1. INTRODUCTION

Diarrhoea in calves is one of the most important disease complex evident by rapid and frequent passage of semisolid and liquid faeces material through the gastrointestinal tract. It involves both increase in motility of gastrointestinal tract and absorption of fluid with loss of electrolytes, particularly sodium (Na\(^{+}\)) and water (Rang et al., 2003) which may lead to disease and eventualy death of calves. The effectiveness of treatment and control of herd epidemics of diarrhoea in calves is threatening and causes heavy economic loss (Radostits et al., 2010). The national economy of Indian farmers lies heavily on agriculture and livestock raising (Mathur, 1990). As a matter of fact, bullock continue to provide the bulk of motive power in form of bioenergy whereas, sale of milk fetches the much needed supplemental cash income to small and marginal farmers.

Diarrhoea is characterized by wet stool and abdominal pain, accompanied by increased secretion and decrease absorption of fluid and thus loss of water and electrolytes (Longe and Dipro, 1992). The treatment of diarrhoea is not specific and is usually aimed at reducing the discomfort and inconvenience of frequent bowel movement (Suleiman et al., 2008). Infectious agents are considered to be the most commonly detected causes of calf diarrhoea (Schroeder et al., 2012).

Several studies have addressed the high distribution of Escherichia coli (E. coli) strains in infectious calf diarrhoea (Nguyen et al., 2011). E coli strains produce a variety of adhesions that promote attachment of bacteria to cell surface receptors. The fimbrial adhesion F5 (K99) plays a role in colonization of enterotoxigenic E coli in epithelial cells of small intestine of calves. The strip test based on the principle of lateral immuno-chromatography that can be very easy method for detection of the attachment factor F5 or toxin. Whenever a small number of analysis is to be performed, chromatographic lateral flow assay is preferable because of its simplicity, rapidity, sensitivity and specificity.
In order to overcome the menace of diarrhoea in developing countries, the use of traditional herbal management have been reported to be useful in terms of treatment, management and control (Abdullahi et al., 2001). The present study was undertaken to examine the possible usefulness of Psidium guajava leaf aqueous extract (PGE) in the treatment, management and control of calf diarrhoea. Psidium guajava (Guava) leaves are traditionally used for variety of human ailments including the management, control and treatment of diarrhoea, dysentry, fever, cough, ulcer, boils, wounds, painful arthritis and other inflammatory conditions (Van Wyk and Wink, 2004). The aqueous leaf extract of Psidium guajava contains pharmacologically active substances with ant-diarrhoeal properties, which revealed their inhibitory effect on gastrointestinal propulsion. India has a rich wealth of local and traditional knowledge of ethno veterinary practice in medicine. Over 7500 species of plants have been used for treating common and complex ailments both in human and in animals. Besides these, number of indigenous preparations have been recommended for curing the diarrhoea with encouraging results.

Hence, the present study was aimed to evaluate the efficacy of different forms of Psidium guajava with the following objectives.

1. Screening of diarrhoeic calves for presence of E.coli infection by using immuno-chromatography strips.

2. To study the comparative therapeutic efficacy of Psidium guajava (Guava) leaves in different forms as antidiarrhoeal in calves.

The results of the investigation would provide valuable clues to the large animal veterinary practitioners to effectively combat the calf diarrhoea through rationalized treatment regimen combined with proper feeding management.
2. REVIEW OF LITERATURE

Incidence

Sridhar et al. (1988) observed debility, anorexia lethargy, pyrexia and marked increase in pulse and respiratory rate in scouring calves.

Devid et al. (1993) observed that E.coli k99 ETEC may be responsible for 30-50% of scours related death in newborn calves. They have also suggested the use of passive antibody preparation combined with good colostrum feeding practices could significantly improve the outcome of neonatal calf diarrhoea in dairy and beef farm.

Khan and Khan (1997) revealed E.coli as a common isolate (54-58%), followed by Salmonella (13-14%) in diarrhoeic animals. The incidence of E.coli was significantly higher in first week whereas, incidence of salmonella was observed in the third week of age.

Zisan et al. (1997) examined 172 diarrhoeic and 130 non diarrhoeic faecal samples and reported E.coli K-99 isolates to be prevalent i.e. 63.3 per cent and 69.2 per cent respectively. Isolates of E.coli were obtained after primary plating of faecal specimens on blood agar, Mac Conkey agar and Eosin Methylene Blue agar. The coliform isolates were subcultured on Minca-Isovitalex agar. After overnight incubation (37°C), confirmation was made by slide agglutination test.

McClure (2001) found that neonatal diarrhoea as the major cause of illness and death of calves in less than one month of age.

Bukhari et al. (2002) observed diarrhoea due to K99 antiserum of E.coli in calves below 3 days old accompanied by negative fluid balance and lower level of blood circulation, blood volume and tissue fluid.

Shaheen et al. (2002) studied on 28 cases of acute diarrhoea in calves of different ages ranging from 7 to 35 days, postpartum, at the cattle
breeding farm, Mansbal, Jammu and Kashmir. The initial clinical signs in all cases seen as depression, partial refusal to suckling and moribund state. Diarrhoeal discharge was pasty, voluminous and pale yellow with few mucus shreds. Severe tenesmus was observed with blood stained, foul odour faeces. Body temperature was subnormal (99.9±0.5°F). The affected calves revealed different stage of tissue dehydration.

Reisinger (2003) concluded that although *E.coli*, in a combination with a viral agent, might be incriminated in calf scour, but *E.coli* alone could cause the disease. However, the virus *per se* failed to produce scouring.

Srinivasan *et al.* (2003) serotyped *E.coli*, isolated from natural cases of colibacillosis in calves in and around Namakkal in Southern India.

Sena and Pandey (2006b) conducted study on 80 clinical cases of diarrhoea in different breeds of calves and revealed significant higher incidence of diarrhoea in 1-2 months (37.50%), followed by 1-15 days (31.25%), 15 days-1 month(16.25%) and 2-4 months (15.00%) of age. However, no significant variation was found in the sex and breed of calves although males revealed comparatively higher incidence than females.

Balikci and Al (2014) conducted experiment on 40 diarrhoeic calves and 10 non-diarrhoeic calves and found that out of them only 12 calves were affected with *E.coli*.

Meganck *et al.* (2014) have studied about the mortality and morbidity in pre weaned dairy calves and also focused on importance of good colostrum management and correct fluid therapy in calves.

**Clinical signs**

Verma *et al.* (1995) recorded that the calves suffering from the colibacillosis showed signs of elevated to subnormal temperature, increased heart rate, watery to semi solid faeces and dehydration.
Kalita *et al.* (2000) noted symptoms of diarrhoea in kids such as passing of light yellow watery faeces, inappetance, loss of skin elasticity, dryness of muzzle, coldness of extremities and drowsiness. The respiration and heart rates were increased significantly on day 2 onwards. There was also significant reduction in body temperature.

Salvaderi *et al.* (2002) reported that Bovine *E.coli* F5 produces several toxins and colonized factors.

Guzelbektes *et al.* (2007) found that buffalo calves with 4-8% dehydration had a weak suckle reflex, dry mucous membrane and partly good muscular tone.

**Feeding Aspect**

Sahinduran and Albay (2004) strongly advocated that all neonatal calves should be fed colostrum in the first few hours of life @ 1.5 litre thrice a day. Further, to ensure normal development of rumen microflora, good quality alfa alfa should be given after day 7 post-partum.

Guirk (2006) found that total bacterial count of $10^3$ cfu/ml in milk or milk replacer fed to calves is a matter of almost concern in calf rearing units and suggested measures to minimize the bacterial load by proper hygienic and sanitary precautions. The author urged that all nipple bucket and other feeding utensils be cleaned thoroughly between feeds and old cracked pails should be discarded.

**Haematological aspects**

Deshpande *et al.* (1992) conducted study in 46 buffalo calves with diarrhoea taking five apparently healthy control of similar age. They revealed significant increase in PCV level in diarrhoeic calves.

Michell *et al.* (1992) observed increase PCV level in cases of induced diarrhoea in calves.
Constable et al. (1996) observed a moderate dehydration, marked lethargy, decreased cardiac output and plasma volume, increased blood lactate. PCV, albumin, creatinine, sodium and phosphate in calves suffering from diarrhoea induced by administering milk replace isotonic sucrose solution and frusemide.

Rajora and Pachauri (2000) evaluated 36 diarrhoeic calves and six apparently healthy control. In diarrhoeic calves they revealed significant increase in packed cell volume.

