoles.
- Edwin *et al.* (2015) study was AR and common worm control practices in sheep farms in Flanders, Belgium. His result indicated widespread resistance against Benzimidazoles (Albendazole, Fenbendazole and Mebendazole) with treatment failure on his study investigated. *Haemonchus contortus* and *Teladorsagia circumcita* were the predominant species after treatment failure.
- Frahat *et al.* (2000) observed 54.77% prevalence of *Haemonchus contortus* in sheep from Punjab and the infection rate was highest between July (89.55%) to august (87.13%) where as lowest prevalence was noted during February (20.02%) and march (20%).
- Garge *et al*. (2003) conducted epidemiological of *Haemonchus contortus* infection in goats in semi-arid region of India by examination of sample, abomasii and coproculture. Overall incidence was noted 56.38% which was lower in summer season as compared to winter and rainy season. Abomasal examination of slaughtered goats showed of 4-4.11 worm. Abomasal worm and faecal egg count were positively correlated and the correlation was significant. Female worms were more common than males with an average of 1.447 female/male ratio.
- Ismail *et al*. (2004) concluded that *Haemonchus contortus* was fairly prevalent in the local goats of south Darfur state of Sudan and male and female ratio was (0:9) in January while highest (2:72) was found in March.
- Kumar *et al*. (2006) studied the rate of incidence of parasite diseases in migratory Nellore sheep flocks and it was noted that amphistomiasis was significantly higher in migratory sheep than non-migratory flocks. Monieziosis was very common among both flocks however fascioliosis and strongyle infection were high in migratory flocks. The major problem during migration was identified that common water sources which perceives maximum no. of contamination, infection and outbreaks. Further it was demonstrated that

under normal condition also, sheep flocks possessed certain degree of intestinal parasitism with or without clinical symptoms but worm burden reached to pathogenic level during the migratory phase mostly because of grazing during early hours in a day which facilitates higher incidence of parasitism.

- Makvana *et al.* (2009) study on AR nematode parasite was carried out in sheep aged 12-24 month at organised sheep breeding farm Patan (Gujarat). The relative efficacy of Albendazole, Tetramisole hydrochloride & ivermectin was 54.32, 66.15 & 72.73% respectively.
- Morales *et al.* (2001) evaluated the effect of seasonal rainfall extremes on the prevalence of gastrointestinal nematodes in naturally infected ewes in the state of falcon, Venezuela. Necropsy was performed during rainfall period and dry period which revealed that most prevalent parasites were *Haemonchus contortus*, *Trichostrongylus axei*, *Trichuris ovis* and *Bunostomum trionocephalum*.
- Priyanka *et al.* (2019) study was conducted to detect the status of AR of commonly used anthelmintic drugs against gastrointestinal nematodes in goats in village Satnali, District Mehandergargh, Haryana. They use three drug group fenbendazole @ 10 mg/kg b.wt. Orally, morental @ 20mg/kg b.wt. Orally & ivermectin @ 0.4 mg/kg b.wt. S/c respectively. Thus the study revealed presence of multiple AR of fenbendazole, Morantal & ivermectin against *Heamonchus contortus* in goats of unorganised sector in Haryana.
- Ramdeep *et al.* (2017) study on AR against commonly used Anthelmintic fenbendazole was evaluated by employing FECRT in naturally occurring GIN in the semi organised sheep & goat farm on Ludhiana & Amritsar Districts. The study result was envisaged to detect the status of AR to the most commonly used anthelmintic viz. Fenbendazole, against gastrointestinal nematodes of sheep & goats in Amritsar & Ludhiana Districts of Punjab state by FECRT.
- Saiful *et al.* (2018) study on status of AR of gastrointestinal nematodes in organised sheep and goat farms & their study results revealed that gastrointestinal nematodes were found to be resistant to albendazole in organised sheep farm & suspected to be resistant to levamisole & ivermectin. In organised goat farm, the gastrointestinal nematodes found to be susceptible to all anthelmintic used for this study.
- Singh *et al*. (2005) noted 78% prevalence of helmintic infections in sheep in Ludhiana, Punjab and revealed strongylus, trichuris, monezia and paramphistomum, infection were most commonly encountered during pre and post rainy seasons. Fortnight mean eggs per gram and climatic factors (rainfall and temperature) were found to be positively correlated.

Only 11.52% cases were found positive for mixed helminthic infection out of which the most common cases of infection were of strongyles and moniezia spp.

- Sreedevi and Murthy (2005) noted overall 37.6% of gastrointestinal parasites in sheep at Andhra Pradesh. The prevalence was more in summer and lowest in monsoon. Seasonal and age wise prevalence revealed maximum in sheep during summer (47.5%) whereas, in lambs, monsoon was more favourable (46.1%) for parasitism. The prevalent parasite were strongyles and moniezia spp.
- Stayavir *et al.* (2015) study was conducted to determine the efficacy of levamisole and ivermectin alone & in combination against gastintestinal nematodes in sheep. Identification of infective larvae from both pre and post treatment faecal culture revealed the predominance of *Haemonchus contortus*. The result indicated the partial resistance of levamisole & ivermectin against *Haemonchus contortus*. Thus the present study indicated the combination of levamisole + ivermectin was more effective against resistant *Haemonchus contortus* then when the drugs were administered individually.
- Swarnkar *et al*. (1999) studied on multiple anthelmintic resistance in *Haemonchus contortus* of sheep showed that fenbendazole and tetramisole were respectively, found 0 and 25% effective against *Haemonchous contortus*, while closantel showed 100% efficacy. Though rafoxanide was 96% effective against *Haemonchus contortus*.
- Thangathurai *et al*. (2003) noted 47.2% prevalence of enteric parasitism in sheep and goats in around bidar, Karnataka. The common parasites encountered were *O.columbianum*, hookworm, Oesophagostomum, Trichuris, *Stilesia hepatica* among a local population of sheep and goat.
- YildizAydenizoz (2001) noted 66.31% prevalence of helminthic infection in sheep flocks in turkey and indicated that prevalence of parasites belonging to family Trichostrogyloidae was 38.65% with common incidence of Haemonchus spp., Ostertagia spp. And nematodirus spp. Followed by trichuris spp.

2.1 HAEMATO – BIOCHEMICAL STUDIES

- Arora *et al*. (2001) recorded significantly decrease in total protein, albumin and blood glucose during bursate worm infection in sheep and goat.
- Lakra *et al*. (2007) estimated different biochemical constitute in goats naturally infected with common gastrointestinal nematodes (Haemonchus, Trichuris, Oesophagostomum, Ostertagia, Bunostomum and others) and noted significant reduction in Hb, PCV,TEC,

serum calcium, inorganic phosphorus, Cu & Zn and values during infection and suggested that decreased biochemical profile might have occurred due to blood loss caused by blood sucking nematodes. Hypoproteinemia, hypoalbuminia, hypoglycaemia and serum phosphorus level got decreased due to reduced feed intake and absorption and due to alteration in carbohydrates metabolism.

- Sharma *et al*. (2000) observed significantly decline in packed cell volume, Hb and total erythrocyte count during haemonchosis in goats in Mathura, Uttar Pradesh.
- Sharma *et al*. (2001) evaluate some biochemical parameters during experimental *Haemonchus contortus* infection in goats and observe significant increase in level of SGPT and SGOT, while significant decrease in total serum protein level as compare to control group of animals.
- Swarnkar *et al*. (2000) observed that mean pack cell volume, Hb concentration, erythrocyte count decreased significantly in experimentally infected lambs with *Haemonchus contortus*, were as worm burden and faecal egg count were negatively correlated with Hb%, PCV, TEC and body weight**.**

2.2 FAMACHA TECHNIQUIES

- Bath *et al.* (1996) the major limitation to instituting a selective treatment approach has been the lack of an efficient and economical means of identifying those animals requiring treatment. This problem has recently been solved by a novel system developed in South Africa for identifying sheep that anaemic.
- Kaplan *et al*. (2004) FAMACHA was developed in South Africa which enables clinical identification of anaemic sheep and goats. When *Haemonchus contortus* is the primary parasitic pathogen, this system can be applied on the farm level to reduce the no. Of treatments administered, thereby increasing the proportion of the worm population in refugia. Since most studies validating the FAMACHA method have been performed in South Africa, it is important that the method be tested in other regions before its use in broadly recommended.
- Van Wyk and Bath (2002) in subsequent studies where FAMACHA was used by farmers and treatments were based solely on FAMACHA scores without the aid of PCV determinations, mean reduction on 10 farms in the no. Of treatments from previous year was still 58%.
- Vatta *et al*. (2001) demonstrated that FAMACHA has also been validated on goat farms in South Africa.

2.3 ANTHELMINTIC PROPERTIES OF *Carica papaya*

- Adebowale Adebiyi *et al*. (2003) demonstrated that the higher concentration of EEPS caused prompt uterine quiescence, which was also significantly irreversible. Cross section of EEPS pre- treated non gravid rat uterus (stained with haematoxylin and eosin) examined under light microscope revealed degeneration of endometrium and myometrium with obvious cytoplasmic vacuolation indicating that EEPS could have direct toxic effect on the uterine tissue. Previous workers have reported benzylisothiocynate (BITC) as the main bioactive and anthelminthic compound in different extracts of papaya seeds.

- Ajith *et al.* (2017) Observed significant anemia, hypoglycemia, hypoproteinemia and hypoalbuminemia in caprinepediculosis irrespective of the type of lice infested. Remarkably increased oxidative stress was observed in chewing lice infested goats and no significant changes in oxidative stress markers were observed in sucking lice infested goats. TGF-β mediated suppression of Th1 and Th2 immune responses was observed in sucking lice infested goats; whereas, a Th2 cytokine dominant inflammatory response was observed in chewing lice infested goats. They concluded that sucking lice infestation produces remarkable immunosuppression and chewing lice infestation produces significant oxidative stress and inflammatory responses in goats.

- Al-Khayat *et al.* (2012) mentioned that iron deficiency anemia is caused by chronic blood loss, gastro-intestinal blood loss and internal parasitic infestations like *H. contortus*.
- Ameen *et al.* (2010) demonstrated the effect of *Carica papaya* seed extracts where broad spectrum in action. The papain compound present in the *Carica papaya* seed extract could have caused reduction in worm load through the same mechanism that culminates in exhaustion and death of worm. Since the aqueous seed extract of *Carica papaya* significantly reduced the faecal egg counts of the helminths, it could serve as an anthelminthic agent.

- BersissaKumsa *et al.* (2006) evaluated the efficacy of albendazole and tetramisole was evaluated against Ogaden isolate of *Haemonchus contortus* in experimentally infected lambs. Thirty Arsi breed experimental lambs were randomly divided into 4 treatment groups, 1 positive control group, and 1 negative control group. The treatment groups received on Day 35 post-infection either of the following compounds: albendazole and tetramisole. The efficacy of the drugs was evaluated in vivo by fecal egg count reduction test (FECRT) and controlled anthelmintic efficacy test. In vitro egg hatch assay was

performed using different concentrations of albendazole on eggs of *H. contortus*, Ogaden isolate, and the result was compared with eggs from known susceptible and resistant reference strains of *H. contortus*. All the drugs were found to possess a 100% efficacy against Ogaden isolate of *H. contortus* at the dose recommended by manufacturers using the FECRT and controlled anthelmintic efficacy evaluation.

- Bordoloi *et al*. (2012) Conducted study on the Haemato – biochemical parameters changes due to experimentally induced Haemonchosis in Sahabadi sheep. There are two group in his study one infected and another uninfected. In infected group they induced 700 L3 larvae of *Haemonchus contortus*/kg of each sheep were given orally then after blood sample collected on day 0 to 42 day after post infection. Their Haematological parameters are Hb concentration, PCV, TEC and Biochemical parameters are TSP, serum albumin, serum globulin, alkaline phosphatase, alanine amino transferase. After statical analysis revealed that significant decerease in Hb concentration, PCV, TEC and TSP concentration and significant increases level of serum enzyme in infected sheep. So, this study shows that experimental *Haemonchus contortus* infection caused disturbences in Haematological and Biochemical parameters i.e. they cause anaemic due to lowering of haematological parameters, lower in TSP and increasing of enzyme level.

- Dixit *et al*. (2019) Study on the efficacy of herbal extracts and closantel against fenbendazole – resistant *Haemonchus contortus* in goats. They use aqueous extract leaf extract of neem @1g/kg b.wt. ; Sitaphal @1.5 g/kg b. wt. and tobacco @1g/kg b.wt. Orally respectively in four groups of animals in which each group contains 10 goats. And in 5^{th} group closantel @10 mg/kg b.wt. Orally given. And in last 6^{th} group of 10 animals kept control. After post treatment there is poor antiparasitic activity found in herbal treated group but closantel treated group is good efficacy 95.64%.

- Dolinska *et al*. (2016) reported that problem of drug resistance has developed for all commercially available anthelmintics in several genera and classes of helminths. In vitro and *in vivo* tests were used to detect anthelmintic resistance. Two *in vitro* methods (larval migration inhibition test and micro motility test) for the detection of ivermectin (IVM) resistance were compared using IVM-resistant and IVM-susceptible isolates of *Haemonchus contortus*. The degree of resistance for each test was expressed as a resistance factor (RF). The micro motility test was more sensitive for quantitatively measuring the

degree of resistance between susceptible and resistant isolates. The RFs for this test for IVM and eprinomectin ranged from 1.00 to 108.05 and from 3.87 to 32.32, respective.

- Frida *et al*. (2018) Study on the isolation, identification and antioxidant activity of chemical compound in ethanol extract of papaya leaves (*Carica papaya* L.). After extraction and phytochemical screening of *Carica papaya* leaves they use Thin Layer Chromatographic (TLC) for analysis. And then after antioxidant test, their result showed that ethanol extract of papaya leaf has a strong antioxidant activity. Identification of active compound then after isolate active compound EtOH. Their result of UV – visible spectrophotometry, FTIR spectrophotometry and GC – MS reveal the presence of the phenol compounds.

  Gilleard (2013) Reported that anthelmintic resistance is essentially a complex quantitative trait in which multiple mutations contribute to the resistance phenotype in an additive manner. *Haemonchus contortus*, a gastro-intestinal parasite of sheep, has shown a remarkable propensity to develop resistance to all the drugs used in its control. Partly because of this, and partly because of its experimental amenability, research on this parasite has contributed more than any other tour understanding of anthelmintic resistance.

- Graef *et al.* (2013) stated that anthelmintic resistance of parasites in small ruminants, cattle and horses is increasing worldwide as a consequence of the over usage of the currently available products. In Belgium, *Cooperia oncophora* is the most common cattle nematode in which resistance, especially against macrocyclic lactones, occurs. Once resistance has been diagnosed, a change to another drug with a different mode of action is advised. However, effective anthelmintics will be hardly available in the near future. In this way, anthelmintic resistance may be delayed, and the effectiveness of anthelmintic drugs may be prolonged.

- Herve Hoste *et al.* (2006) reported that the tannin- rich plants have their effect on internal nematodes in ruminants. These plants could act through direct antiparasitic activity but might also act indirectly by increasing host resistance. The effects vary with the species of plant, parasite and host. Results suggested that such plants might be used as nutraceuticals with anthelmintic properties; as such, they are a promising option for use in integrated nematode control within a variety of farm production systems

  Kermanshai *et al.* (2001) Reported that anthelmintic activity of papaya seed extract and benzyl isothiocynate content correlate positively. Aqueous extracts prepared from heat

treated seeds had no anthelmintic activity or benzyl isothiocyanate content although both appeared when these extracts were incubated with a myrosinase-containing fraction fraction prepared from papaya seeds. A 10 h incubation of crude seed extracts at room temperature led to a decrease in anthelmintic activity and fractionated samples showed a lower benzyl isothiocyanate content relative to non-incubated controls. Benzyl thiocyanate, benzyl cyanide, and benzonitrile were not detected in any preparations and cyanogenic glucosides, which were present, could not account for the anthelmintic activity detected.

- Maqbool *et al*. (2012) Study conducted on the Biochemical studies and Serodiagnosis of Haemonchosis in sheep and Goats. They use various allopathic, herbal, homeopathic and biological products for therapeutical trials in different groups of goats. After therapeutic trial there are a range of Haematological value were significantly different between infected and control group. There is no significant differences between infected non – infected (control) groups in WBC (TLC) counts, but TLC was relatively high in infected group then healthy control group. This study revealed that decreased in the the concentration of Hb%, Total serum protein, total RBCs and Albumin/Globulin (A/G) ratio which is the important parameters of Haemonchosis in sheep and goat.

- Pena *et al*. (2014) reported anthelmintic resistance on one of the largest organic small ruminant farms in Denmark. The flock was established in 2007 by purchase of animals from other Danish farms and had history of clinical parasitism, high mortality of young stock and anthelmintic treatment failure. In October 2011, 40 lambs and 40 kids were selected for a faecal egg count reduction test (FECRT) with fenbendazole (FBZ), ivermectin (IVM), moxidectin (MOX) and levamisole (LEV). Lambs were treated with the recommended sheep dose of each product while kids received the sheep dose of IVM, 1.5× sheep.

- Nawaz *et al*. (2014) Study was on the *In vitro* and *In vivo* anthelmintic activity of leaves of *Azadirachta indica*, *Dalbergia sisso* and *Morus alba* against *Haemonchus contortus*. Anthelmintic activity of water extract of *Azadirachta indica*, *Dalbergia sisso* and *Morus alba* was evaluated by FECRT, Egg hatch test and Adult motility assay. For FECRT water extract of all three herbal plant administered @ 02, 04 and 08 ml/kg b. wt. then after 12 days of administration of all three water extract of herbal plant i.e. after treatment the plants extract induced 89%, 87% and 36% reduction in EPG. So, this study results concluded that

the extracts of *Azadirachta indica*, *Dalbergia sisso* and *Morus alba* are good for induce antiparasitic activity.

- Prakash *et al.* (2018) Reported anthelmintics resistance status of *Haemonchus contortus* in sheep and goat. A total of 6785 sheep/goats abomasum were examined, out of which 2645 abomasal samples were found to contain *H. contortus* worms. Egg hatch assay (EHA) and larval migration inhibition assay (LMIA) were carried out to assess the status of thiabendazole and ivermectin resistance. In EHA, 36% of the samples were benzimidazole resistant with a mean ED50 of 0.247 µg/ml and ED50 0.070 µg/ml in susceptible populations of *H. contortus*. Resistance factor for thiabendazole was 3.5. In LMIA, 42% of the samples were ivermectin resistant with LM50 value of 0.149.

- Jaiswal *et al.* (2008) studied the molluscicidal activity of seed and lyophilized latex powder of *Carica papaya* and seed powder of *Areca catechu* against the vector snail *Lymnaea acuminate.* The toxicity of these plant products was time and dose dependent. The toxicity of *C. papaya* lyophilized latex powder (LC_{50} at 96 h: 8.38 mg/l) was more pronounced than that of *A. catechu* seed powder (LC_{50} at 96 h: 12.32 mg/l) and *C.papaya* seed power (LC_{50} at 96 h: 61.56 mg/l). Ethanolic extracts of *C. papaya* seed and *A. catechu* seed were more toxic than their other extracts. The ethanolic extract of *A. catechu* seed (LC_{50} at 24 h: 17.21 mg/l) was more effective than the ethanolic extract of *C. papaya* seed (LC_{50} at 24 h: 53.38 mg/l). The LC_{50} of column –purified fraction of *A. catechu* seed at 96 h was 3.99mg/l, whereas that of *Carica papaya* seed was 7.06 mg/l. *Carica papaya* and *A. catechu* may be used as potent molluscicides since the concentrations used to kill the snails were not toxic for the fish *Colisafasciatus* which shares the same habitat with the snail *L. acuminate*.

- Raaman (2015) Study conducted on Thin Layer Chromatographic Analysis and Antioxidant Activities of Methanol Extract of leaves of *Carica papaya* L. In this study Antioxidant activities of leaves were carried out by DPPH free radical scavenging assay, OH^+ radical scavenging assay, NO^+ radical scavenging assay, Fe^{3+} reducing power assay and phosphomolybdenum reduction assay. The present study shows that the methanol extract of leaves of *Carica papaya* it's include significant amount of phenols and flavonoids. Important role of polyphenolic compounds is in stabilizing lipid oxidation and this is associated with antioxidant activity. So, this study revealed the best antioxidant activity of leaves of *Carica papaya.*

- Rahman (2016) Study was conducted to compare the efficacy of closantel (An anthelmintic drug) and *Azadirachta indica* (Neem plant) diet in controlling Trichostrongylid Nematode parasites in Goats in Malaysia. They use modified McMaster for Faecal Egg Count (FEC) and prevalence of Nematode species in goats. They found that the FECRT for closantel was minimum with approximately 29.22%; while FECRT for Neem was lower than the closantel at 4.25%.

- Doyle *et al.* (2018) stated that helminthic control is heavily dependent on the regular administration of anthelmintic drugs. Resistance to these drugs is widespread in many livestock systems, and there is concern that mass drug administration programs to control human helminthes may be selecting for resistance. Here, two previous genetic crosses between ivermectin resistant and sensitive isolates of the parasitic nematode *Haemonchus contortus,* an economically important gastrointestinal parasite of small ruminants that is a model for anthelmintic research. By combining genetic mapping and whole genome sequencing with novel analyses, the first single genomic locus conclusively associated with ivermectin resistance in a parasitic nematode was identified.

- Tramboo *et al*. (2017) Demonstrated the efficacy of Ivermectin, Closantel and Fenbendazole against Gastrointestinal Nematodes of sheep in Kashmir valley. They selected 115 sheep in field condition and randomly divided into four group. They kept 30 animal in each three treatment group (Ivermectin, Closantel, Fenbendazole) and 25 animal in other 4^{th} group which is in untreated control group. After applying FECRT on 0, 8 and 14^{th} days. All anthelmintic efficacy was give good result. So, no evidence of development of anthelmintic resistance by gastrointestinal Nematode of merino sheep (cross breed) in District Budgam of Kashmir valley to ivermectin, closantel and fenbendazole respectively.

3.0 SITE OF PRESENT INVESTIGATION

The present study was conducted in Department of Veterinary Medicine, Bihar Veterinary College, Bihar Animal Sciences University, Patna.

3.1 SOURCES OF GOATS

The study was carried out in goats of two districts of Bihar (Muzzafarpur & Patna). Two blocks from each selected district were identified and four villages from each block was selected, therefore total eight villages was selected for collection of samples. Samples was collected from 25 goats of each village irrespective of age, sex, showing signs of anemia by FAMACHA technique. All samples of such animals were brought to Department of Veterinary Medicine for further study.

Samples from such goats was examined two times between July, 2020 to December, 2020. All faecal samples were brought to the laboratory for examination and identification of gastrointestinal nematodes and EPG. The blood samples of goats were processed for hematological and biochemical examination.

Therapeutic trials (of chemical and herbal anthelmintic) was done in ILFC, Bihar Animal Sciences University.

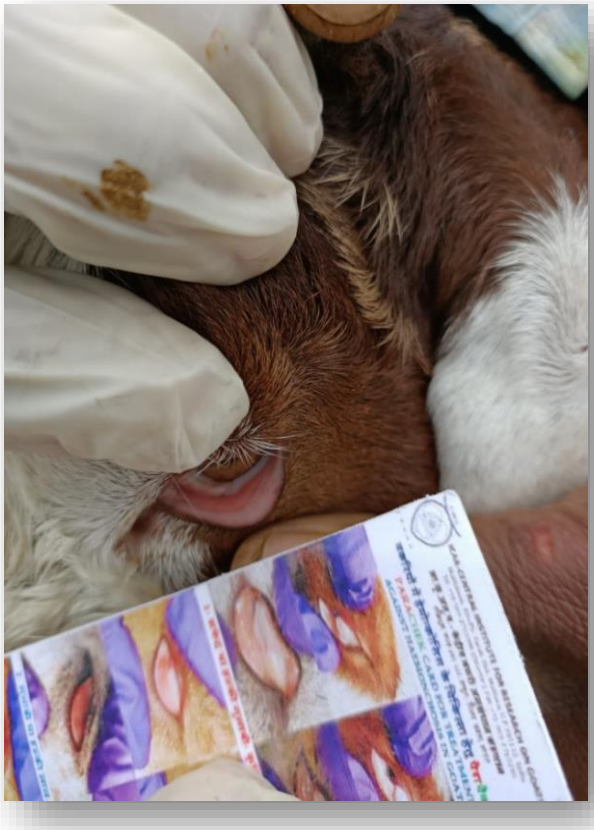
The clinical observations included in the study was frequency, quality and consistency faeces, colour of mucus membrane, appearance of submandibular region, general body condition, appetite, body weight, rectal temperature, pulse and respiration.

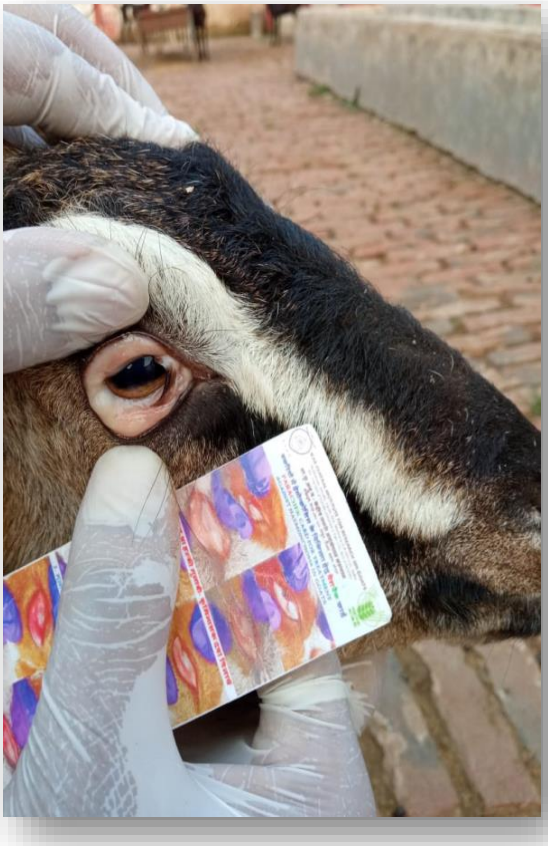
Fig. – 01 Animals of Masaurhi, Patna

Fig. – 02 Animals of Mokama, Patna

Fig. – 03 Animals of Bandra, Muzaffarpur

Fig. – 04 Animals of Mouraul, Muzaffarpur





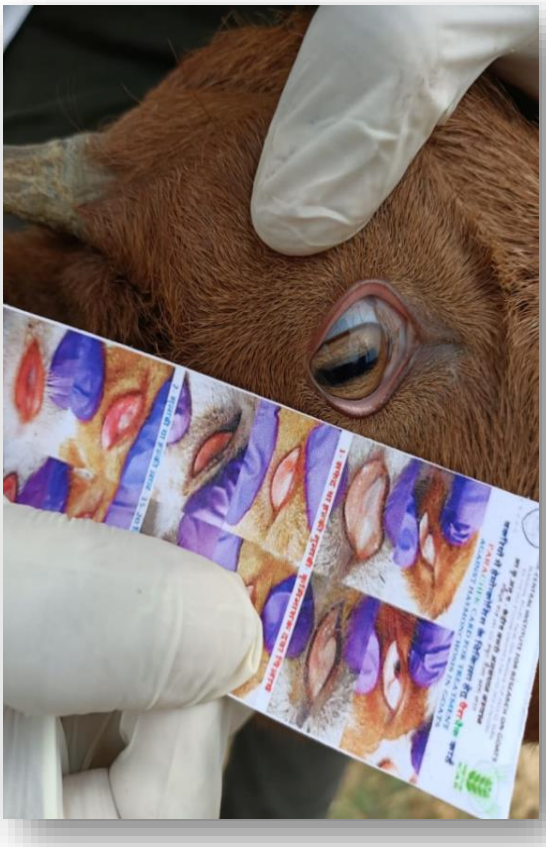


Fig. – 05 Screening of Goats By FAMACHA Technique

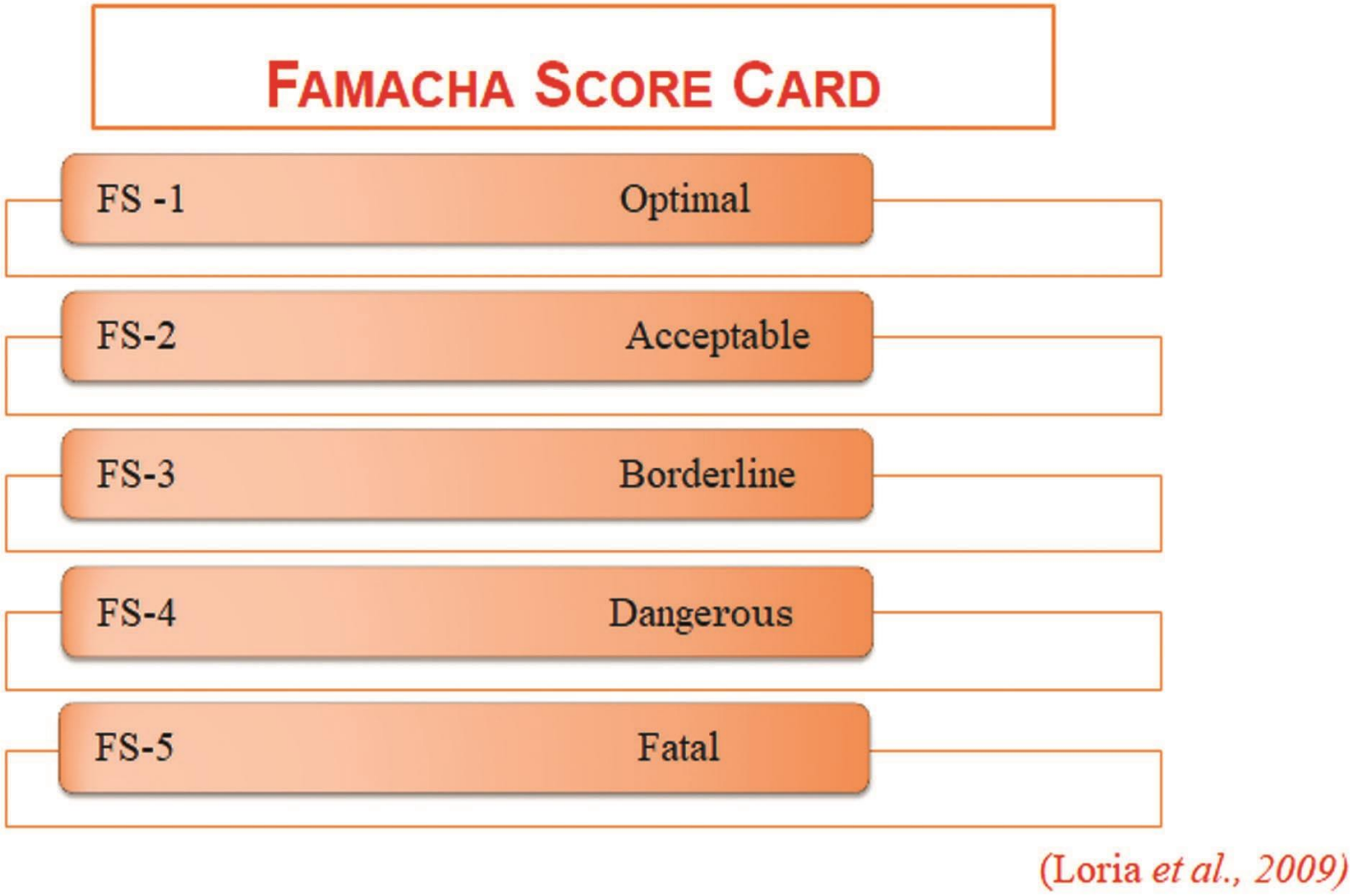


Fig. – 06 FAMACHA Score Card

3.2 DIAGNOSTIC

FAMACHA technique was applied for the screening of cases for faecal, hematological and biochemical examination.

3.3 COLLECTION AND EXAMINATION OF FAECAL SAMPLES

The faecal samples was collected from rectum of affected goats. Few drops of formalin was added in the collected samples to preserve the morphological character of eggs.

Faecal samples collected was examined by using direct and indirect methods as described by Soulsby (1982).

3.4 IDENTIFICATION OF PARASITES

The speciation of different parasites was done on the basis of egg morphology. Parasites were also be identified by studying the larval morphology after culture and isolation of larvae by charcoal faecal culture methods as described by Soulsby (1982).

3.5 COLLECTION OF BLOOD FOR HAEMATOLOGICAL AND BIOCHEMICAL STUDY

Blood samples was collected on 0 day (Pre-treatment) for the study of different hematological and biochemical parameter from all the goats. Also hematological and biochemical parameters were determined in two clinical groups each consisting of 6 animals on 0 day (Pre-treatment) and 7 day (Post-treatment).