Bukhari (2002) conducted chemoprophylactic trials in neonatal calf diarrhoea and found significant rise in Hb concentration, PCV%, TEC and TLC.

Changkija (2002) recorded the clinical symptoms of dullness, depression and partial anorexia in calves suffering from mild to moderate diarrhoea. Further, the haemato-biochemical profile revealed haemoconcentration, hypoglycemia, hypernatremia, hypochloremia, increased urea nitrogen and creatinine.

Santos et al. (2002) evaluated haematological and serum biochemical changes in diarrheic calves and reported increased PCV%, TEC and Hb concentration, concomitant with a transitory leucopenia.

Kaur et al. (2006) conducted study in 32 diarrhoeic calves and found that on haematological examination mean PCV values were significantly higher than those of healthy control calves. Therapeutic measures resulted in gradual and significant decline in mean PCV values from 41.90±1.44% at 48 hours to 39.58±1.755 at 144 hours that were comparable to healthy controls.

Radiostits et al. (2010) reviewed that hypochloremia might be due to increased loss of chloride ions during diarrhoea and failure of gastric H⁺ and Cl⁺ to be reabsorbed by the villus of small intestine.

Hassan et al. (2013) performed study in 30 diarrhoeic lambs suffered due to colibacillosis and recorded the significant increase in PCV, TEC, TLC, Lymphocytes and neutrophil percentage.
Kullu et al. (2013) reported that the aqueous extract of *Psidium guajava* had significant effect on RBC, Hb, MCHC, MCH, PCV and MCV. He also observed that RBC and PCV also significantly increased that stimulate erythropoietin the humoral regulators of RBC release in the kidney.

Malik et al. (2013a) reported that increased number of neutrophils and leukocytosis in early stage of diarrhoea clearly indicated involvement of bacteria with significant increase in chloride level in diarrhoeic calves.

**Biochemical aspects**

**Serum Sodium and Potassium**

Dubey et al. (1991) reported that in induced enteric colibacillosis in serum, sodium (mEq/L) and chloride (mEq/L) concentration had decreased significantly to 133.8 and 307.6, respectively. Further, serum potassium concentration (mEq/L) continued to fall and reached the critical value of 119.45 and 4.63 for sodium and potassium, respectively.

Maach et al. (1992) found extreme metabolic acidosis, hemoconcentration, hypoglycemia, hyponatremia, hypochloremia and hyperkalemia in calves suffering from acute diarrhoea.

Duncan et al. (1994) documented hyponatremia and hyperkalemia in ruminants as a result of diarrhoea.

Aly et al. (1996) observed the clinical signs of anorexia, elevated temperature and depression with varying degree of dehydration in 28 diarrhoeic buffalo calves passing faeces with offensive odour and blood mucoid discharge. Biochemical estimation of serum revealed significant increase in serum potassium and a significant decrease in serum total protein, glucose sodium and chloride.

Lorenz et al. (1998) conducted study on 50 calves suffering from diarrhoea and observed increased potassium and sodium level. The results
attribute that the pronounced hyponatremia in older calves can hardly lead to loss of sodium via faeces and urine.

Bali et al. (2000) recorded changes in electrolytes decreased concentration of serum sodium and increased concentration of serum potassium levels in diarrhoeic calves.

Chaleva and Encheva (2003) observed that value of sodium in diarrhoeic calves was comparatively lower than in healthy calves respectively.

Kaur et al. (2006) studied biochemical indices in 32 diarrhoeic calves and revealed increased mean plasma sodium and potassium level in diarrhoeic calves as compared to healthy calves which was 139.33±5.98 and 5.19±0.26 before treatment in diarrheic calves as compared to healthy control i.e. 128.40±7.04 and 4.51±0.29 respectively.

Azza (2008) studied the serum parameter in 30 diarrhoeic calves of the Swiss Holstein breed and found decreased values of serum sodium, potassium, bicarbonate, glucose and total protein.

Sobiech et al. (2014) studied biochemical indices in 20 neonatal diarrhoeic calves and observed that the value of sodium was lower in diarrhoeic calves (138.12±1.11) as compared to healthy control (139.15±1.23).

**Serum chloride**

Alone et al. (2000) reported a non significant changes in serum chloride concentration in diarrhoea which was induced in eighteen healthy calves.

Bellino et al. (2012) studied on diarrhoeic calves and observed a significant decrease in the concentration of chloride and sodium ions in the blood.
Sobiech et al. (2014) studied in 20 neonatal diarrhoeic calves (99.67±2.01) and 20 healthy calves (101.24.15± 1.43) and observed that the value of chloride was significantly lower in diarrhoeic calves.

Bednarski et al. (2015) conducted study on 36 diarrhoeic calves and revealed significant decrease in value of chloride.

**Serum total protein**

Dubey et al. (1991) observed that the serum total protein concentration (g/dl) in calves with induced colibacillosis reached the critical value of 2.21±0.85 at 36 hrs. Further, the circulatory globulin concentration had increased concurrent with the persistent reduced albumin concentration in diarrhoeic calves.

Bali et al. (2000) investigated 24 cases of *E.coli* infected diarrhoeic calves and noted increased serum protein in diarrhoeic calves.

Singh et al. (2014) conducted study on 25 cases of *E.coli* diarrhoeic calves and recorded significant increase in total protein (7.74±0.08 g/dl) and serum albumin (3.71±0.03 g/dl) as compared to healthy calves respectively.

**Serum albumin**

Walker et al. (1998) reported increased albumin concentration in diarrhoeic neonatal calves.

Kaur et al. (2006) revealed increase in plasma albumin level (3.42±0.10) in diarrhoeic calves as compared to healthy control.

Mir (2009) conducted study in 36 diarrhoeic calves and reported that albumin level was significantly increase (3.88±0.01) in diarrhoeic calves as compared to healthy calves (3.60±0.02).
Bednarski et al. (2015) conducted study on 36 diarrhoeic calves aged between 14-21 days and observed low concentration of albumin (15.37g/L) in comparison to healthy control.

**Treatment aspect**

**Indigenous medicine**

Cabalar et al. (2001) studied on 235 non-diarrhoeic calves, out of which 28 were positive for K99. They have also observed that the most sensitive antibiotic were enrofloxacin and danofloxacin under the study.

Shaheen et al. (2002) reported relapse of colibacillosis with mortality following administration of a suspension of norfloxacin with metronidazole. Complete recovery was, however observed when ampicillin was given concomitant with cloxacillin. Oral cephalxin administration showed no relapse or mortality. Following intravenous infusion of ciprofloxacin relapse was uneventful without mortality.

Chowdhury and Das (2003) reported the incidence of drug resistance in *E.coli* strains in West Bengal. A remarkably high degree of sensitivity of *E.coli* isolates was observed: ciprofloxacin (100%), norfloxacin (97.08%), and gentamicin (79.56%).

Salgado et al. (2006) evaluated antidiarrhoeal effects of *Psidium guajava* aqueous leaf extract in mice and observed that crude aqueous extract of the leaves of guava tree possess anti-diarrhoeal effects.

Ojewole et al. (2008) studied antidiarrhoeal activity of *Psidium guajava* (Myrtaceae) leaf aqueous extract in rodents and observed that *Psidium guajava* leaf aqueous extract protected rats and mice against castor oil induced diarrhoea, inhibited intestinal transit and delayed gastric emptying.

Birdi et al. (2010) evaluated the effect of a hot aqueous extract (decoction) of dried leaves of *Psidium guajava* on parameters associated with
pathogenicity of infectious diarrhoea. He also showed that the crude decoction of *Psidium guajava* leaves contains components other than quercetin which contribute to its antidiarrhoeal action.

Mittal *et al.* (2010) studied phytochemistry and pharmacological activities of *Psidium guajava*. They concluded that aqueous extracts of guava leaves could be used in treatment of various type of gastrointestinal disturbances such as vomiting, diarrhoea, inhibition of the peristaltic reflex, gastroenteritis, spasmolytic activity, dysentery, abdominal distension, flatulence and gastric pain.

Chanu *et al.* (2011) observed that aqueous extract of *Psidium guajava* showed significant activity against candida and *Escherichia coli*. These results supported the claims of its use for the treatment of diarrhoea. These results were encouraging and can be extrapolated further for the use of *Psidium guajava* leaf extracts as an alternative treatment option for diarrhoea caused due to enteric pathogens.

Joseph and Priyar (2011) observed the antidiarrhoeal effect of *Psidium guajava* and quercetin as they help to relax the intestinal smooth muscle and inhibit bowel contractions.

Hassan *et al.* (2011) made study on 15 albino rat and revealed that ethanol extract of guava leaf has efficient level of anti-diarrhoeal and antimicrobial effect. They have also observed that LC50 value is wider indicated its safety margin and also its minimum toxicity level.

Gupta *et al.* (2013) reported that in vitro sensitivity of the isolates to antimicrobial drug was found to be 100% to ciprofloxacin and sulfadiazine, followed by ceftriaxone (96.88%), cefotaxime (71.90%), amoxyclave (68.75%) and amikacin (46.9%).

Hassan *et al.* (2013) treated the 10 diarrhoeic calves with ciprofloxacin and reported 100% efficacy of the drug.
Malik *et al.* (2013b) found that out of 41 isolates, 30 revealed production of toxin hence, considered to be pathogenic. Further, on the basis of drug sensitivity, they found that amikacin (87.80%), azithromycin (73.17%) and gentamicin (12.2%) were effective.

Richard *et al.* (2013) revealed that *Psidium guajava* aqueous extract was effective against *S. aureus, S. epidermidis, M. gypseum* and *T. mentagrophytes* in inhibiting their growth.

**Fluid therapy**

Alone *et al.* (2000) induced diarrhoea in 18 calves, divided into 3 groups. The control group (C) was kept untreated. Whereas, the second group (T1) was given Ringer’s lactate I/V in three divided doses per day for three days. The third group (T2) was drenched with isotonic oral rehydration solution @ 1 litre for three days which contain 32.8g of mixture taken from sodium chloride 113.6g, potassium chloride 50.3g, sodium bicarbonate 108. 9g, glucose 535.1g and glycerine 223g. They have suggested that T2 was efficiently used in correcting diarrhoeic electrolyte imbalance and in view of its easy preparation, administration, efficacy and cost economics could be recommended under field condition.

Rajora and Pachauri (2000) categorized three groups of diarrheic calves with mild, moderate and severe degree of dehydration. The calves with mild dehydration were given O.R.S comprising of 20g glucose, 3.5 g sodium chloride, 5.2g sodium bicarbonate and 1.5 g potassium chloride in 1 litre of water at 12 hr Interval for 3 days. The calves with moderate dehydration were administered 5% solution of sodium bicarbonate (I/V) followed by O.R.S. The calves with severe dehydration were administered sodium bicarbonate (I/V) followed by administration of mixtures of isotonic saline and bicarbonate with 5% dextrose (I/V) followed by O.R.S. All the calves with mild and moderate rehydration showed recovery with the above rehydration therapy however, two of the severely dehydrated calves did not recover with the above rehydration therapy.
Senturk (2003) found that the administration of low volume of hypertonic saline and dextrose 70 solution @ 4ml/kg b.wt I/V in combination with oral electrolyte solution @ 50 ml/kg P.O. was economical and effective in treatment of dehydrated diarrhoeic calves.

Das et al. (2006) reported that therapy consisting of parenteral fluid along with antidiarrhoeal and anti protozoal drugs was found more effective than oral fluid therapy.

Mir (2009) studied the effect of Bael extract in calves suffering from diarrhoea and found that the therapy comprised of Neblon powder with intravenous fluid therapy (RL) and Bael pulp with RL was better as compared to other therapies which included Bael pulp with ORS, Neblon powder with ORS followed by unripped and half riped Bael.

Sen and Constable (2013) stated that bicarbonate containing fluids are more effective at rapidly correcting severe acidosis.
3. MATERIAL AND METHODS

Technical programme

Location and place of work

The proposed work was conducted in the Department of Veterinary Medicine, Diagnostic lab, T.V.C.C College of Veterinary Science and Animal Husbandry, Jabalpur. Livestock farm Adhartal and Private Goshalas in and around Jabalpur, Madhya Pradesh.

Epidemiological data

The age, breed, sex, history of deworming and feeding habit of the calves were recorded.

Source of samples

Out of the total of 50 calves (less than 3 month of age) selected from different dairy farms clinically showing poor body condition, weakness, rough hair coat were screened to know the status of calves. Faecal samples (3-5 gm) from these calves were collected per rectal using sterilized gloves and were placed in polythene bags labelled and sealed properly (Table-01 and Plate-01).

Table 01: Sources of collection of sample

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Place</th>
<th>No. of calves</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Live Stock Farm Adhartal</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Emalia Dairy</td>
<td>06</td>
</tr>
<tr>
<td>3</td>
<td>Kanchan Dairy</td>
<td>07</td>
</tr>
<tr>
<td>4</td>
<td>SKD Dairy</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Sharad Dairy</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>Panagar</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>Total calves</td>
<td>50</td>
</tr>
</tbody>
</table>
For therapeutic studies, 24 calves (comprising 6 calves in each group) were selected irrespective of sex and breeds, besides these, a group of 6 healthy calves was kept as control.

**Examination of faecal sample**

The faecal samples were examined with the help of *E. coli* F5 (K99) immuno-chromatographic test strips to detect *E. coli* F5 attachment factor in calf faeces. The calves tested positive for F5 antigen were selected for further therapeutic studies.

**Standard diagnosis of *E. coli* F5 by lateral flow immunoassay**

Chromatographic lateral flow immunoassay test strips, for detection of *E.coli* F5 in bovine faeces- Bio X diagnostics Belgium, Product ID-BIO K153.

**Principle**

This assay is a immune chromatographic lateral flow immuno assay containing strips coated with coloured gold colloidal reagents labelled with monoclonal antibodies species for bovine *E.coli* F5. There are two regions and a control region, on the membrane of the test strips. The first line develops rapidly when *E.coli* F5 is not present in specimen. If *E.coli* F5 is not present, no T line develops in the test region. The control line (C line), should always appear regardless of the presence of *E.coli* and serve as an internal qualitative control of test system (Plate 02).

**Test Procedure**

I. A spoonful of faecal sample was diluted in the liquid provided with the kit.

II. The sample and diluents were thoroughly homogenized.

III. The strips was plugged into liquid with the arrow pointing downwards.

IV. Ten minute time was given for reaction to take place.
Interpretation of results

Positive- A positive reaction was interpreted when two lines control (c) and test strip, indicating the presence of *E.coli* F5 were present the T line was seen as a pink shadow.

Negative- Only one line the C line, but no T line developed on the test strips, indicating the *E.coli* F5 is not detected in the specimen and the test result is negative.

Non valid- If C line did not appear within 10 minute, the test was considered non valid and repeated with a fresh strip.

Clinical Observation

The clinical study was conducted on calves below three month of age with clinical signs like diarrhoea, poor body condition, dehydration, weakness and rough hair coat. Diarrhoea due to *E.coli* infection is characterized by pasty yellow to whitish focus occasionally streaked with blood flakes with noxious odours (Radostits *et al.*, 2010),(Plate 03).

Clinical examination

All affected calves were clinically examined for body temperature (°F), pulse rate per minute, respiration per minute and dehydration score-skin fold test (Radostits *et al.*, 2010).

Table 02: Dehydration score (Mir, 2009)

<table>
<thead>
<tr>
<th>Score</th>
<th>Faecal consistency</th>
<th>Dehydration score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>1</td>
<td>Pasty faeces</td>
<td>Mild dehydration, skin test &lt;3 sec</td>
</tr>
<tr>
<td>2</td>
<td>Semi liquid faeces</td>
<td>Moderate dehydration, skin test &gt;3 sec but &lt;8 sec</td>
</tr>
<tr>
<td>3</td>
<td>Watery faeces</td>
<td>Severe dehydration, skin test &gt;8 sec</td>
</tr>
</tbody>
</table>
Preparation of Medication

Fresh leaves of *Psidium guajava* were collected in bulk from Veterinary College campus Jabalpur. One kg of *Psidium guajava* leaves were air dried at room temperature and then milled it into fine powder (Ojewole *et al.*, 2008). The powdered material was macerated in distilled water and extracted twice, on each occasion with 2.5 litre of distilled water at room temperature for 48 hours. The aqueous extract was evaporated in a rotary evaporator at 60°C (Plate 04 and 05).

Control group

Six apparently healthy calves were selected under control group at Live Stock Farm, Adhartal. Blood samples were collected from them for analysis of various parameters similar to diarrhoeic calves.

Comparative therapeutic efficacy of different treatment regimens

The animal diagnosed with *E.coli* F5 antigen were placed into four treatment groups T1, T2, T3 and T4 as shown in table 03 to compare their therapeutic efficacy (Plate 06). Total 24 diarrhoeic *E.coli* F5 positive calves were placed in the four treatment groups comprising 6 animal in each group. Six healthy animal were placed in the T5 group.