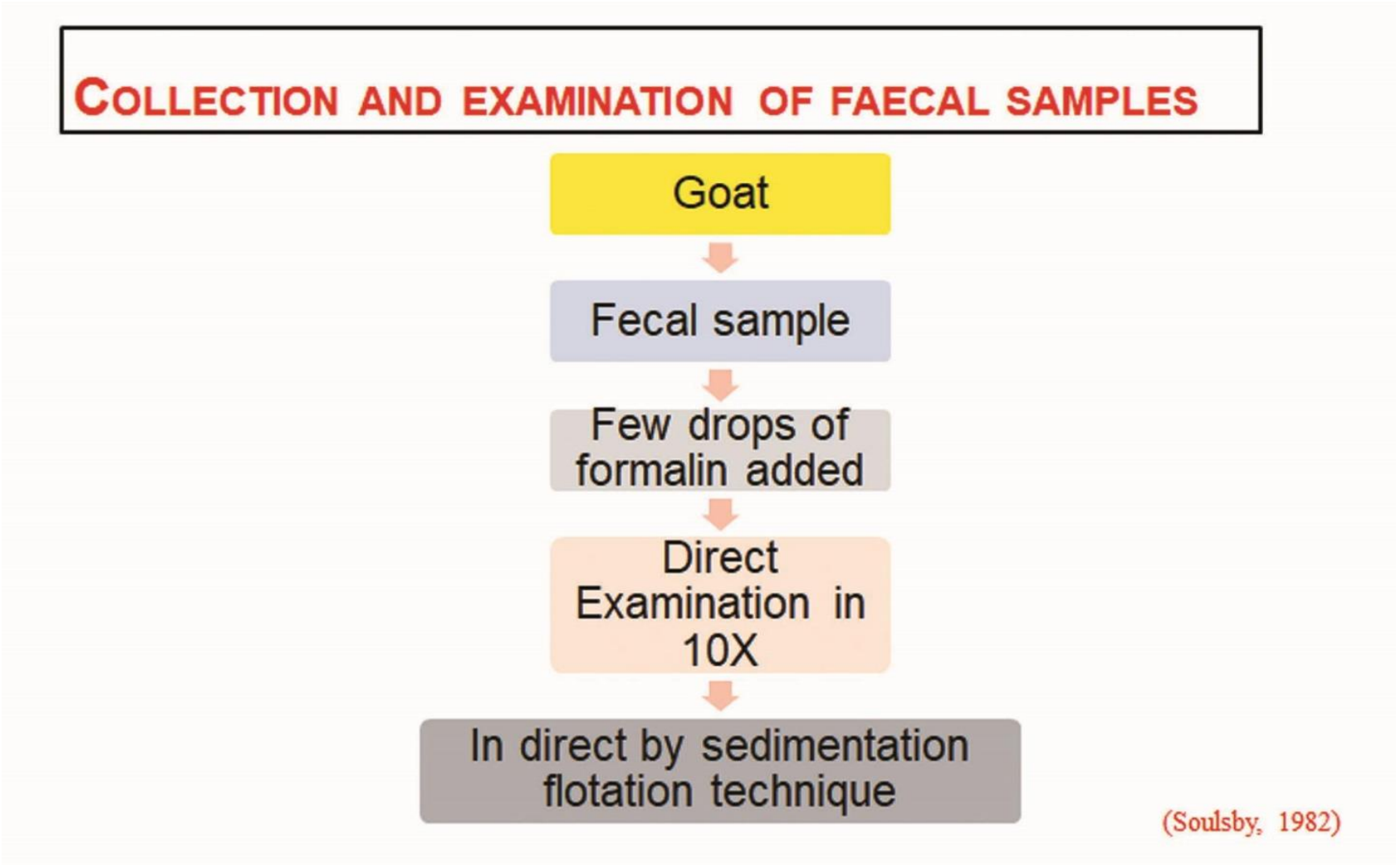


Fig. – 07 Collection And Examination Of Faecal Samples

Fig. – 08 Collection Of Faecal Samples

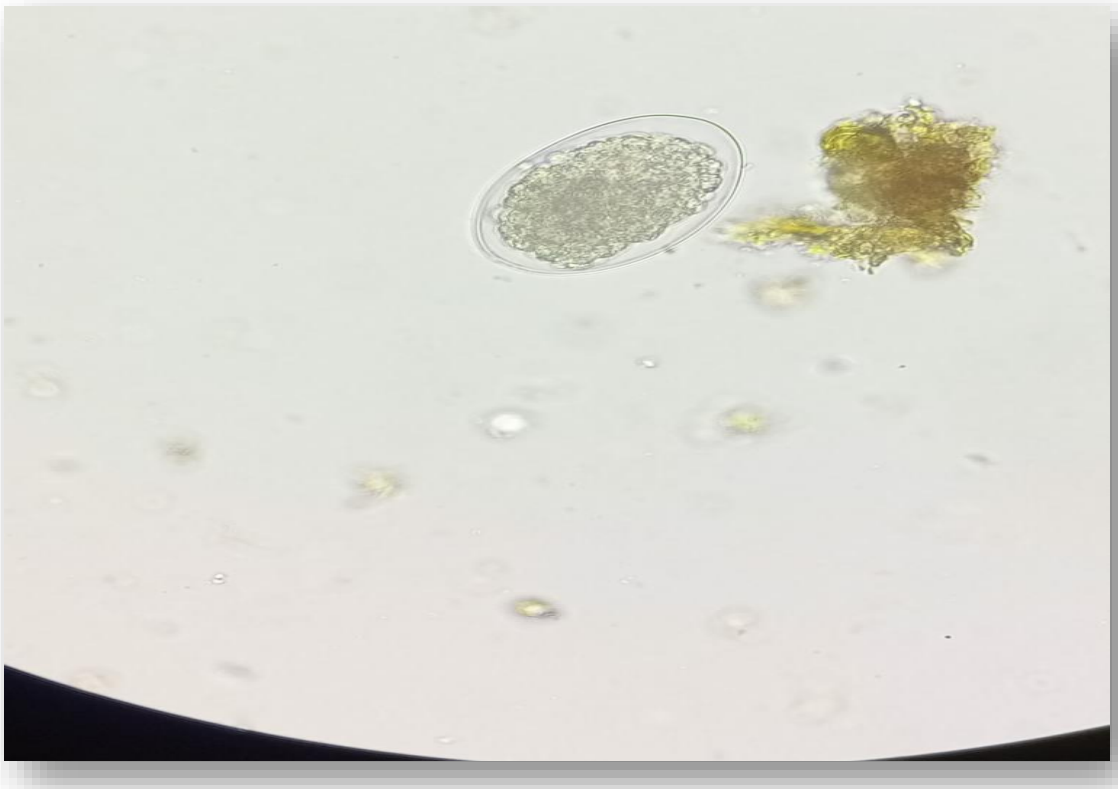


Fig. – 09 Identification Of Parasites (by microscopic examination)

Fig. – 10 Collection of blood sample

Fig. – 11 Haemato- Biochemical Examination

3.5.1 FOLLOWING HAEMATOLOGICAL PARAMETER WERE STUDIED

3.5.1.1 Hb (Hemoglobin)

The values of haemoglobin was determined by Sahli'shaemoglobinometer as per the protocol described by Schalm *et al*. (1985).

3.5.1.2 PCV (Packed cell Volume)

PCV was determined by using Wintrobe's hematocrit method as per technique described by Schalm *et al*. (1985).

3.5.1.3 TEC (Total Erythrocytes Count) & TLC (Total Leucocytes Count)

The value of TEC and TLC was determined as per method described by Schalm *et al*. (1985).

3.5.2 SERUM

About 5 ml of blood was collected in a clean, dry and sterilized plain vials. The vials was kept for 6-8 hrs. in a slant position and then centrifuged at 2000 r.p.m for 15 minutes to get the clean serum. The serum samples was kept at -20^0C. Serum was used for the estimation of following biochemical parameters :

- Total protein (gm/dl)
- Albumin (gm/dl)
- Globulin (gm/dl)
- Serum glucose (mg/dl)
- ALT (IU/L)
- GGT (IU/L)
- Na (Meq/l)
- K (Meq/l)
- Ca (mg/dl)
- P (mg/dl)

3.5.3 SERUM BIOCHEMICAL ESTIMATION

The harvested sera was analyzed for different biochemical parameters including Total serum Protein, serum albumin, serum Globulin, serum glucose, serum alanine amino

transferase (ALT), sodium(Na), Potassium (K), calcium (Ca), Phosphorus(P) by spectrophotometric methods.

3.6 THERAPEUTIC TRIALS

Therapeutic trials were conducted to determine the efficacy of herbal anthelmintic (*Carica papaya*) in comparison to chemical anthelmintic in an attempt to control the nematodes worms of goats. A total of 12 adult goats naturally infection with nematodal worms without any previous history of use of anthelmintic was randomly selected for this study.

3.7 PROCESSING OF PLANT MATERIAL

From selected plant seed material one cold aqueous extracts prepared. The seed was cleaned manually by removing the coarse impurity by hand and blowing the air to remove the dust and fine impurities, these were shade dried in laboratory and further dried in incubator at 39°c for 6 hours to remove moisture; if any. The dried seeds were grinded in electric grinder machine at room temperature to obtain coarse powder, which were used for extraction.

3.8 PREPARATION OF AQUEOUS HERBAL EXTRACTS

Fifty gm of powered sample was soaked in 400ml of distilled water and stirred every one hour interval initially for 2-3 times and left undistributed for 8 hours at room temperature and then filter through muslin cloth and separating funnel. Then after filtered was concentrated by using rotatory vaccum evaporator at 50-55ºC.

Fig. – 12 Processing of Plant Material

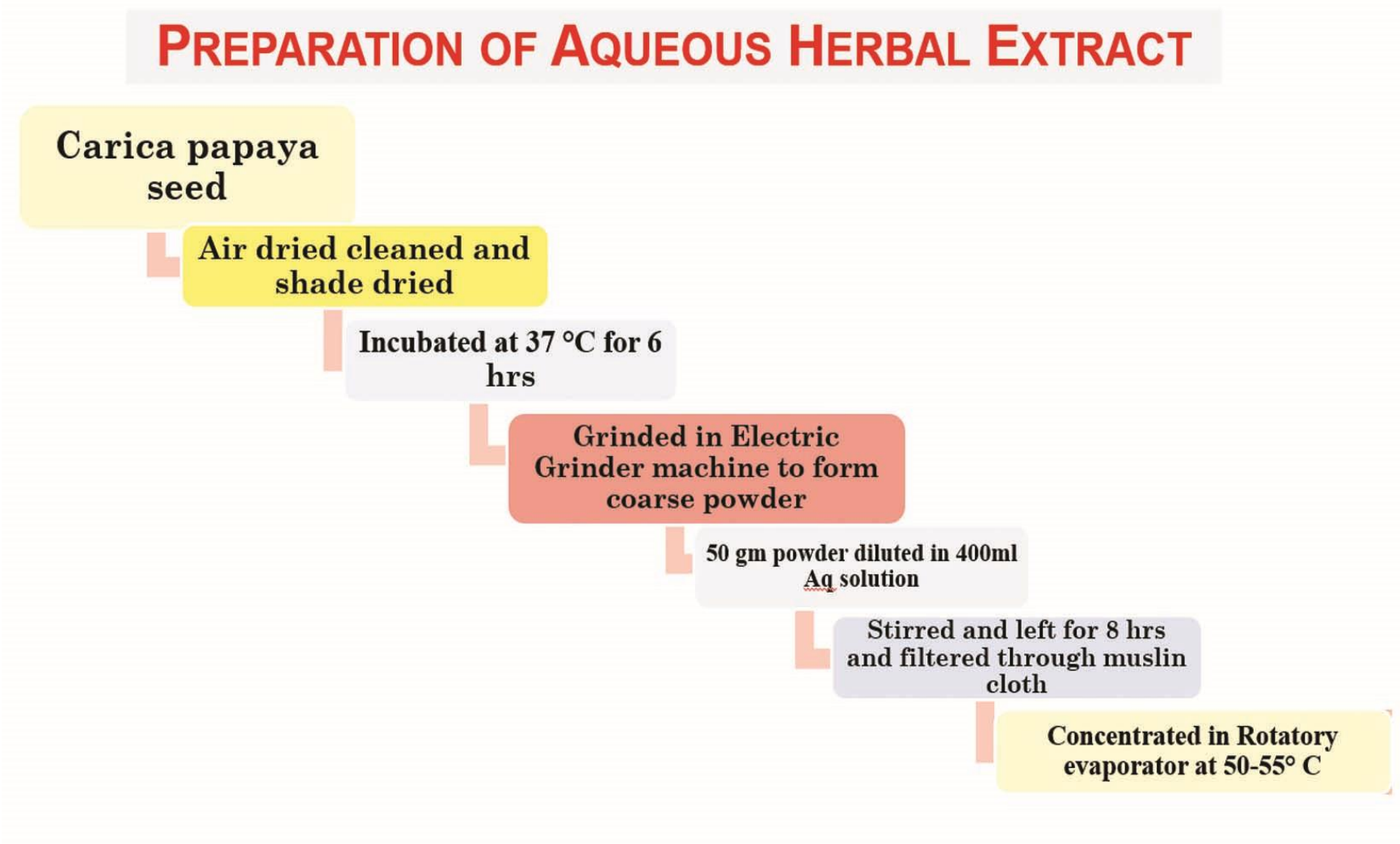


Fig. – 13 Preparation of Aqueous Herbal Extract

Fig. – 14 Preparation of Aqueous Herbal Extract

3.9 PRESERVATION OF EXTRACT

The extract residues were individually marked, kept in air tight glass petridishes in the cool and place at 4℃ (refrigerator) for further use.

3.10 DILUTION OF EXTRACTS RESIDUES

All the extracts residues and crude powder of each plants, different concentrations viz. 2.5 mg /ml, 5 mg/ml, 10 mg/ml, 15 mg/ml were prepared in NSS for evaluation of their anthelmintic activity.

3.11 COLLECTION OF WORM

Adult *Haemonchus contortus* was procured from the abomasum of freshly slaughtered goat. The abomasii were separated immediately with omasum from one side and small portion of duodenum from another side. Then after they were kept in wide mouth container having lukewarm normal saline and brought to laboratory. The abomasii were opened in large sized tray immediately after arrival. The motile worms were collected and clean with luke warm normal saline. The cleaned worms were transferred in beaker containing NSS at 37℃.

Fig. – 15 Dilution of Extract Residues

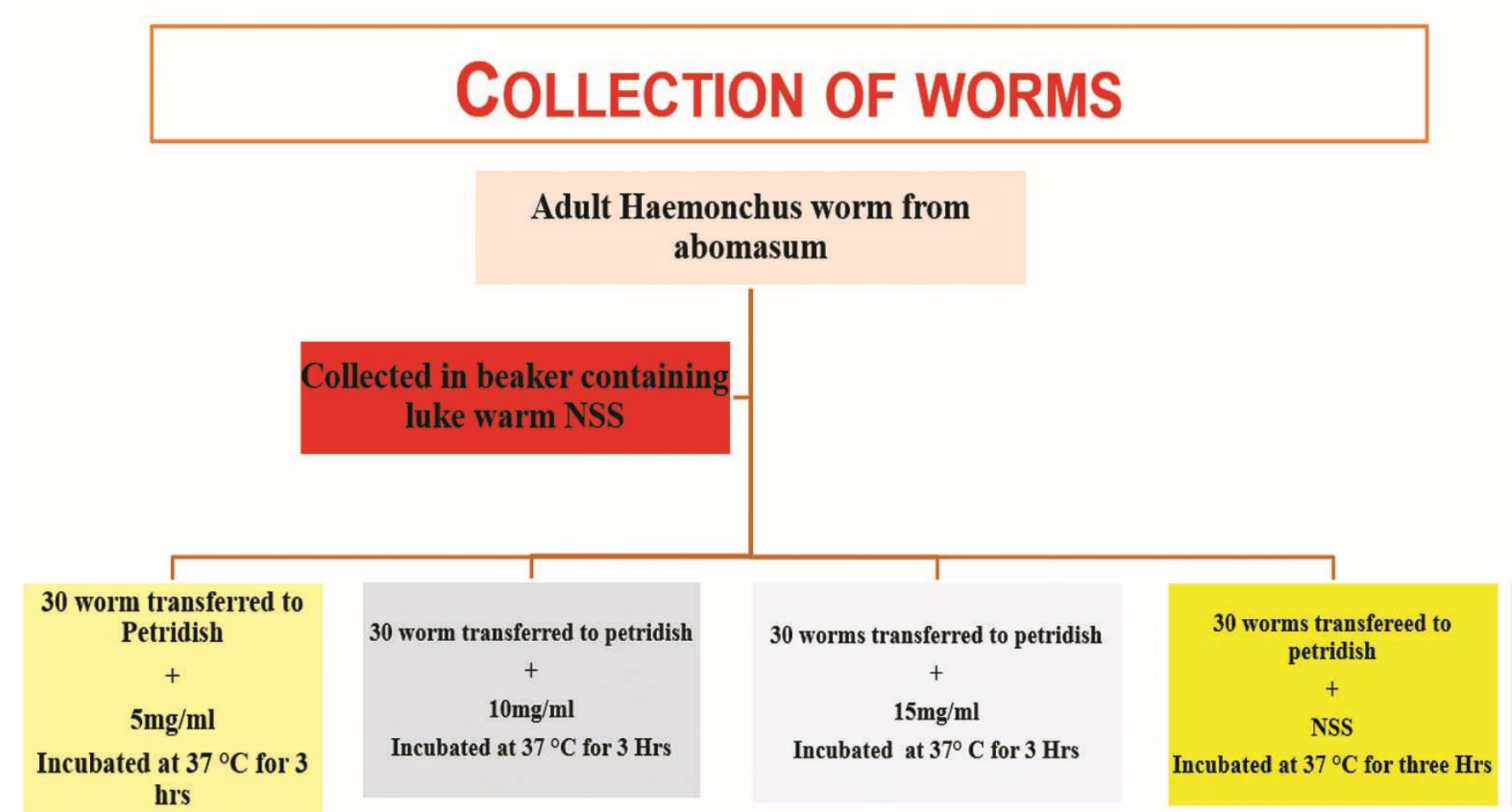


Fig. – 15 Observation for Estimation Anthelmintic Efficacy

Fig. – 16 Collection of Adult *Haemonchus contortus* Worm from Abomasum

3.12 OBSERVATION FOR ESTIMATION OF ANTHELMINTIC EFFICACY

30 adult *H. contortus* were taken in each small petridishes having different dilutions of test extract in NSS. Total volume of each petridishes was kept on 15ml. Exclusive 15 ml NSS was taken as control. It was then incubated at 37 c for 3 hours and number of live and dead adult worms were counted at 1hr, 2hr and 3hrs. Interval. The non-motile (dead) worms were counted and the percentage was calculated. The minimum lethal time for all the 30 worms in each extract was recorded. The corrected mortality for each extract was calculated by taking into account the mortality of worms, if any, in the NSS.

3.13 *IN-VITRO* TRIAL EVALUATION OF ANTHELMINTIC ACTIVITY OF PLANT EXTRACT RESIDUES

Corrected mortality was calculated as per the formula given by Sangwan and sangwan (1988).

Corrected mortality= Total mortality – control mortality X 100

3.14 *IN VIVO* - TRIAL

The experimental Goats were randomly divided into two groups T_1 and T_2. Another group T will be kept as positive control. The group T1 were treated by closantel (10 mg/kg body wt.) as single dose and group T2 were treated by Aq. Extract of *Carica papya* seed extract @ 15 mg/kg b.wt./goats.

Fig. – 17 *In – vitro* trial in Laboratory

Fig. – 18 Dosing of aq. Herbal Extract (*In- vivo* trial)

3.15 EFFICACY OF THE DRUGS

The efficacy of the drugs were assessed on the basis of percent reduction in faecal egg count (EPG), restoration of haemogram and different bio-chemical parameters, absence of clinical signs and improvement in the general condition after treatment.

The percent reduction in faecal Egg Count (EPG) was calculated by the formula as given below:

3.16 EGG PER GRAM

EPG of faeces was determined before treatment from all the faecal samples of two district.

Also, in a clinical trial group of 6 goats, EPG was determined (pre-treatment) and after 7^{th} day post treatment by Mc-Master technique.

3.17.1 METHOD OF EPG

Mc Master counting chamber is made of two glass, separated by 3 or 4 narrow transversely placed strips of glass 1.5 mm thick, so that 2 or 3 spaces of 1.5 mm depth are obtained between the two slides. On the under surface of the upper slide an area of 1 cm^2 is ruled over each space. The volume under this ruled area will therefore be 0.15 ml.

3.17.2 PROCEDURE

- Weigh 2g of faeces and 30 ml water in a container.
- Mix (stir) the contents thoroughly with a glass rod and make homogenize solution.
- Filter the faecal suspension through a tea strainer into centrifuge tube.
- Add 30 ml of saturated salt solution in filtered faecal fluid and mix well.
- Fill the chamber of Mc Master slide with solution by the help of pipette.
- The egg will float and adhere to the under surface of the upper slide of each chamber.
- Count number of eggs or oocysts in one chamber under microscope and multiply number of eggs under etched area by 100 or number of eggs in two chambers and multiply by 50 to arrive at the number of eggs per gram of faeces (EPG).

Eggs per gram (EPG) = Number of eggs in one (or two) chambers x 100 (50)

3.18 STATISTICAL ANALYSIS

All results were expressed as mean ± S.E.M. Statistical analysis were conducted to determine the difference among the groups at the same sampling time by using ANOVA, post-hoc Tukey's test with general linear models in SPSS 16. While, the comparison among the values within the same group at different time intervals was analyzed by the repeated measures approach using ANOVA with mixed linear models in SPSS 16. P values less than 0.05 were considered significant.

RESULTS

The present study in goats suffering from Hematophagus nematodes and its therapeutic management by herbal anthelmintic was conducted in two phase i.e in the first phase survey study was done in two district of Bihar (Patna and Muzzafarpur). Two blocks and two villages from each district were selected for sample collection faecal samples of 200 goats collected during the period July 2020 to December 2020 from Patna and Muzzafarpur district. Famacha score technique was applied in field condition to assess the anaemia in goats.

4.0 PREVALENCE

The faecal samples of 200 goats irrespective of age, sex and breed were collected from two districts of Bihar viz Patna and Muzaffarpur. All the samples were brought to Department of Veterinary Medicine and examined. The overall 30% goats in Patna district and 28 % goats in Muzzafarpur district were found to be positive for *Haemonchus contortus* parasite. The detail of the finding in given in table No-01.

The present study reveals the presence of other parasites along with *Haemonchus contortus*. The presence of other parasites like Trichuris, Amphistomses, liver fluke etc. were very low therefore not included in the result.

The FAMACHA Score technique was applied in the field condition and the mean FAMACHA score in two districts were found to be 3.015.

The Egg per gram (EPG) of positive samples along with Hb concentration alone. The overall EPG of goats suffering from Haemonchus were level of goats suffering from Haemonchosis were found to be 834.000.

Table No. – 01: Prevalence of rate of *Haemonchus contortus* infection

Name of District	Total sample collected	Positive sample	Prevalence Rate (%)
Patna	100	30	30
Muzzaffarpur	100	28	28

4.1 SYMPTOLOGY

The most important clinical signs in all the goats suffering from *Haemonchus contortus* were blanched mucous membrane, weakness, loss of growth, diarrhoea. The diarrhoeic faeces were fluid to semi – solid in consistency with light black to tarry coloured.

The conjunctival mucous membrane were found to be complete white to light pinkish in most of the cases and swelling of face and develop oedema were the main findings.

The addition to the above clinical signs loss of appetite, acute mortality, loss of weight, stunted growth, generalized weakness and emaciation, dehydration, moderate hypothermia were also found. The history of all affected goats were grazing in the field condition.

4.2 CLINICAL PARAMETERS

4.2.1 FAMACHA Score Card

The average FAMCHA score card of goats in two districts of Bihar was found to be 3.015. The FAMACHA score varies from 3 to 5 in goats kept under semi – intensive system of farming.

4.2.2 Mucous Membrane

The mucous membrane coloured of goats in field varies from whitish to light pinkish in colour.

4.2.3 Temperature (°F)

The temperature of goats suffering from Haemonchosis were normal to slightly low. Only in few cases the body temperature were found to be high. The mean temperature was found to be 103±0.07.

4.2.4 Pulse (per minute)

The mean pulse rate of goats suffering from Haemonchosis was found to be (65-66/minute).

4.2.5 Respiration (per minute)

The mean of respiration of goats suffering from Haemonchosis was found to be 25±0.6 (22-24/minute).

4.3 CLINICAL TRIALS

For the clinical trials study, 18 goats were selected at Instructional Livestock Farm. Out of 18 goats, 6 goats were kept as healthy control (T) and other 6 goats were kept as treatment group T1 and T2. All the clinical parameters were studied at 0, 7 and 14 days interval period. The clinical trials were also divided into two major group i.e. *In vivo* and *In vitro* trial.

4.3.1 *IN VITRO* - TRIAL

In vitro trial of chemical and herbal anthelmintic were done in the laboratory of veterinary medicine. Closantel anthelmintic was chosen as chemical anthelmintic and as per literature available. It was used in treatment group T1 In vitro. For this 6 goats abomasum was brought to the laboratory and the adult Haemonchus petridish in normal saline solution. This group was kept as control. Similarly, 30 adult worms from each abomasum were collected in five group of petridish for the In vitro study of closantel and four concentration of herbal anthelmintic.

4.3.1.1 HERBAL ANTHELMINTIC

Carica papaya seed was selected for herbal anthelmintic. The seed was dried and crushed to powder form. The herbal (aqueous) extract of *Carica papaya* seed was obtained and dried to form extract. Four different concentration of seed extract were made i.e 2.5 mg/ml, 5 mg/ml, 10 mg/ml and 15 mg/ml.

In vitro trial of anthelmintic of *Carica papaya* extract and closantel were studied The petridish along with 30 adult worms were tried with different dilutions of test and closantel and

incubated at 37°c for 3 hours and number of live and dead adult worms were counted at 1 hr, 2 hr, and 3 hrs. interval. The corrected mortality for each extract was calculated and the perusal of table no. 19, reveals that closantel @ 10 mg/ml had corrected mortality 26, 28 and 25 at 1 hr, 2 hr, and 3 hrs. respectively with to control 0, 2 and 5 in the same interval period.

Different concentration of *Carica papaya* aq. Seed extract @ 2.5 mg/ml, 5 mg/ml, 10 mg/ml and 15 mg/ml were tried on four different group petridish and the results is depicted in table no. 19, Among different concentration the corrected mortality of aq. Extract 15 mg/ml were found to be 29, 27 and 25 at 1 hr, 2hrs and 3 hrs of trial with respect to control in the same interval of time.

Thus on the basis of In vitro trial and corrected mortality percentage the herbal extract of 15 mg/ml concentration was selected for further In vivo study along with closantel @ 10 mg/ml b.wt.

4.3.2 *IN VIVO* - TRIAL

4.3.2.1 FAMACHA SCORE

FAMACHA score system measuring from 1 to 5 were used to access the degree of anaemia and severity in goats in all three groups i.e. two treatment group and one control group.

Perusal of table no. 02 and fig. 19 shows that the mean FAMACHA score in non – infected varies from 1.33± 0.21 to 1.66 ± 0.21. Which differ non – significantly in different days of treatment. Significantly, higher ($p<0.05\%$). Mean FAMACHA score were recorded on 0 days in T1 (3.33 ± 0.21) and T2 (3.16 ± 0.30), which also differ significantly among infected treatment group. The post treatment values with each of the drug on 7^{th} and 14^{th} days of treatment decreases significantly on 7^{th} and 14^{th} days of treatment. Significantly lowest 1.83 ± 0.30 FAMACHA score was found in T2 group on 14^{th} day which differ non – significantly from T1 (2.00± 0.25) but significantly higher from control T (1.33 ± 0.21). The post treatment values with each drug came back to the level of healthy control with maximum improvement in T2 (*Carica papaya* group).

Table No. – 02: Mean ± S.E of FAMACHA Score in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	1.667 ± 0.211^{ax}	3.333 ± 0.211^{aby}	3.167 ± 0.307^{acz}
7	1.333 ± 0.211^{ax}	2.500 ± 0.224^{aby}	2.333 ± 0.211^{ac}
14	1.333 ± 0.211^{ax}	2.000 ± 0.258^{bay}	1.833 ± 0.307^{caz}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

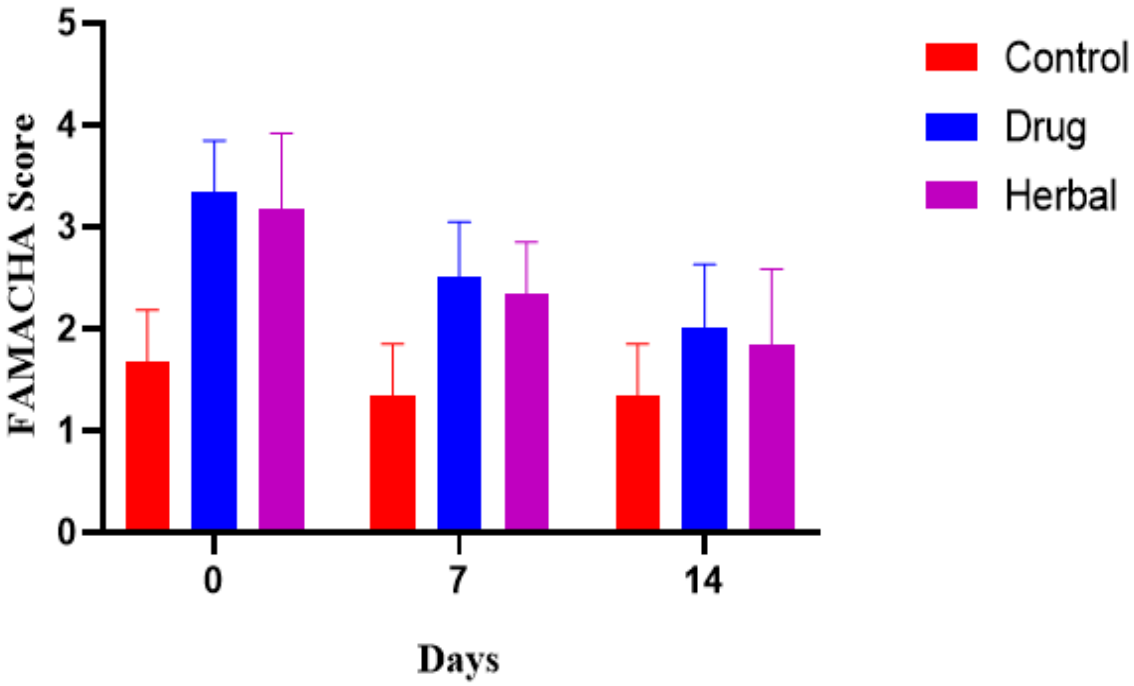


Fig. – 19: Mean ± S.E of FAMACHA Score in different treatment group

4.3.2.2 EGG PER GRAM (EPG)

The mean EPG of goats suffering from Haemonchosis were compared with the healthy control group (T). The mean EPG values of infected group (treatment group) T1 (1000.00 ± 57.73) T2 (950.00 ± 111.80) varie significantly ($p<0.05$) before treatment from control (250.33 ± 21.08) significant improvement in the mean EPG in both treatment group T1 (533.33 ± 33.00), T2 (483.33 ± 60.09) and T1 (383.33± 47.72), T2 (283.33 ± 30.73) were observed on 7^{th} and 14^{th} days of treatment. The post treatment values with each of the drug came back to the level of the healthy control (table no. 03 and fig. 20).

Analysis of variance revealed highly significance ($p<0.05$) different within the groups.

Table No. – 03 Mean ± S.E of EPG in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	250.000 ± 22.362^{ax}	1000.000 ± 57.735^{bx}	950.000 ± 111.803^{cx}
7	233.333 ± 21.082^{ax}	533.333 ± 33.333^{by}	483.333 ± 60.093^{cyz}
14	233.333 ± 21.082^{ax}	383.333 ± 47.726^{axz}	283333 ± 30.732^{az}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

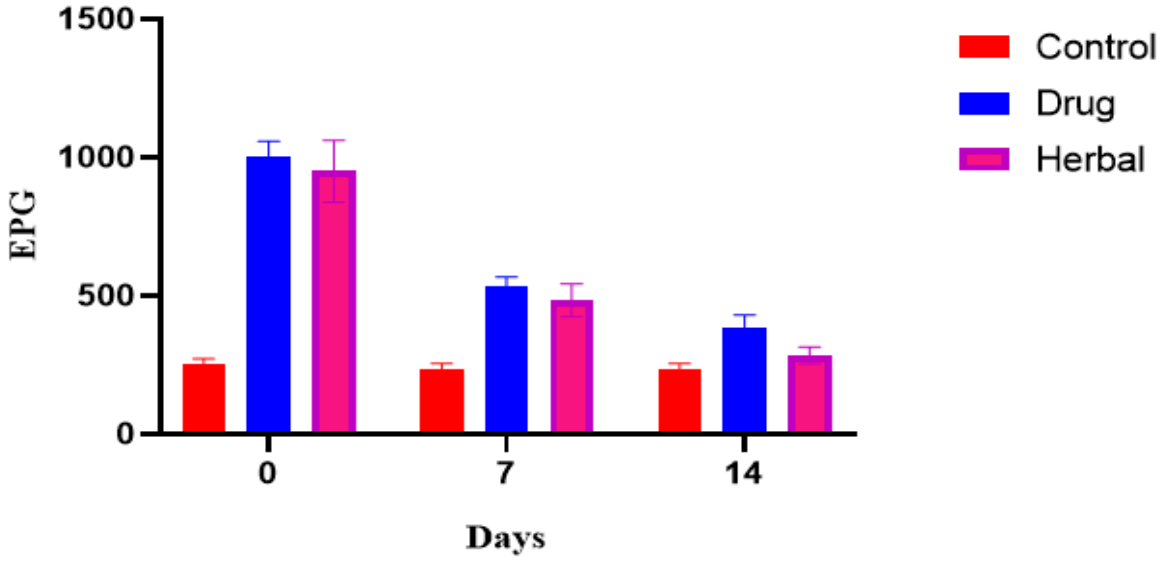


Fig. – 20: Mean ± S.E of EPG in different treatment group

4.4 HAEMATOLOGICAL OBSERVATIONS

4.4.1 HAEMOGLOBIN LEVEL (Hb %)

Mean values along with their SE of Hb of different treatment and within treatment groups of goats have been given table no. 04 and fig. 21.

The mean Hb values in goat under different treatment groups, viz. healthy control, closantel and *Carica papaya* pre – and post treatment were recorded to be 4.08 ± 0.57 in T1 and 5.83 ± 0.24 in T2 which vary significantly ($p<0.05$) lower than the control healthy T (11.06 ± 3.8). Significantly improvement in mean Hb level observed at different time interval in both treatment group. The post treatment values of each treatment groups came back towards normal but vary significantly lower from the healthy control on 14th days of treatment. Maximum improvement in Hb (9.33± 0.33) observed in T2 group on 14th days of treatment.