Table 03: Experimental design for therapeutic study

<table>
<thead>
<tr>
<th>Treatment groups</th>
<th>No. of animal</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>6</td>
<td>1 Tab Ciprofloxacin HCl (250 mg) + Tinidazole (300 mg) @ 1 tab/ 25kg b.wt BID for 3-5 days P.O.</td>
</tr>
<tr>
<td>T2</td>
<td>6</td>
<td><em>Psidium guajava</em> leaf powder @ 300 mg/kg BID for 3-5 days P.O.</td>
</tr>
<tr>
<td>T3</td>
<td>6</td>
<td><em>Psidium guajava</em> aqueous leaf extract @ 300mg/kg BID for 3-5 days P.O.</td>
</tr>
<tr>
<td>T4</td>
<td>6</td>
<td><em>Psidium guajava</em> aqueous leaf extract @ 500mg/kg BID for 3-5 days P.O.</td>
</tr>
<tr>
<td>T5</td>
<td>6</td>
<td>Healthy control</td>
</tr>
</tbody>
</table>

*In all the groups, Injection Ringer lactate was given @10-15 ml/kg b.wt (as per dehydration score) I.V slowly.

** One Tab contains Ciprofloxacin + Tinidazole (250mg+300mg)*
Haemato-Biochemical Profile

For Haemato-biochemical parameter about 5 ml blood was collected aseptically from jugular vein using sterilized needle from each animal. Three ml blood was kept in clean sterilized vials (without EDTA), for harvesting of serum and two ml was kept (with EDTA) for haematological studies on day 0 (pre treatment) and 5 (post treatment).

Haematology

Following haematological parameters were measured as per the method of Benjamin (2001).

(i) Haemoglobin concentration (g/dl).

(ii) Total erythrocyte count (millions/µl).

(iii) Packed cell volume (per cent)

(iv) MCV(fl), MCH(pg) and MCHC(per cent)

Haemoglobin concentration (Hb)

Haemoglobin was estimated by Hellige-Sahli’s haemoglobinometer and values were expressed in g/dl (Feldman et al., 2000).

Total erythrocyte count (TEC)

The total erythrocyte count was done using Neuberger’s slide method and values were expressed in million per cu.mm.

Packed cell volume (PCV)

Packed cell volume was estimated using capillary tube and values were expressed in percentage (%).
Erythrocyte Indices

The following erythrocyte indices were calculated as per the method described by Feldman et al. (2000).

a. Mean Corpuscular Volume (MCV) in femtolitre (fl).

\[ \text{PCV(\%)} \times 10 = \frac{\text{MCV}}{\text{RBC(million/\mu l)}} \]

b. Mean Corpuscular Haemoglobin (MCH) in pictogram (pg).

\[ \text{Hb(g/dl)} \times 10 = \frac{\text{MCH}}{\text{RBC(million/\mu l)}} \]

c. Mean Corpuscular Haemoglobin Concentration (MCHC) in g/dl of red cells.

\[ \text{Hb(g/dl)} \times 100 = \frac{\text{MCHC}}{\text{PCV(\%)}} \]

Biochemical Profile

I. Serum albumin (g/dl)

II. Total protein (g/dl)

III. Serum chloride (mEq/l)

IV. Serum Sodium and Potassium (mEq/l)

Serum globulin of the sample was calculated by the subtraction of serum albumin concentration from the total serum protein. The ratio of albumin and globulin was also calculated. The biochemical parameters were estimated as follows:

Serum sodium and potassium were estimated by Flame Photometric Method (Oser, 1965) and the values were expressed in mEq/L (Plate 07).
Serum chloride, Serum total protein and Serum albumin were estimated by Auto-analyser with standard diagnostic kit (Aspen laboratories) and the values were expressed in g/dl (Plate 08).

Serum globulin values were calculated by subtracting serum albumin valued from serum total protein values and expressed in g/dl.

A :G ratio was determined by dividing the values of albumin with globulin and results were expressed as A:G ratio.

**Statistical analysis**

The data were analyzed by analysis of variance using Hierarchical model (Snedecor and Cochran, 1994).
4. RESULTS

Prevalence of *E. coli* F5 antigen

The present study was undertaken on 50 calves, up to 3 months of age of either sex. All the calves belonged to murrah breed with history of no deworming. The presence of *E. coli* F5 infection was confirmed by screening with immuno-chromatographic strips. Out of 50 calves tested, 25 were found positive for *E. coli* F5. Therefore, the overall prevalence of *E. coli* F5 antigen was found to be 50 per cent (25 out of 50 calves). The details of results are presented in table 04.

Table 04: Prevalence of *E. coli* infection in calves

<table>
<thead>
<tr>
<th>No. of calves screened</th>
<th>No. of calves positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>25</td>
<td>50</td>
</tr>
</tbody>
</table>

Sex wise prevalence

The results of sex wise prevalence showed that the presence of *E. coli* F5 was found as 65 per cent in male calves (15 out of 23 calves) and 37 per cent in female calves (10 out of 27 calves). Thus, the prevalence of *E. coli* antigen was higher in male as compared to female calves (Table 05).

Table 05: Sex wise prevalence of *E. coli* F5 in calves

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Sex</th>
<th>No. of calves examined</th>
<th>No. of calves positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>23</td>
<td>15</td>
<td>65.21</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>27</td>
<td>10</td>
<td>37.04</td>
</tr>
</tbody>
</table>

Age wise prevalence

The results of age wise prevalence showed that the presence of *E. coli* F5 was found to be highest i.e. 80 per cent in the calves up to 15 days of age (20 out of 25 calves) followed by 28.57 per cent in the calves from 16 to 30
days of age group (4 out of 14 calves), then 20 per cent in calves from 1 to 2 months of age group (1 out of 5 calves) and no *E. coli* F5 was found in calves of 2 to 3 months of age group (Table 06).

**Table 06: Age wise prevalence of *E. coli* F5 in calves**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Age groups</th>
<th>No. of calves examined</th>
<th>No. of calves positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-15 days</td>
<td>25</td>
<td>20</td>
<td>80.00</td>
</tr>
<tr>
<td>2</td>
<td>16-30 days</td>
<td>14</td>
<td>4</td>
<td>28.57</td>
</tr>
<tr>
<td>3</td>
<td>1-2 months</td>
<td>5</td>
<td>1</td>
<td>20.00</td>
</tr>
<tr>
<td>4</td>
<td>2-3 months</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Feeding aspect**

Feeding regimen of calves was observed during the study period. In the calves of age 0-3 days, colostrum was fed at the rate of 1/10th of the body weight. From 4th day to one month of age, transition milk was fed at the rate of 1/10th of body weight. Milk feeding in the calves in age group of 1–2 months and 2-3 months was done at the rate of 1/15th and 1/20th of the body weight, respectively.

By observing the feeding regimen, it was observed that feeding was as per standards in all the calves (both in healthy and diarrhoeic) which does not indicate significant effect of feeding on the diarrhoea in the present study.

**Evaluation of therapeutic efficacy of *Psidium guajava* (Guava) leaves in different forms as antidiarrhoeal in calves**

The therapeutic efficacy of different doses and forms of *Psidium guajava* (Guava) leaves was evaluated on the basis of improvement in clinical, haematological and biochemical parameters in 24 calves having *E. coli* F5 antigen. Six apparently normal and healthy calves were selected for acquiring base values for clinical and haemato-biochemical parameters.
Clinical Study

The diarrhoeic calves were found to be anorexic, lethargic, dull, depressed and moderately dehydrated. Some had sunkened eyes, congested mucous membrane, while in some cases, profuse diarrhoea was evident. The faeces of all affected calves varied in consistency from watery to pasty with mucus and offensive odour. The colour of faeces was green to yellow white.

Clinical examination

Temperature (°F)

The mean values of rectal temperature (° F) on day 0 before treatment were recorded as 102.50±0.27, 102.40±0.24, 102.10±0.26 and 102.38±0.21 in groups T1, T2, T3 and T4, respectively. However, the mean temperature of healthy calves was 101.6±0.25. The mean value of temperature (° F) on day 5 post treatment were 101.80±0.16, 101.70±0.26, 101.50±0.17 and 101.83±0.22 in groups T1, T2, T3 and T4, respectively (Table 07). No Significant difference (p>0.05) was found in the mean body temperature on day 0 pre treatment and day 5 post treatment as compared to healthy calves.