Table No. – 04 Mean ± S.E of Hb% in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	11.067 ± 0.388^{ax}	4.083 ± 0.597^{bx}	5.833 ± 0.247^{cx}
7	11.217 ± 0.394^{ax}	5.862 ± 0.320^{by}	8.000 ± 0.289^{cy}
14	11.350 ± 0.357^{ax}	7.500 ± 0.365^{bz}	9.333 ± 0.333^{cz}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

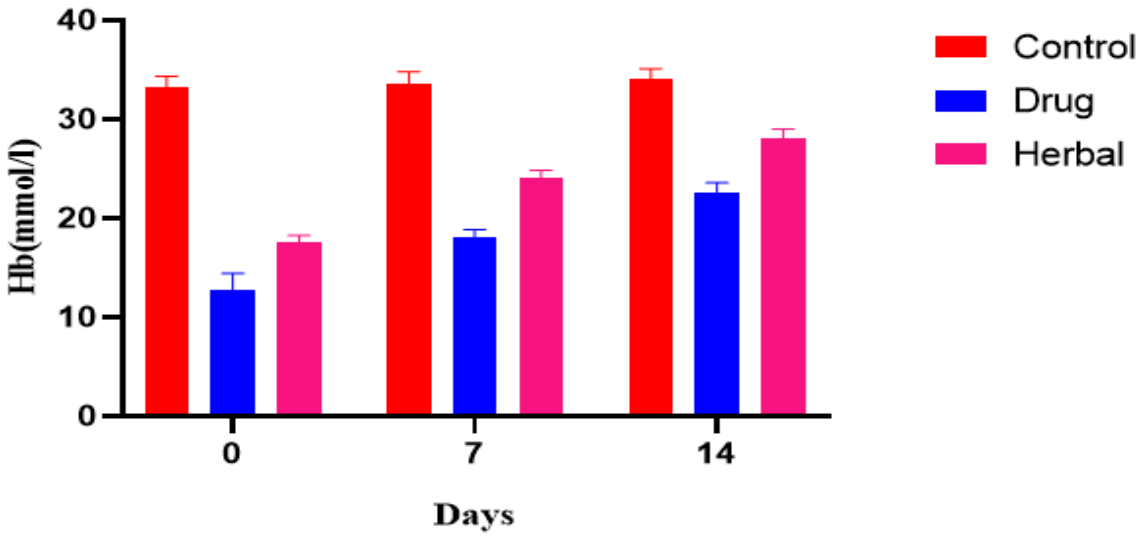


Fig. – 21 Mean ± S.E of Hb% in different treatment group

4.4.2 PACKED CELL VOLUME (PCV)

The mean values along with their SE of PCV (%) of different treatment groups and in different type interval of goats suffering from Haemonchosis have been given in the table no. 05 and fig. 22.

The mean value of PCV pre treatment (0 days) were recorded to be significantly lower ($p<0.05$) than control. Significant ($p<0.05$) improvement in PCV recorded on 7^{th} and 14^{th} days of treatment in T2 group, while in T1 group significant improvement was observed on 14^{th} day of treatment (22.50 ± 1.095).

Analysis of variance (table no. 03) exhibited significant difference between the different treatment groups vs control. However, improvement in PCV value have been observed in both treatment group on 14^{th} days of treatment.

Table No. – 05 Mean ± S.E of PCV (gm %) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	33.200 ± 1.164^{ax}	15.250 ± 1.055^{bx}	17.500 ± 0.742^{cbx}
7	33.650 ± 650^{ax}	18.000 ± 0.866^{bx}	24.000 ± 0.866^{cy}
14	34.050 ± 1.070^{ax}	22.500 ± 1.095^{by}	28.000 ± 1.000^{cz}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

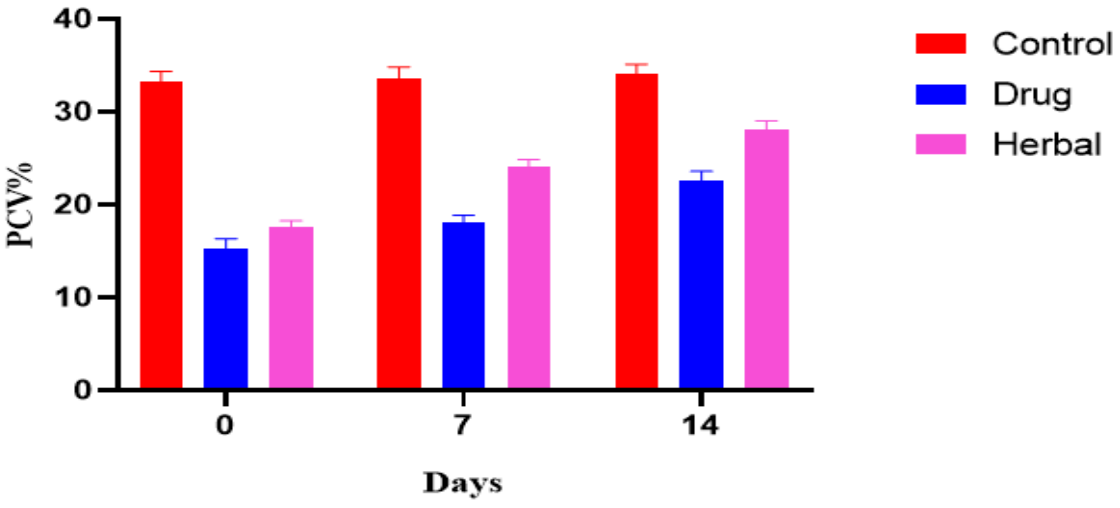


Fig. – 22 Mean ± S.E of PCV (gm %) in different treatment group

4.4.3 TOTAL ERYTHROCYTE COUNT (TEC) (x 10^6/µl)

Mean values along with SE of TEC(x 10^6/µl) of different treatment groups and within the treatment group have been given in table no. 06 and fig. 23.

The mean total erythrocyte, pre treatment varies significantly ($p<0.05$) from the healthy control and found to be lower in T1 (2.46 ± 0.18) and T2 (3.41± 0.53) vs control (5.33± 0.19). Significant improvement the mean total erythrocyte found on 14th day. The post treatment value of mean erythrocyte count in T1 group was found to be 3.75 ± 0.18 and 4.66 ± 0.16. Significantly higher and better improvement in mean TEC was observed in T2 with respect to T1.

Table No. – 06 Mean ± S.E of TEC (10^6 /µl) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	5.533 ± 0.194^{ax}	2.467 ± 0.189^{bx}	3.417 ± 0.531^{cx}
7	5.600 ± 0.197^{ax}	2.300 ± 0.163^{bx}	3.917 ± 0.139^{cxy}
14	5.658 ± 0.172^{ax}	3.750 ± 0.183^{by}	4.667 ± 0.167^{cy}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

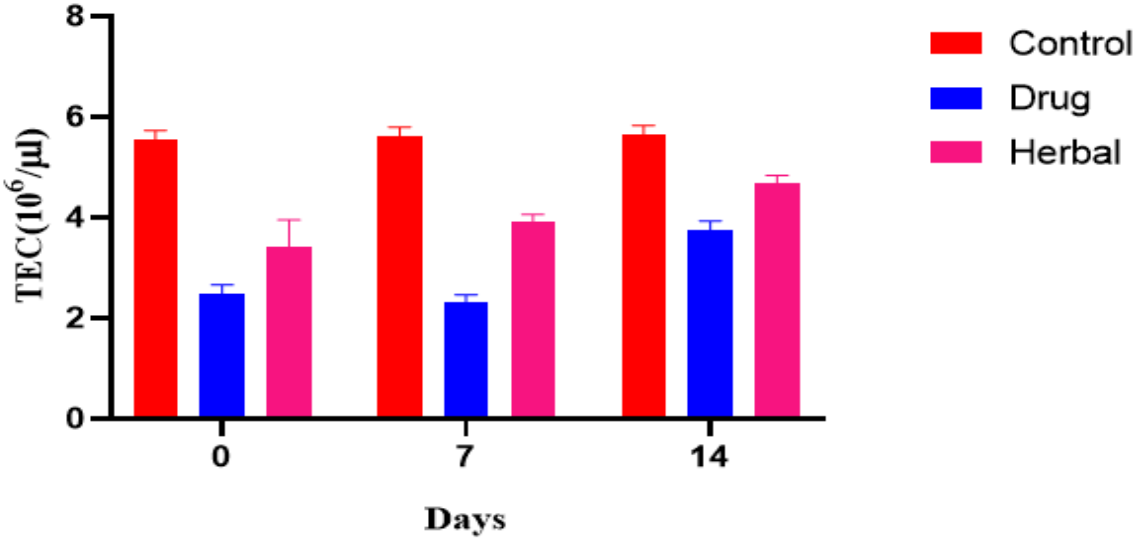


Fig. – 23 Mean ± S.E of TEC (x 10^6/µl) in different treatment group

4.4.4 TLC (x 10^3/µl)

Perusal of table no. 07 and fig. 24 shows that the significantly higher mean TLC were observed in group T1 (10.76± 0.04) and T2 (10.73 ± 0.06) pre treatment with respect to control group T (9.15 ± 0.19). Significant ($p<0.05$) lowering of mean TLC was observed on 7th and 14th days of treatment. The post treatment value of TLC came back to normal on 14th days and the post treatment mean TLC in T1 (9.53 ± 0.67) and T2 (9.41± 0.13) vary non – significantly with the control and among themselves.

Table No. – 07: Mean ± S.E of TLC (10^3/µl) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	9.150 ± 0.198^{ax}	10.767 ± 0.049^{bx}	10.733 ± 0.067^{cbx}
7	9.383 ± 0.130^{ax}	10.033 ± 0.061^{by}	10.000 ± 0.063^{cby}
14	9.483 ± 0.095^{ax}	9.533 ± 0.067^{az}	9.417 ± 0.130^{az}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

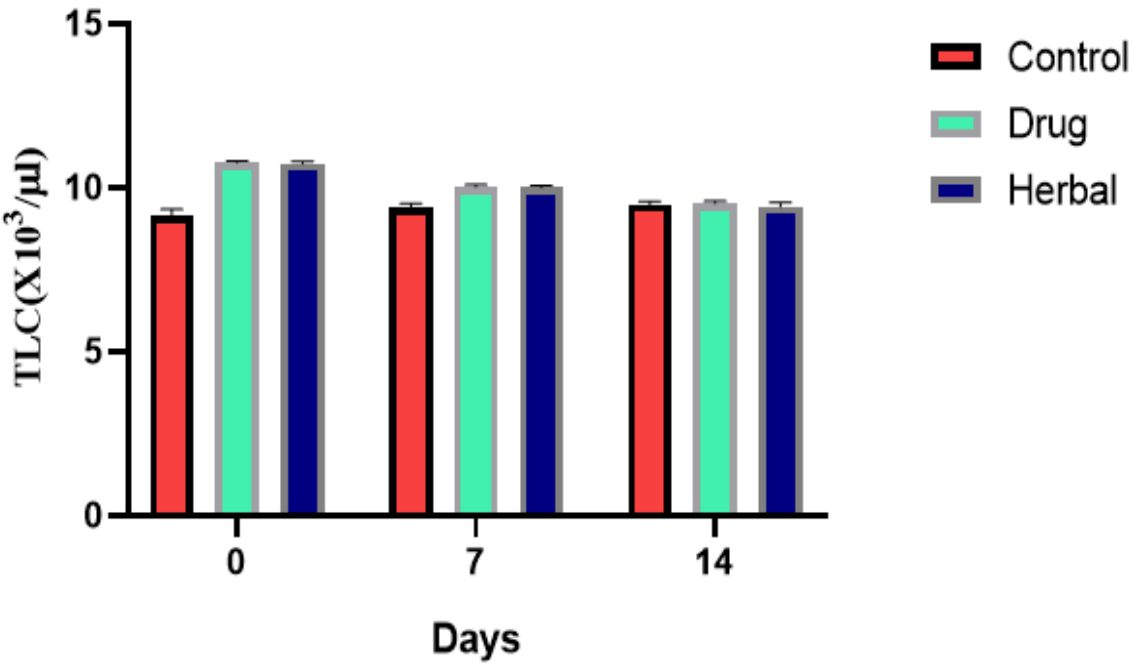


Fig. – 24 Mean ± S.E of TLC (x 10^3/µl) in different treatment group

4.5 BIOCHEMICAL PARAMETERS

4.5.1 TOTAL PROTEIN (gm /dl)

Lower mean Total protein were observed in group T1 and T2 from the control group T (7.93± 0.29) pre treatment. Significantly lower ($p<0.05$) mean total protein level was found in T1 (5.46± 0.78) than T2 (7.57± 0.28) and control T (7.93± 0.30) which vary non – significantly among themselves. Non - significant variation in mean total protein level observed on 7th and 14th days of treatment, which vary non- significantly among themselves and from the control group (Table no. 06 and fig. 25).

Table no. – 08: Mean ± S.E of Total Protein (gm/dl) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	$7.933 + 0.295^{ax}$	$5.462 + 0.783^{bx}$	$7.572 + 0.285^{ax}$
7	$7.933 + 0.309^{ax}$	$6.992 + 0.564^{ax}$	$7.710 + 0.577^{ax}$
14	$7.883 + 0.324^{ax}$	$7.710 + 0.577^{ay}$	$8.973 + 0.520^{ax}$

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

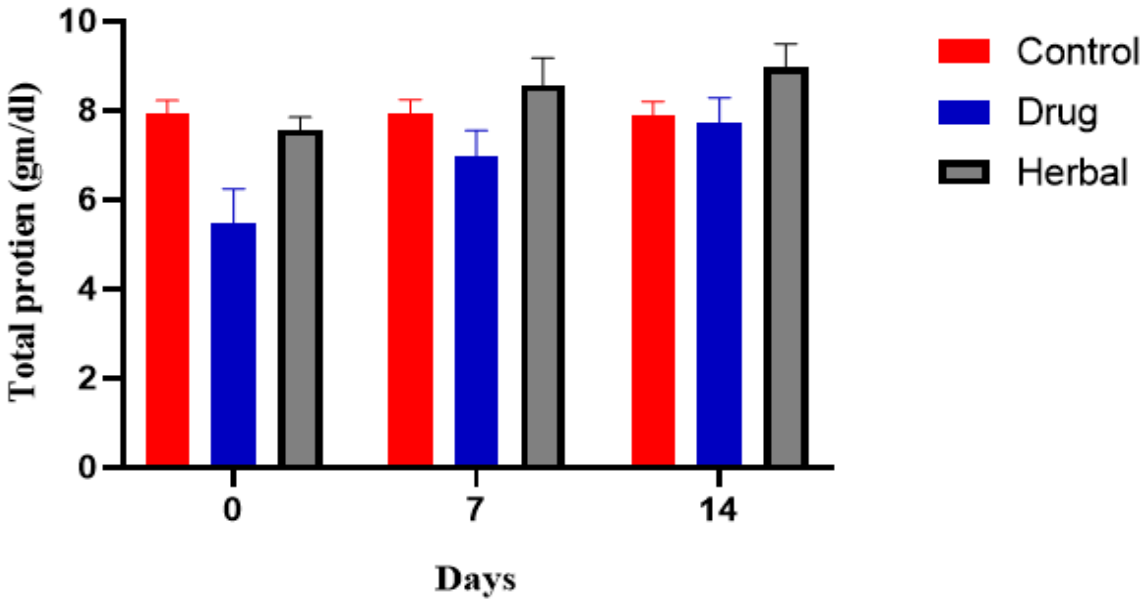


Fig. – 25 Mean ± S.E of Total Protein (gm/dl) in different treatment group

4.5.2 ALBUMIN (gm/dl)

Mean values along with SE of mean albumin level of different treatment groups of goats suffering from Haemonchosis have been given in table no. 09 and fig. 26, respectively.

The mean albumin value differ significantly among healthy control (3.68 ± 0.125) and pre treatment group T1 (1.95± 0.23) and T2 (1.65 ± 0.23). Significant improvement in mean albumin level observed in T1 group (3.49 ± 0.40) on 14th and in T2 (3.570 ± 0.33) on 7th days of post treatment. The post treatment values with each of the drug came back to the level of healthy control (table no. 09and fig. 26).