Table 07: Mean body temperature (°F) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Temperature (°F)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>102.50±0.27</td>
<td>101.80±0.16</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>102.40±0.24</td>
<td>101.70±0.26</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>102.10±0.26</td>
<td>101.50±0.17</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>102.38±0.21</td>
<td>101.83±0.22</td>
<td></td>
</tr>
<tr>
<td>Healthy control</td>
<td>101.60±0.25</td>
<td>101.70±0.27</td>
<td></td>
</tr>
</tbody>
</table>

* Non-significant difference at p>0.05
Pulse rate (Per minute)

The mean values of pulse rate (per min.) in diarrhoeic calves on day 0 (Pre treatment) were 89.60±0.98, 89.60±0.77, 88.50±1.20 and 87.30±0.78 in T1, T2, T3 and T4, respectively. On day 5 (post treatment) the mean values per minute were 86.60±1.05, 88.30±0.66, 85.20±0.74 and 86.20±0.70 in groups T1, T2, T3 and T4, respectively (Table 08). However, the mean pulse rate of healthy calves was 89.00±0.99. A non significant difference in the mean pulse rate was observed after treatment in all the groups.

Table 08: Mean pulse rate (per minute) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pulse rate (Per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
</tr>
<tr>
<td>T1</td>
<td>89.60±0.98</td>
</tr>
<tr>
<td>T2</td>
<td>89.60±0.77</td>
</tr>
<tr>
<td>T3</td>
<td>88.50±1.20</td>
</tr>
<tr>
<td>T4</td>
<td>87.30±0.78</td>
</tr>
<tr>
<td>Healthy control</td>
<td>89.00±0.99</td>
</tr>
</tbody>
</table>

*Non-significant difference at p>0.05

Respiration rate (Per minute)

The mean values of respiration rate (per minute) in diarrhoeic calves on day 0 (Pre treatment) were 24.70±0.71, 28.16±1.08, 27.00±0.49 and 26.80±0.91 in groups T1, T2, T3 and T4, respectively. On day 5 (post treatment) the mean values were 23.07±0.52, 25.30±0.77, 25.50±0.67 and 25.70±0.66 in groups T1, T2, T3 and T4, respectively (Table 09). However, the mean respiration rate of healthy calves was 25.20±0.63. No significant difference was observed in different treatment groups before and after treatment.
Table 09: Mean respiration (per minute) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Respiration (per minute)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
</tr>
<tr>
<td>T1</td>
<td>24.70±0.71</td>
<td>23.07±0.52</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>28.16±1.08</td>
<td>25.30±0.77</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>27.00±0.49</td>
<td>25.50±0.67</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>26.80±0.91</td>
<td>25.70±0.66</td>
<td></td>
</tr>
<tr>
<td>Healthy control</td>
<td>25.20 ±0.63</td>
<td>25.70±0.84</td>
<td></td>
</tr>
</tbody>
</table>

*Non-significant difference at p>0.05

HAEMATOLOGICAL ASPECT

Haemoglobin concentration (g/dl)

The mean values of Haemoglobin concentration (g/dl) on 0 day were 11.90±0.27, 12.72±0.18, 11.91±0.54 and 11.50±0.46 in groups T1, T2, T3 and T4, respectively. The mean values of haemoglobin concentration (g/dl) on day 5 were 11.43±0.12, 12.13±0.19, 11.21±0.41 and 10.71±0.42 in group T1, T2, T3 and T4, respectively (Table 10). No Significant difference was found in the haemoglobin of calves before and after treatment. However, when haemoglobin was compared within groups a significant difference was found in animals of group T2, T1, T3 and T4 as compared to healthy group.

Table 10: Mean haemoglobin (g/dl) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Haemoglobin (g/dl)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
</tr>
<tr>
<td>T1</td>
<td>11.90±0.27</td>
<td>11.43^{AB}</td>
<td>±0.12</td>
</tr>
<tr>
<td>T2</td>
<td>12.72±0.18</td>
<td>12.13^{A}</td>
<td>±0.19</td>
</tr>
<tr>
<td>T3</td>
<td>11.91±0.54</td>
<td>11.21^{AB}</td>
<td>±0.41</td>
</tr>
<tr>
<td>T4</td>
<td>11.50±0.46</td>
<td>10.71^{B}</td>
<td>±0.42</td>
</tr>
<tr>
<td>Healthy control</td>
<td>09.95±0.59</td>
<td>10.17^{C}</td>
<td>±0.53</td>
</tr>
</tbody>
</table>

*A,B,C shows significant difference at (p<0.05) in mean values between groups
Total Erythrocyte Count (million /µl)

The mean values of total erythrocyte count (million/µl) on day 0 were 5.90±0.13, 6.46±0.10, 6.10±0.15 and 5.73±0.14 in the groups T1, T2, T3 and T4, respectively. The mean values of total erythrocyte count on day 5 were 5.51±0.18, 6.10±0.17, 5.65±0.14 and 5.11±0.12 in groups T1, T2, T3 and T4, respectively (Table11). A significant change in the mean total erythrocyte count was observed in group T1 and T4. When compared within groups. However, when compared between treatments groups, significant difference was found in group T4, T3 and T1, as compared to healthy calves.

Table 11: Mean total erythrocyte count (million/µl) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Total erythrocyte count (million/µl)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
</tr>
<tr>
<td>T1</td>
<td></td>
<td>5.90(^a)±0.13</td>
<td>5.51(^bB)±0.18</td>
</tr>
<tr>
<td>T2</td>
<td></td>
<td>6.46(^b)±0.10</td>
<td>6.10(^Ab)±0.17</td>
</tr>
<tr>
<td>T3</td>
<td></td>
<td>6.10(^b)±0.15</td>
<td>5.65(^Bb)±0.14</td>
</tr>
<tr>
<td>T4</td>
<td></td>
<td>5.73(^a)±0.14</td>
<td>5.11(^bC)±0.12</td>
</tr>
<tr>
<td>Healthy control</td>
<td></td>
<td>6.40(^b)±0.16</td>
<td>6.43(^Ab)±0.13</td>
</tr>
</tbody>
</table>

\(^a, b\) shows significant difference (p<0.05) in mean values within groups

\(^A, B, C\) shows significant difference (p<0.05) in mean values between groups

Packed Cell Volume (%)

The mean values of PCV (%) on day 0 were 35.00±0.57, 38.75±0.65, 35.83±0.33 and 31.33±0.49 in the groups T1, T2, T3 and T4, respectively. The mean values of PCV(%) on day 5 were 31.08±0.37, 36.25±0.35, 33.75±0.44 and 28.75±0.54 in groups T1, T2, T3 and T4, respectively (Table12). A significant decrease was found in mean PCV values on day 5 post treatment in groups i.e. T1, T2 and T4. However, when compared within groups, significant difference was observed in group T1, T2 and T3 as compared to healthy calves.
Table 12: Mean PCV (%) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Packed cell volume (%)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
</tr>
<tr>
<td>T1</td>
<td></td>
<td>35.00±0.57</td>
<td>31.08±0.37</td>
</tr>
<tr>
<td>T2</td>
<td></td>
<td>38.75±0.65</td>
<td>36.25±0.35</td>
</tr>
<tr>
<td>T3</td>
<td></td>
<td>35.83±0.33</td>
<td>33.75±0.44</td>
</tr>
<tr>
<td>T4</td>
<td></td>
<td>31.33±0.49</td>
<td>28.75±0.54</td>
</tr>
<tr>
<td>Healthy control</td>
<td></td>
<td>29.00±1.50</td>
<td>30.16±1.20</td>
</tr>
</tbody>
</table>

*A, B, C shows significant difference (p<0.05) in mean values between groups
*a, b shows significant difference (p<0.05) in mean values within groups

Mean corpuscular volume (fl)

The mean values of mean corpuscular volume MCV (fl) on day 0 were 60.04±0.24, 60.61±0.26, 60.21±0.41, and 60.16±0.50 in the groups T1, T2, T3, and T4, respectively. The mean values of MCV (fl) on day 5 were 59.03±0.89, 58.64±0.61, 57.75±0.93, and 59.12±0.60 in groups T1, T2, T3, and T4, respectively (Table 13). However, the MCV in healthy control calves was 44.35±0.33. No significant changes were found on day 5 post treatment in groups T1, T2, T3, and T4 whereas, significant changes were found on day 5 post treatment in groups T1, T2, T3, and T4 in comparison to healthy control.