Table No. – 09 Mean ± S.E of Albumin (gm/dl) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	3.683 ± 0.125^{ax}	1.950 ± 0.230^{bcx}	1.950 ± 0.230^{bcx}
7	3.717 ± 0.135^{ax}	2.750 ± 0.395^{bcxz}	3.570 ± 0.331^{acyz}
14	3.617 ± 0.178^{ax}	3.490 ± 0.403^{ayz}	3.501 ± 0.222^{az}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

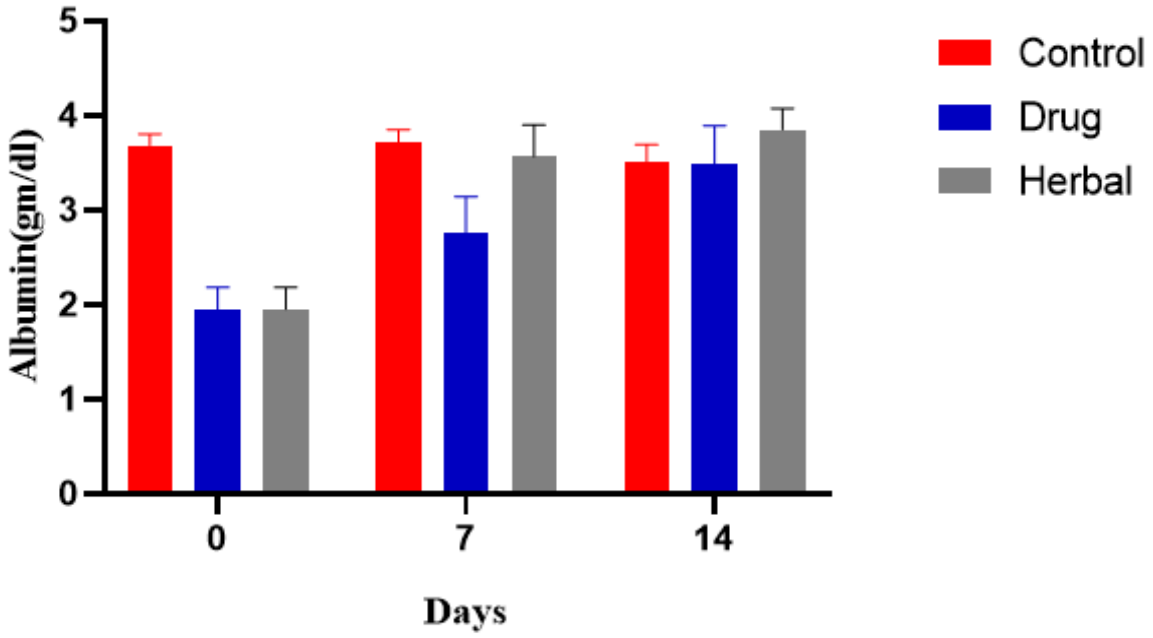


Fig. – 26 Mean ± S.E of Albumin (gm/dl) in different treatment group

4.5.3 GLOBULIN (gm/dl)

The mean globulin level in goats pre treatment (0 days) were found to be 4.983 ± 0.162 in T(control), 3.80 ± 0.36 (T1) and 4.81 ± 0.53 in (T2) group. Non - significant variation were observed on 0 days. The post treatment values with each of the drug came back to normal level of healthy control and also vary non – significantly on 14th day of post treatment (table no. 10 And fig. 27).

Table No. – 10: Mean ± S.E of Globulin (gm/ dl) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	4.983 ± 0.162^{ax}	3.805 ± 0.368^{ax}	4.815 ± 0.536^{ax}
7	5.100 ± 0.234^{ax}	4.242 ±0.657^{ax}	4.442 ±0.735^{ax}
14	4.983 ± 0.172^{ax}	4.220 ± 0.635^{ax}	5.120 ± 0.538^{ax}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

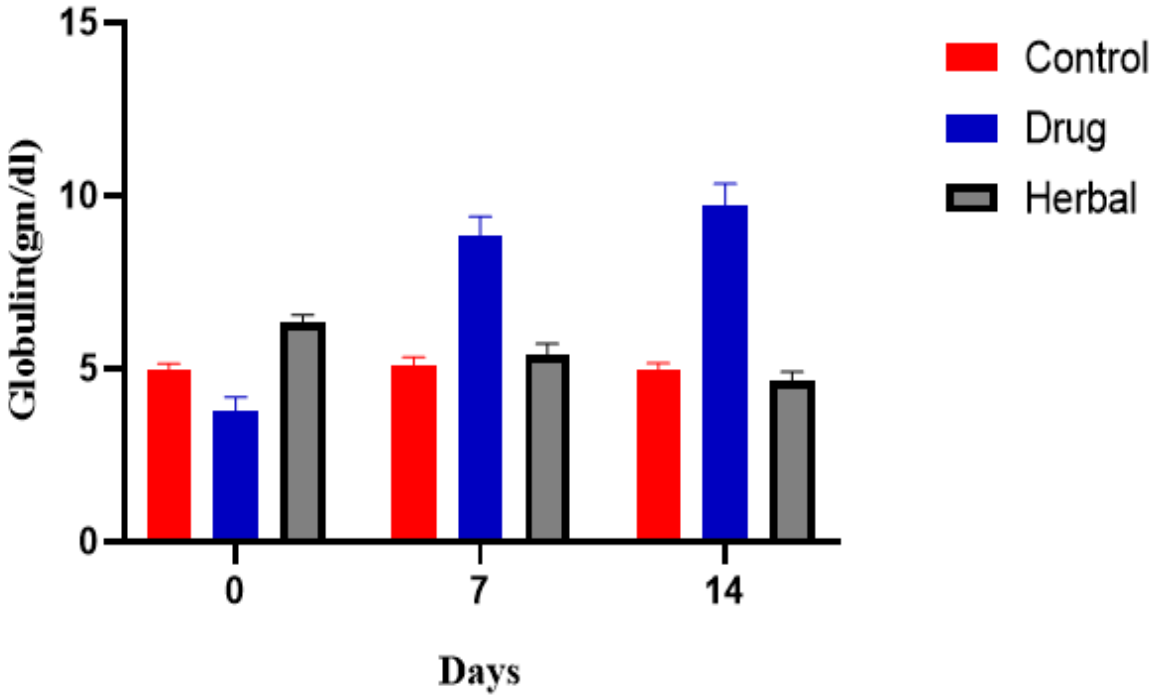


Fig. – 27 Mean ± S.E of Globulin (gm/dl) in different treatment group

4.5.4 GLUCOSE (mg/dl)

The mean glucose (mg/ml) in different treatment group i.e T1, T2 and T (control) were 35.74 ± 2.86, 45.00± 1.91 and 55.16 ± 2.22 mg/ml, respectively. Significantly lower mean glucose value were found in T1 with respect to control and T2 group pre treatment. Non – significant but improvement in mean glucose level were observed in both treatment groups on 7^{th} and 14^{th} days of post treatment. The post treatment values with each drug T1(44.40 ± 2.64) and T2 (46.20± 1.70) found increased but vary significantly lower than the control (T) mean level of glucose (54.00 ± 1.93) on 14^{th} days of post treatment (table no. 11 and fig. 28).

Table no. – 11: Mean ± S.E of Glucose (mg/dL) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	55.167 ± 2.227^{ax}	35.743 ± 2.864^{bx}	45.000 ± 1.915^{cx}
7	55.667 ± 1.820^{ax}	38.318 ± 2.695^{bcx}	44.195 ± 0.926^{cx}
14	54.000 ± 1.932^{ax}	44.403 ± 2.648^{bx}	46.207 ± 1.702^{bx}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

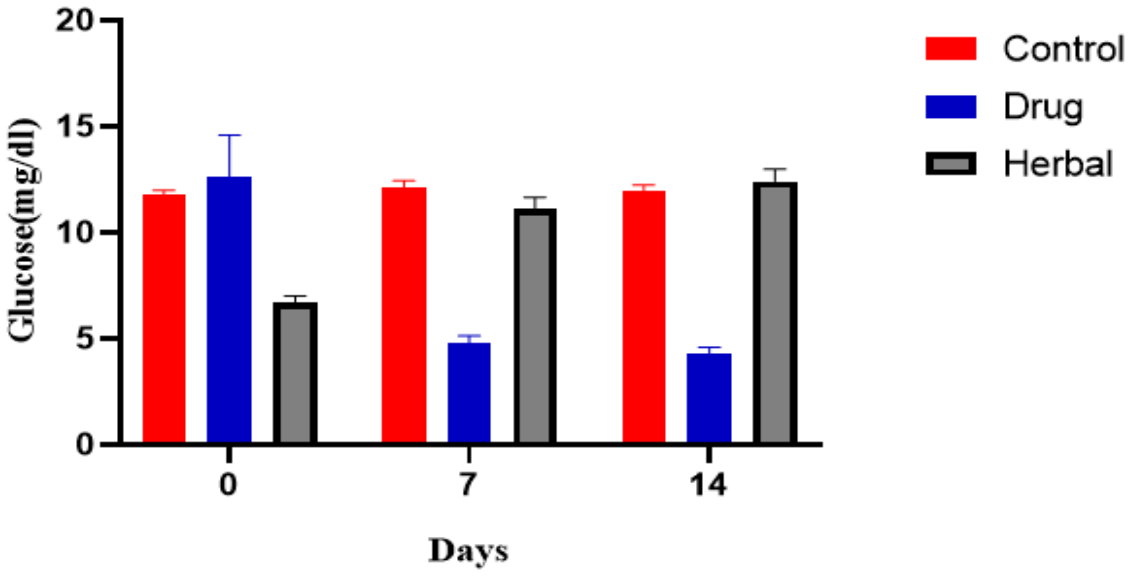


Fig. – 28 Mean ± S.E of Glucose (mg/dL) in different treatment group

4.5.5 SGPT (ALT) (IU/L)

Mean values along with their SE of ALT of different treatment group T1and T2 and healthy control (T) is given in Table no. 12 and fig. 29.

Perusal of the table shows that the ALT level was significantly higher in T2 group (52.33 ± 3.23) on 0 days with respect to T1 (43.16 ± 2.84) and T (41.16 ± 3.29) on pre treatment. The post treatment values of SGPT (ALT) in both treatment group becomes comparable to healthy control on 14th days of treatment. Non – significant improvement in SGPT level was observed in T2 (31.13± 0.67) followed by T1 group (35.92 ± 1.68).

Table No. – 12: Mean ± S.E of SGPT (IU/L) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	41.167 ± 3.293^{ax}	43.167± 2.845^{ax}	52.333± 3.23^{bx}
7	41.667 ± 3.293^{ax}	42.000± 2.745^{ax}	46.500± 2.184^{axz}
14	40.500 ± 2.975^{ax}	35.920± 1.683^{ax}	31.238± 0.678^{ay}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

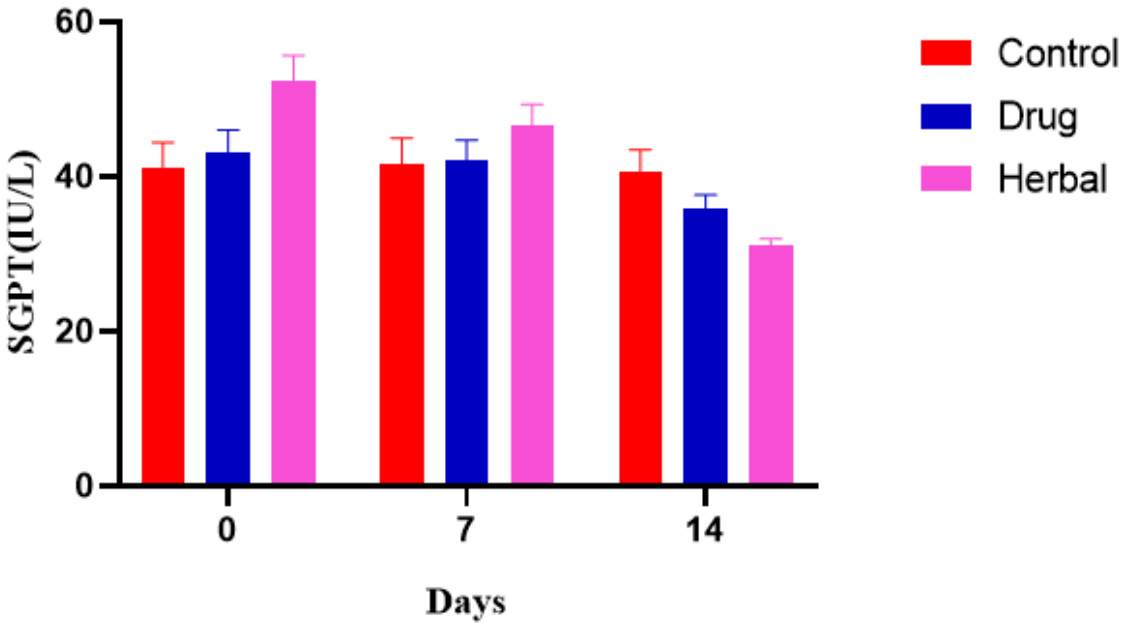


Fig. – 29 Mean ± S.E of SGPT (IU/L) in different treatment group

4.5.6 GGT (IU/L)

The mean value with SE of mean GGT in goats suffering from Haemonchosis is given table no. 13 and fig. 30.

The mean GGT values in goats under different treatment groups and control pre treatment vary significantly ($p<0.05$). Significantly higher mean GGT values were found T1 (38.00 ± 1.93) and (38.11 ± 2.13) with respect to control. Significant decrease in mean GGT were observed in both treatment group from 7^{th} days of treatment which vary non – significantly from 14^{th} days of treatment. The post treatment values with significantly lower value of GGT in group T2 (15.92 ± 1.13) from the control (22.33 ± 0.91).

Table No. –13 Mean ± S.E of GGT (IU/L) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	20.667 ± 2.201^{ax}	38.000 ± 1.932^{bcx}	38.618 ± 2.130^{cx}
7	22.000 ± 1.880^{ax}	24.482 ± 1.403^{ayz}	15.508 ± 1.780^{byz}
14	22.333 ± 0.919^{ax}	23.337 ± 0.682^{bz}	15.928 ± 1.132^{bz}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

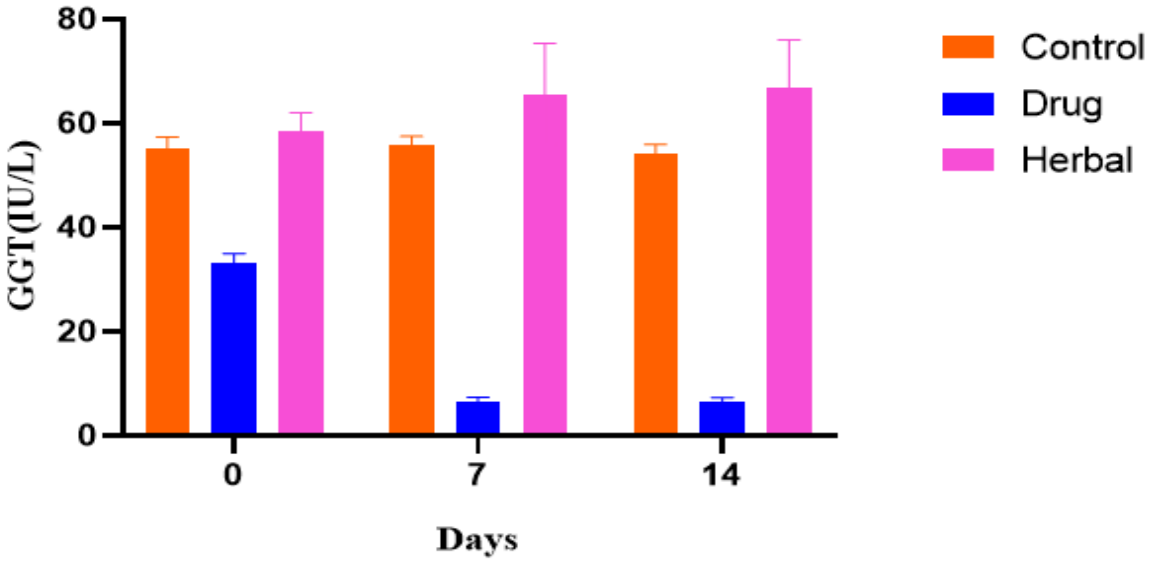


Fig. – 30 Mean ± S.E of GGT (IU/L) in different treatment group

4.5.7 Sodium (Na)

The mean value of sodium with SE in goats suffering from Haemonchosis with respect to control in pre treatment varies significantly ($p<0.05$). Significantly lower mean sodium were found in T1 (122.00 ± 0.57) and T2 (125.75 ± 9.8) respectively with the control group T (1.44 ± 4.11). Significant ($p<0.05$) improvement in mean sodium level was achieved in T1 (141.83 ± 0.60) on 7th days of treatment, while in T2 group significant improvement was noticed on 14th days of treatment. The post treatment value of both treatment came back to normal in days 14th which vary non – significantly among themselves and with control (Table no. 14 and fig. 31).