Table 13: Mean corpuscular volume (fl) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean corpuscular volume (fl)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
</tr>
<tr>
<td>T1</td>
<td></td>
<td>60.04±0.24 b</td>
<td>59.03±0.89 b</td>
</tr>
<tr>
<td>T2</td>
<td></td>
<td>60.61±0.26 b</td>
<td>58.64±0.61 b</td>
</tr>
<tr>
<td>T3</td>
<td></td>
<td>60.21±0.41 b</td>
<td>57.75±0.93 b</td>
</tr>
<tr>
<td>T4</td>
<td></td>
<td>60.16±0.50 b</td>
<td>59.12±0.60 b</td>
</tr>
<tr>
<td>Healthy control</td>
<td></td>
<td>44.35±0.33 a</td>
<td>45.85±0.90 a</td>
</tr>
</tbody>
</table>

*a, b shows significant difference (p<0.05) between groups
Mean corpuscular haemoglobin (pg)

The mean values of mean corpuscular haemoglobin (pg) on day 0 were 20.31±0.30, 19.88±0.16, 19.50±0.50 and 20.44±0.53 in the groups T1, T2, T3 and T4, respectively. The mean values of MCH (pg) on day 5 were 19.71±0.30, 19.73±0.15, 19.39±0.46 and 20.16±0.15 in groups T1, T2, T3 and T4, respectively (Table14).

No significant changes were found on day 0 (pre treatment) and day 5 (post treatment) between groups T1, T2, T3 and T4 respectively. However, significant changes are observed in comparison to healthy groups.

Table 14: Mean corpuscular haemoglobin (pg) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean corpuscular haemoglobin (pg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
</tr>
<tr>
<td>T1</td>
<td>20.31±0.30&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>T2</td>
<td>19.88±0.16&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>T3</td>
<td>19.50±0.50&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>T4</td>
<td>20.44±0.53&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Healthy control</td>
<td>15.33±1.20&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>*a, b shows significant difference (p<0.05) between groups</sup>

Mean corpuscular haemoglobin concentration (%)

The mean corpuscular haemoglobin concentration (%) per cent on day 0 were 33.63±0.48, 32.66±0.38, 31.91±0.46 and 33.34±0.30 per cent in the groups T1, T2, T3 and T4, respectively. The mean values of MCHC on day 5 were 33.70±0.48, 33.61±0.34, 33.62±0.24 and 33.24±0.37 per cent in groups T1, T2, T3 and T4, respectively (Table 15). No significant changes were observed between the groups T1, T2, T3, and T4 on day 0 pre treatment and day 5 post treatment.
Table 15: Mean corpuscular haemoglobin concentration (%) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean corpuscular haemoglobin concentration (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
</tr>
<tr>
<td>T1</td>
<td>33.63±0.48</td>
</tr>
<tr>
<td>T2</td>
<td>32.66±0.38</td>
</tr>
<tr>
<td>T3</td>
<td>31.91±0.46</td>
</tr>
<tr>
<td>T4</td>
<td>33.34±0.30</td>
</tr>
<tr>
<td>Healthy control</td>
<td>32.33±0.71</td>
</tr>
</tbody>
</table>

*Non-significant difference at p>0.05*

Biochemical Aspect

Serum total protein (g/dl)

The mean values of serum total protein (g/dl) on day 0 were 7.53±0.25, 7.45±0.24, 7.10±0.19, and 7.57±0.05 in the groups T1, T2, T3 and T4, respectively. The mean values of serum total protein on day 5 were 7.26±0.26, 7.00±0.21, 6.74±0.33 and 7.45±0.48 in groups T1, T2, T3 and T4, respectively (Table 16). Significant variations were found in groups T3 and T4. But in comparison to healthy group, only group T4 showed significant variations. However, non significant variation were observed within groups.

Table 16: Mean serum total protein in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Serum total protein(g/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
</tr>
<tr>
<td>T1</td>
<td>7.53±0.25</td>
</tr>
<tr>
<td>T2</td>
<td>7.45±0.24</td>
</tr>
<tr>
<td>T3</td>
<td>7.10±0.19</td>
</tr>
<tr>
<td>T4</td>
<td>7.57±0.05</td>
</tr>
<tr>
<td>T5</td>
<td>6.94±0.08</td>
</tr>
</tbody>
</table>

*A, B, C shows significant difference (p <0.05) in mean values between groups*
Serum albumin (g/dl)

The mean values of serum albumin (g/dl) on day 0 were 3.86±0.12, 3.95±0.14, 3.59±0.15 and 3.82±0.04 in the groups T1, T2, T3 and T4, respectively. The mean values of serum albumin on day 5 were 3.36±0.05, 3.50±0.08, 3.30±0.04 and 3.75±0.03 and in groups T1, T2, T3 and T4 respectively (Table 17). Significant changes were observed within interval in groups T1 and T3. However, no significant changes were observed in between treatment groups.

Table 17: Mean serum albumin (g/dl) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Serum albumin (g/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
</tr>
<tr>
<td>T1</td>
<td>3.86±0.12&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T2</td>
<td>3.95±0.14&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T3</td>
<td>3.59±0.15&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T4</td>
<td>3.82±0.04&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Healthy control</td>
<td>3.44±0.10&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a, b</sup> shows significant difference (p<0.05) in mean values within groups

Serum globulin (g/dl)

The mean values of serum globulin (g/dl) on day 0 were 3.88±0.34, 3.78±0.21, 3.51±0.25 and 3.75±0.04 in the groups T1, T2, T3 and T4, respectively. The mean values of serum globulin on day 5 were 3.72±0.24, 3.23±0.43, 2.78±0.31 and 3.70±0.07 in groups T1, T2, T3 and T4, respectively (Table 18). Significant changes were observed in group T3 on day 5 post treatment. However, non significant changes were found between groups T1, T2, T3, and T4.
Table 18: Mean serum globulin (g/dl) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Serum globulin (g/dl)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>3.88±0.34&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.72±0.24&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>3.78±0.21&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.23±0.43&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>3.51±0.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.78±0.31&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>3.75±0.04&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.70±0.07&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Healthy control</td>
<td>3.34±0.19&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.40±0.14&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a, b</sup> shows significant difference (p<0.05) in mean values within groups

**A : G ratio**

The mean values of serum albumin : globulin ratio on day 0 were 1.05±0.13, 1.06±0.91, 1.03±0.09 and 1.00±0.01 in the groups T1, T2, T3 and T4, respectively. The mean values of serum albumin : globulin on day 5 were 1.13±0.06, 1.20±0.07, 1.20±0.11 and 1.10±0.02 in groups T1, T2, T3 and T4, respectively (Table 19). No significant changes were observed between groups T1, T2, T3, and T4.

Table 19: Mean albumin: globulin ratio in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>A : G ratio</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>1.05±0.13</td>
<td>1.13±0.06</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>1.06±0.91</td>
<td>1.20±0.07</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>1.03±0.09</td>
<td>1.20±0.11</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>1.00±0.01</td>
<td>1.10±0.02</td>
<td></td>
</tr>
<tr>
<td>Healthy control</td>
<td>1.04±0.77</td>
<td>1.02±0.08</td>
<td></td>
</tr>
</tbody>
</table>

*Non-significant difference at p>0.05*
Serum potassium

The mean values of serum potassium (mEq/L) on day 0 were 8.50 ±0.34, 8.46±1.90, 7.48±1.60 and 8.35±1.80 in the groups T1, T2, T3 and T4, respectively. The mean values of serum potassium on day 5 were 7.30±0.12, 7.80±0.30, 6.26±1.20 and 7.46±0.06 in groups T1, T2, T3 and T4, respectively (Table 20). No significant changes were observed between groups T1, T2, T3, and T4.