Table No. – 14: Mean ± S.E of Sodium (meq/L) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	144.500 ± 4.113^{ax}	122.000 ± 0.577^{bx}	125.755 ± 9.842^{bx}
7	144.750 ± 4.554^{ax}	141.833 ± 0.601^{y}	132.167 ± 0.833^{axy}
14	143.050 ± 3.519^{ax}	142.167 ± 0.792^{ay}	140.667 ± 0.494^{ay}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

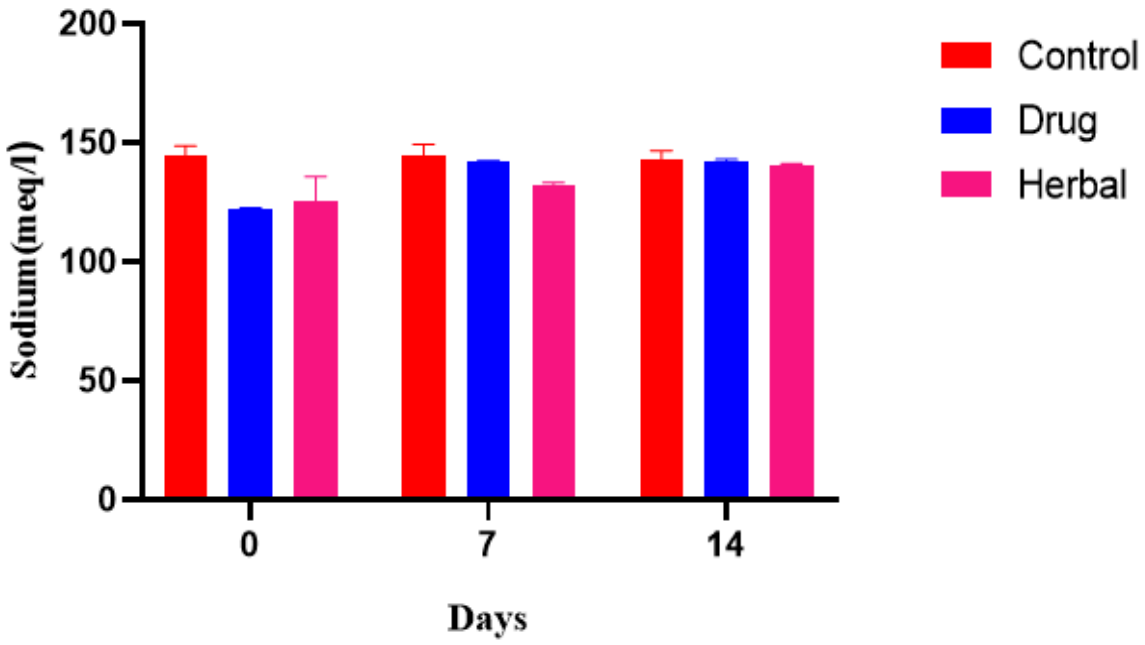


Fig. – 31 Mean ± S.E of Sodium (meq/L) in different treatment group

4.5.8 POTASSIUM (meq/L)

The mean value of potassium with SE in goats suffering from Haemonchosis is given in table no. 15 and fig. 32.

The mean value of potassium in goats under different treatment groups and control, pre treatment vary significantly ($p<0.05$). Significantly lower mean potassium was found in T2 (3.29 ± 0.08) with respect to control (4.98 ± 0.16).

Significant ($p<0.05$) improvement in the mean potassium level was observed on days 14^{th} in both treatment groups. The post treatment values with each of the drug came back to normal with respect to control.

Table No. – 15: Mean ± S.E of Potassium (meq/L) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	4.983 ± 0.162^{ax}	3.805 ± 0.368^{abx}	3.293 ± 0.089^{cx}
7	5.100 ± 0.234^{ax}	4.785 ± 0.202^{cxy}	4.863 ± 0.103^{cxy}
14	4.983 ± 0.176^{ax}	4.817 ± 0.136^{bz}	4.892 ± 0.388^{cxz}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

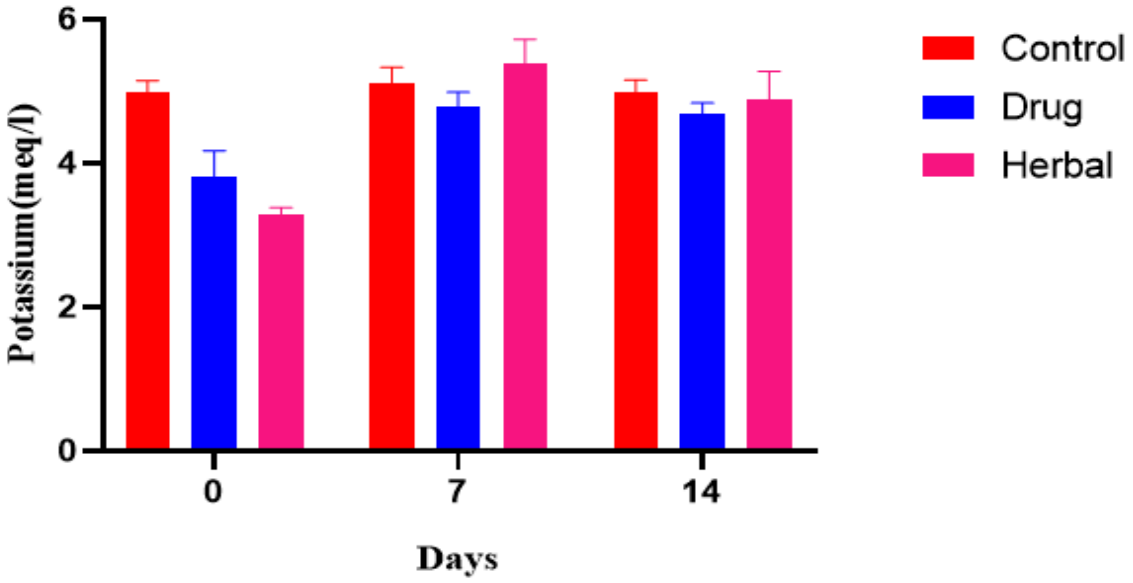


Fig. - 32 Mean ± S.E of Potassium (meq/L) in different treatment group

4.5.9 CALCIUM (mg/dL)

The mean value of calcium with SE in goats suffering from Haemonchosis is given in table no. 16 and fig. 33.

The mean value of calcium in goats in treatment group T1 (6.98 ± 0.27) and T2 (4.484 ± 0.38) vary significantly ($p<0.05$) lower than the control group T (8.75 ± 0.56).

Significant improvement in mean calcium level was observed in T2 group from 7th days of treatment with significantly maximum improve on days 14th was observed. Non – significant improvement was also noticed group T1on 7th and 14th days of treatment.

The post treatment values with each of the drug vary non – significantly on 14th days of treatment.

Table No. – 16: Mean ± S.E of calcium (mg/dl) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	8.752 ± 0.563^{ax}	6.985 ± 0.279^{bx}	4.484 ± 0.384^{bcx}
7	9.112 ± 0.450^{ax}	7.083 ± 0.337^{bx}	7.682 ± 0.571^{aby}
14	9.262 ± 0.471^{ax}	7.700 ± 0.285^{bx}	8.332 ± 0.561^{aby}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

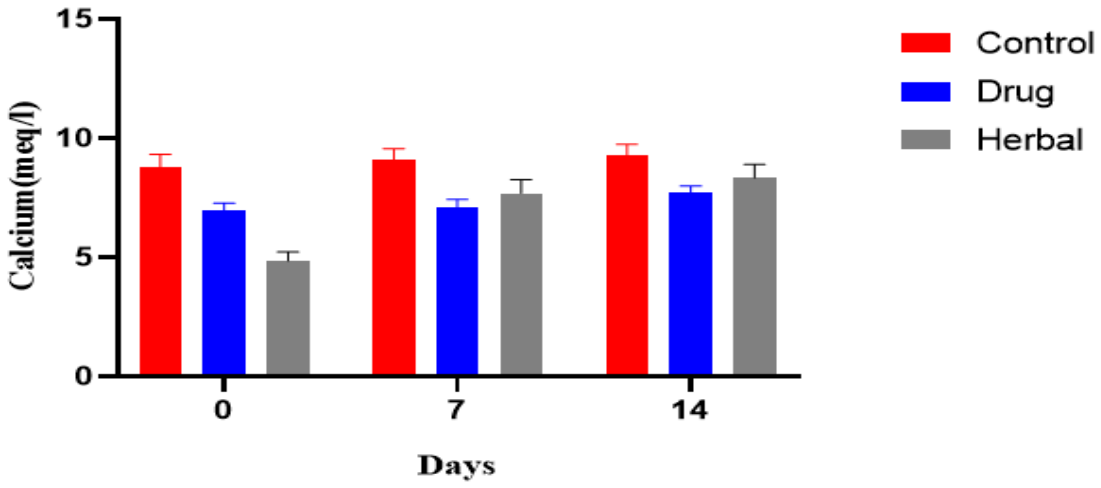


Fig. – 33 Mean ± S.E of Calcium (meq/L) in different treatment group

4.5.10 PHOSPHORUS (mg/dl)

The mean value of phosphorus with SE in goats suffering from Haemonchosis is given in table no. 17 and fig. 34.

The mean phosphorus level in goats under different treatment groups viz. healthy control, herbal anthelmintic and closantel group pre – treatment and post treatment were 4.983 ± 0.16, 3.80 ± 0.36 and 4.49 ± 0.17, respectively and 4.983 ± 0.17, 4.85 ± 0.21 and 4.92 ± 0.06, respectively.

Significant, improvement in mean phosphorus level was observed in treatment group T1 (4.85 ± 0.21) on 14th days of treatment. The post treatment values with each of the drug came back to the level of the healthy control.

Table No. – 17: Mean ± S.E of Phosphorus (mg/dl) in different treatment group

Days	T (Control)	T1 (Drug)	T2 (Herbal)
0	4.983 ± 0.162^{ax}	3.805 ± 0.368^{bx}	4.495 ± 0.173^{abx}
7	5.100 ± 0.234^{ax}	4.075 ± 0.272^{bx}	4.822 ± 0.079^{ax}
14	4.983 ± 0.176^{ax}	4.857 ± 0.214^{ay}	4.927 ± 0.060^{ax}

Mean with different row wise superscripts (a, b, c) differ significantly ($p<0.05$)

Mean with different column wise superscripts (x, y, z) differ significantly ($p<0.05$)

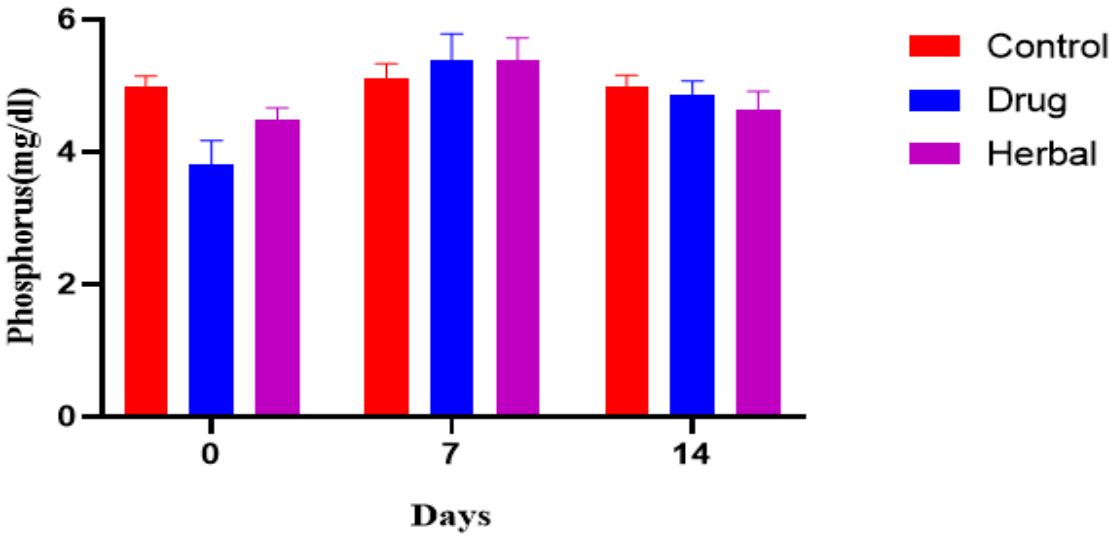


Fig. – 34 Mean ± S.E of Phosphorus (mg/l) in different treatment group

4.6 CORRELATION OF FAMACHA SCORE WITH HAEMATOLOGICAL PARAMETERS

FAMACHA Score in goats suffering from Haemonchosis were correlated with haemoglobin percentage, EPG, PCV, TEC, and TLC.

Significantly and strongly negative correlation were found between F.S vs Hb (- 0.178), F.S vs EPG (- 0.86) and F.S vs PCV (- 0.718), F.S vs TEC (- .714) and F.S vs TLC (- 0.324). Significantly strong positive correlation exist between Hb% vs PCV (0.999), Hb vs TEC (0.999) and significantly but weak positive correlation exist between F.S vs TLC (+0.264) (Table no. 18).

Table No. - 18: Haematological Correlation with FAMACHA Score and EPG

	F.S	**Hb%**	**EPG**	**PCV**	**TEC**	**TLC**
F.S	1					
Hb %	-7.18	1				
EPG	.860	-.799	1			
PCV	-.718	.999	-.799	1		
TEC	-.714	.999	-.796	.999	1	
TLC	-.324	.264	-.272	.267	.264	1

4.7 CORRELATION OF BIOCHEMICAL PARAMETER WITH EPG

The correlation of EPG with biochemical parameters were depicted in table no. 19.

Perusal of the table no. 18 shows that EPG is negatively correlated with TSP, Albumin, Glucose, Na, K, Ca and phosphorus level. Positive correlation with EPG and globulin, GGT, SGPT were found.

Table No. – 19: Biochemical Correlation with EPG

	EPG	TSP	Albumin	Globulin	Glucose	GGT	SGPT	Na	K	Ca	P
EPG	1										
TSP	.424	1									
Albumin	.128	.546	1								
Globulin	.426	.901	.151	1							
Glucose	-.042	-.015	-.184	.058	1						
GGT	-.267	.120	-.082	.163	.112	1					
SGPT	.206	.319	.115	.349	-.036	-.132	1				
Na	-.167	.081	.115	.008	.010	.259	-.126	1			
K	-.212	-.041	.108	-.077	-.015	.138	-.087	-.043	1		
Ca	.333	.072	-.093	.091	.169	-.006	.172	-.215	-.124	1	
P	.284	-.014	-.146	-.092	.173	-.082	.074	-.157	-.095	.599	1

Table No. – 20: Corrected Mortality of adult worm with Closantel and aq. Extract of *Carica papaya* (2.5, 5, 10, 15 mg/ml)

Drugs Concentrations	**No. of adult worm in different time intervals.**			
	0 hr.	**1 hr.**	**2 hrs.**	**3 hrs.**
Control	0	0	2	5
Closantel	0	26	28	25
Caricapapaya 2.5mg/ml	0	0	4	15
Carica papaya 5mg/ml	0	2	7	21
Carica papaya 10mg/ml	0	25	25	24
Carica papaya 15mg/ml	0	29	27	25

5

DISCUSSION

The present study was carried out on the occurrence of Hematophagus parasites in two district of Bihar. The study of FAMACHA score and hemato-biochemical alternation in goats suffering from Haemonchosis. In vitro and In vivo trial of herbal anthelmintic in comparison to chemical anthelmintic was also tried in the study. Faecal samples of 200 goats were collected from two districts of Bihar i.e. Patna and Muzzafarpur. The FAMACHA score technique was applied in field condition to access the anaemia in goats.

The overall prevalence of *Haemonchus contortus* in goats in Patna and Muzzafarpur districts were found to be 30% and 28% respectively. The observation in respect of *Haemonchus contortus* in goats are not in conformity with the finding of (Bhojane *et al*. 2002) who reported 12.23% infection and (Garge *et al*. 2003) reported incidence of 56.38% of Haemonchosis in summer season. The moderate level of parasitism of Haemonchosis in the grazing goats in Bihar might be due to less grazing area, more stall feed or backyard goat keeping. The higher prevalence of *Haemonchus contortus* might be due to favourable climatic condition which facilitate the free living development of Haemonchus species larvae and also the presence of Haemonchus species larvae on the tip of the grass, especially in the morning hours and more when there is low dew. *Haemonchus contortus* is the most frequent gastrointestinal nematode affecting the goat production in China and Bangladesh. (Bhojane *et al*. 2002) in Nagpur district found 12.23% of Haemonchus parasites, besides that he also observed 16.57% strongylus. Our finding of presence of other parasites along with *Haemonchus contortus* corroborates with the findings of (Chaudhri *et al*. 2000, Morales *et al*. 2001, Garge *et al*. 2003, Singh *et al*. 2005, and Amulya *et al*. 2005).

The FAMACHA score system was applied for the screening of goats in field condition of Patna and Muzzafarpur districts. The overall FAMACHA score of the two districts were found to be 3.015. Our findings of screening of goats for anaemia and indirectly Haemonchus parasites were supported by the finding of (Vatta *et al*. 2001) who validated the FAMACHA on goat farm in South Africa. (Kaplan *et al*. 2004) also enables to identify anaemic sheep and goat with the help of this technique. As per (Bath *et al*. 1996) this technique was prove to useful and economical for the farmers in identifying and deworming their sheep and goat against Haemonchus species.

The EPG, Haemoglobin concentration and FAMACHA score screening was done in goats in field condition. It was found that the goats with high EPG have high FAMACHA score and the mean EPG of goats suffering from Haemonchosis was found to be 834.00. Similarly, the mean haemoglobin level of goats (6.055) was found to be low with goats having high EPG and high FAMACHA score. Our Findings is in conformity with the findings of (Yilmaz *et al*. 2016) who assess the severity of anaemia by using FAMACHA chart in Saannen goats in Turkey. He reported Hb gradually decreases as the score of FAMACHA move from 1 to 5. The FAMACHA chart could be useful tool to classify the anaemic animals and can be used by illiterate goats keepers in diagnosis of anaemia in field conditions. Our findings also corroborates with the findings of (Kaplan *et al*. 2004, Bath *et al*. 1996, Van Wyk and Bath, 2002 and Vatta *et al*. 2002).

5.0 SYMPTOMATOLOGY

The most important clinical manifestation in all the goats suffering from *Haemonchus contortus* were anaemia, weakness, loss in body weight and diarrhoea. The diarrhoeic faces were semi – solid in consistency to light black to tarry coloured.