**Table 20: Mean serum potassium (mEq/L) indifferent treatment groups at different intervals**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Serum potassium (mEq/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
</tr>
<tr>
<td>T1</td>
<td>8.50±0.34</td>
</tr>
<tr>
<td>T2</td>
<td>8.46±1.90</td>
</tr>
<tr>
<td>T3</td>
<td>7.48±1.60</td>
</tr>
<tr>
<td>T4</td>
<td>8.35±1.80</td>
</tr>
<tr>
<td>Healthy control</td>
<td>7.00±0.24</td>
</tr>
</tbody>
</table>

*Non-significant difference at p>0.05

Serum sodium (mEq/L)

The mean values of serum sodium on day 0 (mEq/L) were 167.60±1.4, 180.48±1.0, 168.60±1.1, and 161.50±0.25 in the groups T1, T2, T3 and T4, respectively. The mean values of serum sodium on day 5 were 182.70±1.50, 183.00±1.10, 173.60±1.60 and 163.30±0.36 in groups T1, T2, T3 and T4, respectively (Table 21). No significant differences were observed in between groups.
Table 21: Mean serum sodium (mEq/L) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Serum sodium (mEq/L)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>167.60±1.40</td>
<td>182.70±1.50</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>180.48±1.00</td>
<td>183.00±1.10</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>168.60±1.10</td>
<td>173.60±1.60</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>161.50±0.25</td>
<td>163.30±0.36</td>
<td></td>
</tr>
<tr>
<td>Healthy control</td>
<td>165.08±0.21</td>
<td>168.85±0.15</td>
<td></td>
</tr>
</tbody>
</table>

*Non-significant difference at p>0.05

Serum chloride (mEq/L)

The mean values of serum chloride (mEq/L) on day 0 were 113.86±1.13, 114.52±1.50, 114.31±1.69 and 114.71±0.95 in the groups T1, T2, T3 and T4, respectively. The mean values of serum chloride on day 5 were 104.25±0.85, 103.68±1.10, 112.53±1.20 and 112.60±0.60 in groups T1, T2, T3 and T4, respectively (Table 22). No significant difference was found in between groups. However, significant changes were found within interval groups T1 and T2.

Table 22: Mean serum chloride (mEq/L) in different treatment groups at different intervals

<table>
<thead>
<tr>
<th>Groups</th>
<th>Serum chloride (mEq/L)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>113.86±1.13&lt;sup&gt;a&lt;/sup&gt;</td>
<td>104.25±0.85&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>114.52±1.50&lt;sup&gt;a&lt;/sup&gt;</td>
<td>103.68±1.10&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>114.31±1.69&lt;sup&gt;a&lt;/sup&gt;</td>
<td>112.53±1.20&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>114.71±0.95&lt;sup&gt;a&lt;/sup&gt;</td>
<td>112.60±0.60&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Healthy control</td>
<td>114.17±0.84&lt;sup&gt;a&lt;/sup&gt;</td>
<td>113.20±0.47&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a, b</sup> shows significant difference (p<0.05) in mean values within groups
Results of therapeutic regimens.

The result of the therapeutic efficacy of various medicaments used under various treatment groups i.e T1, T2, T3 and T4. It was observed that T1 (comprising of Cfl ox TZ) and T4 (Psidium guajava aqueous extract @ 500 mg /kg b.wt ) have given excellent results.

Whereas, in the group T2 and T3 in which Psidium guajava was given@ 300 mg /kg b.wt in the form of leaf powder and in the form of aqueous extract @ 300 mg /kg b.wt respectively gave appreciable results. During the study no significant effect was observed in any of the group as regard the form in which the Psidium guajava was given.
5. DISCUSSION

Overall prevalence

The present investigation was aimed to evolve the effective control of calf diarrhoea using herbal preparation in different forms with Ringer’s lactate at Livestock farm Adhartal. It was deemed worth while to include certain privately owned dairy farms in the surrounding areas to obtain a comprehensive insight into the vexed problem faced by dairymen in neighbourhood. The evident of prevalence of *E.coli* F5 was observed in and around Jabalpur. In the present study the per cent positivity of 50% was recorded in diarrhoeic calves due to *E.coli*. The evident of clinical haematological and biochemical indices were taken into consideration to determine the effect of different therapeutic regimens.

Sex wise prevalence

The sex wise prevalence showed that the presence of *E.coli* F5 was found 65 per cent in male calves (15 out of 23 calves) and 37 per cent in female calves (10 out of 27 calves). Thus, the prevalence of *E.coli* infection was higher in male as compared to female calves. However, Pal *et al.* (2012) have also reported highest prevalence (45.56%) in male than in female i.e. (43.58%).

Age wise prevalence

The results of age wise prevalence showed that the presence of *E.coli* F5 was found to be highest i.e. 80 per cent in the calves up to 15 days of age (20 out of 25 calves) followed by 28.57 per cent in the calves from 16 to 30 days of age group (4 out of 14 calves), then 20 per cent in calves from 1 to 2 months of age group (1 out of 5 calves) and no infection was found in calves of 2 to 3 months of age group.

On the other hand, the findings of Pal *et al.* (2012) suggested similar observations in terms of the maximum prevalence up to the age of 15 days in calves (i.e. 28.75% between 4-6 days and 9.9% between the age of 13-15 days).
Feeding status

During the entire period of study all the calves were fed on colostrum and transitional milk. The study of the study revealed that no significant effect of feeding status in all the calves including healthy control.

Clinical aspect

A perusal of data pertaining to body temperature of calves revealed a mild increase in the body temperature of diarrhoeic calves as compared to healthy control calves. Which fall down on day 5 but difference found was non-significant. These findings are in agreement with (Sridhar et al., 1988; Ramkumar, 2012; Malik et al., 2013 and Singh et al., 2014).

The pulse rate of calves were fell down on day 5 post treatment than day 0 pre treatment. These were in conformity with observations of Singh et al. (2014), however, statistical analysis of data revealed a non significant difference in pulse rate of animal in all treatment groups.

As regards the respiration rate in calves under investigation showed mild increase in respiration rate from day 0 (pre treatment) and subsequent, days (post treatment) which was in agreement with Ramkumar (2012) and Singh et al. (2014).

Dehydration score on day 0 was found mild to moderate which leads to normalcy on day 5 in group T1. While, Group T2, T3 and T4 showed mild dehydration on day 5 post-treatment to severe dehydration on day 0 which later on remained less. On the other hand, no change was observed in dehydration status in healthy control calves. On day 0, all the diarrhoeic calves showed varying degree of dehydration. This increased dehydration prior to treatment can be attributed to inflammed epithelium, without any food and water intake. Whereas, all the calves showed progressive improvement in dehydration status during the course of treatment. This may probably because of the continuous fluid administration during the entire period of treatment resulted in rehydration in all the calves.
HAEMATOLOGICAL ASPECTS

An overview of haemogram revealed increased values of major haematological parameters i.e. Hb, PCV, TEC, MCV, MCH and MCHC in all diarrhoeic calves as a result of haemoconcentration owing to dehydration.

During the present study, a significant elevation of PCV in all the calves was reported. This observation talleyed with the findings of Naylor (1987) in diarrhoeic calves. He has also indicated the reason for this is the fluid loss from the vascular compartment. On the other hand Dahiwal (1993) and Rajora and Pachuri (2000) have reported that estimation of PCV is of utmost importance to monitor dehydration status in animal as a sensitive indicator for assessing the severity of dehydration (Deshpande et al., 1992; Michell et al., 1992; Constable et al., 1996 and Bukhari 2002). Further, they have reported that mean PCV value increased up to significant level in diarrhoeic calves. Kaur et al. (2006) also reported gradual and significant decline in mean PCV values from 41.90 ± 1.44% at 48 hours to 39.58 ± 1.75% at 48 hours to 39.58 ± 1.75% at 144 hours which was comparable of healthy control. Similarly, Grove-White and White (1999) also observed a significantly increased value of PCV (48.4 ± 10.3%) in diarrhoeic calves as compared to non diarrhoeic calves (33.6 ± 4.3%). They have also suggested that increased PCV value was apparently due to haemo-concentration associated with dehydration and hypovolumia.

Hb value in diarrhoeic calves were found to be increased on day 0 in all treatment groups as compared to day 5 post treatment, which revealed haemoconcentration due to loss of fluid from the body leading to dehydration. The haemoglobin concentration was significantly different from that of control group. This was effectively countered by remedial therapy, our findings are in concurrence with the findings of other scientists (Sridhar et al., 1988; Mir, 2009 and Quadri 2010).

Similarly during the study, significant elevation of TEC value was seen in all the calves as also supported by Sridhar et al. (1988) who have also reported significant elevation of TEC in scouring calves, probably due to the haemoconcentration of blood as a result of diarrhoea.
BIOCHEMICAL ASPECTS

Water and electrolyte balance is an integral component of hemostasis or consistancy of metabolism. Change in water balance are inevitably accompanied by change in electrolyte concentration in all body fluids. Thus, It is obvious that water and electrolyte imbalance are associated with certain clinical status like diarrhoea.

In the present study a slight increase in serum total protein before treatment was observed in diarrhoeic calves which was in agreement with the findings of other scientists (Sridhar et al., 1988; Constable et al., 1996; Walker et al., 1998 and Singh et al., 2014). This might have highlight the potentially hazardous clinical status of acute tissue dehydration.