Swelling of the facial and submandibular oedema and blenched mucous membrane were the important findings in severe cases.

The present findings are more or less in concurrence with these of (Iliev *et al*. 2017, Bowman, D Geergis, 2014, Angulo – William, *et al*. 2007, Katoch *et al*. 1999 and Dhanlakshmi *et al*. 2001). The higher prevalence of *Haemonchus contortus* might be due to favourable climatic condition, moisture contents of the grasses and semi – intensive grazing system in goats. This is in the concurrence with the report of (Radostitis, 2000 and Katoch *et al*. 2000). Animal management system and movement between the pastures, seasonal occurrence of the disease and the effects of specific weather are also importance. Sometimes sudden death in goats are also suspected for Haemonchosis. This is in concurrence with the report of (Besier *et al*. 2016).

Anaemia in Haemonchosis might be due to severe haemorrhage caused by the adult worms and severe blood sucking by the larvae. Sub - mandibular oedema may be due to hypoproteinemia caused by the damage of abomasal gastric gland and subsequent loss of protein from the damaged mucosa and reduced dietary protein (Blood *et al*. 2000).

The FAMACHA [FAffa MAlan CHArt] was developed for treating only those animals unable to cope with *Haemonchus contortus* infection on pasture (Van Wyk *et al*. 1997). In our study the average FAMACHA score varies from 3 to 5. Our findings corroborates with the findings of (Van Wyk and Bath, 2002, Bath *et al*. 2001). Similarly developed from for FAMACHA scores in field condition and it helped the farmer to evaluate level of worms challenge when the scores moves from 3 to 5. FAMACHA system can be used to determine the severity of hematophagus worm infection in individual sheep (Van Wyk and Bath, 2002).

Clinical parameters like examination of mucus membrane, temperature, pulse per minute and respiration rate. It was observed that the goats suffering from Haemonchosis shows blenched mucous membrane and sometime light pinkish to completely white in colour. The body temperature of all the goats positive for Haemochosis were normal to slightly low. The mean pulse and respiration in goats suffering from Haemonchosis were found to be slightly higher than the healthy one. The decrease in temperature might be due to diarrhoea and loss of electrolytes and dehydration. This might be due to loss of blood, due to severe blood sucking activity of the parasites and the worm load. The present findings in respect of temperature is in conformity with those of (Blood *et al*. 2000). Inanition reduction in weight and diarrhoea were reported by (Vijaylingam *et al*. 2020). Increase in pulse and respiration rate might be due to anaemia and haemorrhages. The higher pulse and respiration rate might also be due to compensation of loss of oxygen (Blood *et al*. 2000). However, observed no significant difference in heart rate, rectal temperature and respiration rate in Haemonchosis affected sheep from that of non affected sheep.

5.1 CLINICAL TRIALS

The clinical trials of goats were divided into two groups i.e. in vitro and in vivo trial. For in vitro trial, adult parasites were collected from the abomasum of goats and kept on petridish. 30 adult *Haemonchus contortus* were kept in NSS in a petri dish. The mortality of worms in 1^{st}, 2^{nd} and 3^{rd} hours were noted. The corrected mortality of worms was calculated. Closantel @10 mg/ml had a corrected mortality 26, 28, and 25 at 1 hour, 2 hour and 3 hour respectively. Different concentration of *Carica papaya* seed extract tried and it was found that the concentration of 15 mg/ml had a corrected mortality of 29, 27 and 25 at 1 hour, 2 hour and 3 hour of in vitro trial. Thus, it is evidence from the trial that the *Carica papaya* seed extract in the concentration of 15 mg/ml had parasiticidal activity comparable to closantel @10 mg/ml. Similar in vivo and in vitro studies on the efficacy of anthelmintic against *Haemonchus*

contortus in goats were done by (Akhtar *et al*. 2013 and Murphy, 1993) unliked corrected mortality of adult worm of *Haemonchus contortus* used Egg Hatch Assay (EHA). As per (Assis *et al*. 2003) the EHA measures the effect of the drug directly on hatching, development and motility of parasites. Similar findings but with dissimilar herbs *Andrographis paniculata* (kalmegh) leaves on *Haemonchus contortus* was studied by (Singh *et al*. 2011 and Herve Hoste *et al*. 2006) reported that the tannin – rich plants have their effect on internal nematodes in ruminants. *Carica papaya* are used as ethno – veterinary medicine as anthelmintic to combat *Haemonchus contortus*. This plant is easily available and have good agro – ecological adaptability (Mundy and Murdiati, 1991).

5.1.1 FAMACHA SCORE

A novel system called FAMACHA was developed in South Africa for clinical identification anaemia in sheep and goats. This technique can be applied in farm level to reduce the number of treatment and to control drug resistance in *Haemonchus contortus*. Since anaemia is the principal clinical manifestation in Haemonchosis in goats, FAMACHA Score card which varies from 1 – 5 can be applied in clinical as well as farm level (Kaplan *et al*. 2004). In the present study FAMACHA Score card (1 – 5) were used to compare two treatment group of closantel (T1) and *Carica papaya* seed extract with the control healthy group of animals. FAMACHA Score was also applied to test the efficacy of drug within different days of treatment. It was concluded from our study that the mean FAMACHA Score in untreated Haemonchosis goats in both T1 and T2 were high with the control healthy group of goats. After treatment significant decreases in FAMACHA Score card was observed in both closantel (T1) and *Carica papaya* (T2) group. However, the Aq. Extract of *Carica papaya* seed extract FAMACHA score becomes comparable to control group with better clinical improvement in T2 group. This may be due to anthelmitic activity of closantel and papaya seed extract. As per (Pugh and Baired, 2012) plants that contains tannin have been found to reduce Fecal Egg Count and worm burden in goats Our study also corroborates with the findings of (kermanshai *et al*. 2001 and Jaiswal *et al*. 2008) who also reported the anthelmintic property of papaya seed extract. Reduction in FAMACHA Score in both the treatment group suggest that the closantel as a preferred choice of anthelmintic for Haemonchosis in goats with rotational use of *Carica papaya* seed extract as alternative and economical choice for the treatment This is supported by (Dixit *et al*. 2019) who reported overall efficacy of closantel as 95% on *Haemonchus contortus* parasite in goats. Similar finding was also reported by (Dorny, 1994).

5.1.2 EGG PER GRAM (EPG)

The Egg Per Gram (EPG) of goats in both treatment group (T1) and (T2) were done and compared with the healthy control group (T). It was found that the EPG of goats were 1000.57 in T1 and 950.00 ± 11 in T2 group with respect to healthy control (250.33 ± 21). This signifies the variability in EPG of goats and it varies from low 250.33 to high as 1000. This might be due to individual resistance to goats on the same grazing system, breed resistance. (Al omar *et al*. 2016) similarly reported the variability in faecal egg count of *Haemonchus contortus* infection to native goats breeds of China and Bangladesh under natural grazing condition. This might be due to individual animal's genetic makeup and the environment to which the animals are exposed (Gadahi *et al*. 2016).

Two treatment i.e closantel @10 mg/kg b. wt. orally in group T1 and *Carica papaya* seed extract @15 mg/ml were applied in respective group and it was found that significant improvement FEC were reported in both treatment on 7^{th} and 14^{th} days of post treatment. The post treatment value of mean EPG in 14^{th} days of treatment becomes comparable to healthy control group of goats which with slightly better FECRT in group T2 (283.33 ± 30.73) in comparison to T1 (383.33 ± 47.72). This signifies that the *Carica papaya* seed extract well in reducing the faecal egg count and can be a good alternative to chemical anthelmintic. Faecal egg count Reduction Test (FECRT) in vivo and in vitro test are the most common method for detecting the anthelmintic efficacy. Our findings corroborates with the findings of (Tramboo *et al*. 2017) who found 97.60% efficacy of closantel in treatment of Haemonchosis. Almost similar work was supported by (Rahman, 2016) who reported 29.22% FECRT for closantel, while FECRT for neem extract as 4.25% only. In vitro trial % reduction on the larval stages of *Haemonchus contortus* was reported to be 50.28% with closantel and 27.32% with neem extract.

It has been estimated that each worm sucks about 0.5 ml of blood per day by ingestion or seepage (Urquhart *et al*. 2000).

1.2 FAMACHA SCORE, EPG AND HAEMATOLOGICAL PARAMETERS

FAMACHA scores, EPG and Haematological parameters were correlated. In our study significant and strong negative correlation were found between FAMACHA score and haemoglobin, EPG, PCV and TEC. The FAMACHA eye colour chart from 1 to 5 scoring was done on the same day along with EPG and blood samples. The ocular mucus membrane of the

eye of each goats were examined and compared with the laminated colour chart bearing the picture of goat conjunctiva (Bala *et al*. 2015). PCV, Hb and TEC were the main indices for diagnosis of anaemia (Chineke *et al*. 2006). This findings of present study are in accordance with the findings of (Bala *et al*. 2015 and Bandhaiy *et al*. 2020). They observed highly significance negative correlation between EPG and PCV, EPG and Hb and positive correlation between FAMACHA score and EPG**.**

5.3 HAEMATOLOGICAL OBSERVATIOS

The present study revealed that goats suffering from Haemonchosis had significantly ($p< 0.05$) lower Haemoglobin, PCV, TEC. Decreased haemoglobin, PCV, TEC were observed before treatment indicative of severe anaemia. Anaemia in Haemonchosis affected goats may be due to severe blood sucking nature of the parasite (Soulsby, 1982). Rapid blood loss occurs in Haemonchosis (Besier *et al*. 2016). Mild anaemia and reduced body weight are reported in small number of worm burden in abomasum (Radostitis *et al*. 2007). Significant decline in PCV, Hb and TEC from control, indicating presence of anaemia was reported by (Sharma *et al*. 2000).

Significant increase in Hb, PCV and TEC after treatment indicated that the elimination of Haemonchus parasites, arrest of blood loss. Significant increase in Hb, PCV and TEC might also be due to restoration of Iron deficiency and rapid regeneration erythrocytes. The present findings is in agreement with those of (Islam *et al*. 2003 and Rajguru *et al*. 2003). The present study is in accordance of (Dixit *et al*. 2018) who reported that closantel @10 mg/kg b. wt. is an anthelmintic of salicylanilides, that binds to plasma protein and therefore specifically target parasites that ingest blood. *Carica papaya* extract efficacy in treatment and raising the haematological parameters were comparable to closantel in this study, however dissimilar efficacy was reported by other scientists with different herbal anthelmintic like *N. tobaccum*, *A. indica* entrance (Nawaz *et al*. 2014) reported 89% efficacy of aqueous extract of *A. indica* lower against *H. contortus* in sheep. The significant increase in total leucocytes count (TLC) in the present study may be due to secondary bacterial infection or may be due to stimulation of host defence mechanism. The significant lowering of mean TLC on 7^{th} and 14^{th} day may be due to anthelmintic property of *Carica papaya* might have an additional antioxidant properties (Farida and Iswahyani, 2018). The present findings is in agreement with those of (Sena, 2000 and Rajkowa, 2003). Similar observation was also made by (Qamar and Makbool, 2012).

5.4 BIOCHEMICAL PARAMETERS

The mean total protein in infected goats were found to be lower than the control group. After treatment with closantel and *Carica papaya* extract non - significant improvement was observed. The mean albumin level of goats suffering from haemonchosis were found to be significantly lower in affected groups. However, after treatment significant improvement in mean albumin level was observed in T1 and T2 group on 7^{th} days of treatment. Non – significant variation in improvement on days 14^{th} was observed in both group. Non – significant variation in mean globulin level was observed in pre and post treatment group. Decreased in total serum protein in the present study may be attributed to haemodilution, a compensatory mechanism for the abomasal haemorrhages. Decline in total serum protein in infected animals compared to control. (Abrahams – Sandi *et al*. 2005 and Balic *et al*. 2002) demonstrated an increase in both cellular and humoral response. Decline in total serum protein with significant decline in serum protein without any significant changes in globulin was reported by (Bordoloi *et al*. 2012). The affected animals loose large amount of protein in gut lumen and about 210 to 340 of serum protein were excreted through faeces per day (Bordoloi *et al*. 2012 and Dargie *et al*. 1975). Hypoalbuminia in present study might be due to abomasal damage, selective loss of albumin which is smaller size and osmotic sensitivity to fluid movement (Tanwar and Mishra, 2001). This may be due to increase catabolism of albumin. Inapptence and plasma loss along with reduction in dietry intake may be the main cause of hypoproteinemia. After treatment by closantel and *Carica papaya* the serum protein and specially albumin returns to normal, which might be due to less leakage of plasma and more absorption of protein from GI tract. This is in agreement with (Bandyopadhya and Dasgupta, 2000 and Arora *et al*. 2000).

Lower blood glucose level was found in goats suffering from Haemonchosis. Similar report in respect to blood to blood glucose were indicated by (Bandyopdhya and Dasgupta, 2000 and Arora *et al*. 2001). This might be reduction in food intake absorption from injured gut and due to elevation of blood gastrin level (Nicholls *et al*. 1988). After treatment non - significant improvement was noticed which might be due to elimination of the parasites and more absorption of glucose from gastrointestinal tract.

Serum enzyme ALT is a concentration in goats suffering from Haemonchosis vary indifferently. In one affected group T1, it is higher than the control while in other group T2 it is slightly higher. Non – significant lowering of mean ALT level were observed in both

treatment group on 7th and 14th days post treatment. The elevation of serum Alt and AST level indicated some disruptive activities in organs or altered membrane permeability. This might also be due to lack of excretion (Bordoloi *et al*. 2012). The increased level ALT in the present study corroborates with the findings of (Ratnesh *et al*. 2013).

The mean GGT values in goats under treatment vary significantly. Higher GGT values were observed in treatment group, which decreases significantly in treatment group T2. Significant decreases in the mean GGT was also observed in group T2 in 14th day of treatment. Similar findings was also observed by (Kumar *et al*. 2018) which may be due to liver damage.

The major electrolytes Na and K and the macro minerals Ca and P found significantly decreased from the unaffected control level. The level of Na and P mean level found to be low due to prolonged anorexia and passage of dark tarry coloured faeces in goats suffering from haemonchosis. Low level of serum calcium in goats may be due to low absorption of calcium from the gastrointestinal tract. Low level of phosphorus in diet might be reason of hypophosphatemia in goats suffering from Haemonchosis. Significant improvement in mean Na, K, Ca, and P post treatment in both Closantel and *Carica papaya* group might be due to elimination of parasites, improvement in digestion and absorption. (Abakar *et al*. 1999 – 2000) is not in agreement with our findings as he found no connection between phosphorus concentration and *Haemonchus contortus* infection in sheep. However, (Gilani, 1981) reported hypophosphatemia after conducting the trial on haemonchosis. This contradiction results might be due to infective dose of larvae, mineral content in the feed. (Georgieva *et al*. 1975) revealed significant reduction of calcium and phosphorus blood levels in lambs on the 30th and 40th day post inoculation of *Haemonchus contortus* larvae. Our finding also corroborates with the findings of (Murad *et al*. 2018) who reported 7.2% dropped in calcium level in blood during experimental Haemonchus infection.

Hypokalaemia may be responsible for death of goats in haemonchosis in goats as depletion of potassium level were found in diarrhoea in calves. The low level of potassium in the present study and recovery after treatment might be due to less loss in diarrhoeic faces, elimination of parasites and also the improvements in dietary intake. Dietary deficiency of potassium is very uncommon in ruminants (Radostitis *et al*. 2007).

SUMMARY AND CONCLUSION

1. Following conclusions are drawn Haematobiochemical and FAMACHA Score alteration in goats suffering from Hematophagus nematodes and its therapeutic management by herbal anthelmintic.
2. The work was done in the two districts of Bihar viz. Patna and Muzzafarpur.
3. Two hundred faecal sample of goats, 100 each from two district were collected and studied in the department for the screening of goats suffering from parasitic infestation. Endoparasites like Trichuris, Amphistomes, Fasciola hepatica and *Haemonchus contortus* were found in faecal examination.
4. The overall prevalence of Haemonchus parasite in goats of two districts of Bihar i.e. Patna and Muzaffarpur were found to be 30 and 28 %, respectively.
5. The screening of goats with FAMACHA score card reveals mean FAMACHA score to be 3.015.
6. The Egg per gram (EPG) of faecal samples were done and it was found to be 834.00.
7. Strong negative correlation was found between Hb and EPG, F.S and Hb and strong positive correlation was found between F.S and EPG.
8. Closantel and *Carica papaya* seed extract (aq.) were found to be effective in *In – vitro* and *In – vivo* trial.
9. *Carica papaya* extract concentration 15 mg/ml efficacy found to be similar to closantel in *In – vitro* trial.
10. On the basis of bio – chemical and haematological examination, it was found that herbal anthelmintic (*Carica papaya* seed extract) can be good alternative of chemical anthelmintic for controlling Haemonchosis in goats.
11. Use of chemical anthelmintic is not a solution for the control of haemonchosis in goats.
12. Planned grazing, high plain of nutrition, early diagnosis by FAMACHA technique and use of herbal anthelmintic can prevent drug resistance and help in preventing mortality in goats from *Haemonchus contortus*.

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