The significant increase in the value of serum albumin recorded in the present study is in agreement with the findings of Kaur et al. (2006) and Singh et al. (2014). Who have opined that increase in albumin levels during the present study might be due to dehydration as a result of diarrhoea (Mir, 2009).

A significant decrease was perceptible in regard to serum globulin concentration on day 5 post treatment in group T3. Similar observations have been recorded by results of Bukhari (2002) who have also recorded increase serum globulin concentration on day 0 before treatment, presumably changes in serum globulin concentration under different regimens at varying intervals in the study are too narrow to be of any clinico immunological significance.

Fall in A:G ratio in diarrhoeic calves was found in the present study are in agreement with the findings of Sridhar et al. (1988).

Decrease in level of serum sodium in diarrhoeic calves was recorded against the normal healthy calves. These findings are in agreement with the findings of other scientists (Maach et al., 1992; Aly et al.,1996; Groove – White and White 1999 and Mir, 2009). Decrease level of sodium in comparison of day 5 post treatment occur as a result of excessive secretion of Na+ ions by intestinal villi cells which are lost through the intestinal tract particularly in enterotoxigenic E.coli induced diarrhoea (Radostits et al., 2010).
It is not surprising to observe perceptibly increased serum K+ concentration (hyperkalemia) in diarrhoea calves in comparison to healthy control. Mir (2009) also in support of these findings. However, Radostits et al. (2010) mentioned that though, potassium is mainly responsible for maintaining the normal cardiac rhythm, occasionally leading to cardiac arrest. But onset of hyperkalemia in diarrhoeic calves is promoted by metabolic acidosis.

Chloride (Cl\(^-\)) is the major anion in body fluids designed to balance the cation and maintain ionic equilibrium in the healthy state. In calf diarrhoea, metabolic acidosis results from the excess of hydrogen ions (H+) and the associated depletion of NaHCO\(_3\)- because over production of H\(^+\) ions Cl\(^-\) ions is released from the erythrocytes to balance the loss of HCO\(_3\)- and maintain electro neutrality (Sherwood et al., 1988). This observation was in agreement with Mir (2009).

**THERAPEUTIC ASPECTS**

The treatment of calf diarrhoea involved the use of antidiarrhoeal and replenishment of fluid and electrolyte in the form of rehydration therapy. In the present study, four treatment group T1, T2, T3 and T4 were included. The therapeutic agents comprised of antidiarrhoeal (Psidium guajava) as in different forms to check the diarrhoea and rehydration therapy in the form of Ringer’s lactate to helps in replacing the fluids and electrolytes, antidiarrhoeal were given orally.

The *Psidium guajava* is known to be used for antidiarrhoeal effect in *E.coli* infection (Lin *et al*., 2002 and Lozoya *et al*., 2002).

Nadkarni (2000) have advocated the antidiarrhoeal action of *Psidium guajava* is due to its contents i.e tannin, quercetin, triterpenoids and saponin.

It was observed that the therapy in treatment group T1 and T4 Comprising of (Ringer’s lactate in combination with CFlox- TZ and Ringer’s lactate in combination of *Psidium guajava* aqueous extract @ 500mg /kg b.wt.
respectively) gave excellent results as compared to other combinations. Whereas, between the various forms of *Psidium guajava* i.e. leaf powder (T2) and aqueous extract (T3) when given @ 300 mg/kg b.wt gave appreciable results without significant effect. During the study no significant effect was observed in any of the group as regard the form of the *Psidium guajava* which was given in the treatment groups T2 and T3.

The overall results of the present investigation revealed clinical observations as rise of temperature, pulse rate, respiration rate, dehydration score, typical symptoms like diarrhoea, watery to pasty faeces may be greenish to yellow white in colour, with mild to moderate dehydration. Blood analysis revealed increase in haemoglobin concentration, PCV, and TEC in comparison to day 0 pre treatment. However, after treatment all values were observed to be decreased on day 5 post treatment.
6. SUMMARY, CONCLUSION AND SUGGESTIONS FOR FURTHER WORK

6.1 Summary

The present investigation was aimed to study the prevalence and suitable therapeutic approach against *E. coli* antigen. During the study period a total of 50 calves (upto 3 month of age) of either sex belonging to organized and unorganized sectors were screened. The confirmation of *E. coli* F5 antigen in suspected cases was done by immuno-chromatographic strips and to evolve effective control of calf diarrhoea using herbal preparations in combination with rehydration therapy at the composite livestock farm, Adhartal Jabalpur and dairy farms in the surrounding areas to obtain a comprehensive insight into the vexed problem faced by the dairymen. The overall prevalence of the *E. coli* F5 was found to be 50% during the present study period.

The sex wise prevalence of *E. coli* F5 was reported higher in male (65%) as compared to female (37.04%). The age wise prevalence of *E. coli* F5 was higher in 0-15 days calves (80%) followed by 16-30 days (28.57%) then between 1-2 month (20%) and no infection was reported between 2-3 month of age.

In the present study a total of 24 calves upto the age of three months, with the symptoms of *E. coli* diarrhoea were included, besides this six apparently healthy calves were kept as control.

Diarrhoeic calves were selected and treated in four different groups comprising of six calves in each group. The calves of Group T1 were treated with Cflox -TZ @ 1 Tab /25 kg b.wt BID orally with fluid therapy (Ringer’s lactate) I/V for five days. The calves of Group T2 were treated with Guava leaves powder @ 300 mg/kg b.wt BID orally for five day with fluid Ringer’s Lactate @ 5-10 ml /kg body weight slow intravenously. Group T3 were treated with Guava leaves aqueous extract @300 mg/kg b.wt orally BID for five days with Ringer’s Lactate @ 5-10 ml /kg body weight BID slow intravenously. Group T4 calves
were treated with Guava leaf aqueous extract @ 500 mg/kg b.wt orally BID for five days with Ringer’s Lactate (RL) given @ 5-10 ml /kg body weight slow intravenously.

The overall response of the treatment was monitored on the basis of improvement of clinical and haematobiochemical profile of diarrhoeic calves and return of these parameters towards normalcy.

Clinical observations viz; body temperature, pulse rate and respiration rate, were recorded. Degree of dehydration in diarrhoeic calves was also assessed by skin fold test on day 0 (pre treatment) and day 5 (post treatment) under the study.

Body temperature, pulse rate, respiration rate were mildly elevated in all the diarrhoeic calves with declining trend on day 5 post treatment with decrease in body temperature, pulse and respiration rate, which were non significant. Clinically, all the diarrhoeic calves exhibited watery diarrhoea (greenish to yellow/ pasty white). Diarrhoeic calves in all the groups exhibited mild to moderate dehydration which lead to normalcy later on in group T1 and T4 respectively. However, improvement in clinical signs was rapid in group T1 (comprising of Cflox-TZ) and T4 (*Psidium guajava* aqueous extract @ 500 mg/kg b.wt BID) calves respectively.

Haemogram of the animals revealed increased values of PCV% and Hb concentration, on day 0 in T1, T2, T3, and T4, groups as compared to the corresponding post treatment values on day 5. Where, significant fall in PCV was observed in T1 (comprising of Cflox-TZ), T4 (*Psidium guajava* aqueous extract @500 mg/kg b.wt BID) and T3 (*Psidium guajava* aqueous extract @300 mg/kg b.wt BID) whereas, non significant fall was observed in group T2. Moreover, haemoglobin concentration showed a post treatment significant decline in T4 (*Psidium guajava* aqueous extract @500 mg/kg b.wt BID) followed by T2 (*Psidium guajava* leaves powder @300 mg/kg b.wt BID) though in T1 and T3 little decline was observed.
Hyponatremia was observed in all the groups and significant increase in serum sodium level was observed in T2. Hyperkalemia was observed in the diarrhoeic calves as compared to the value recorded in the normal control group. However, it was non significantly declined in all the groups after the treatment. Hyperchloremia persisted in all the groups on day 0 which showed declining trend subjected to the treatment. However, statistical analysis of the data showed significant decline in between T1 and T2 respectively.

In the present study, serum total protein revealed an increasing trend in the diarrhoeic calves in general with significantly declined in group T3 after subjected to the treatment.

There was an apparent increase in the values of serum albumin which declined significantly in T1 and T3 after the treatment. Fall in A:G ratio was observed in the diarrhoeic calves which did not alter significantly even after the treatment.

The result of the therapeutic efficacy of various medicaments used under various treatment groups i.e T1, T2, T3 and T4. It was observed that T1 (comprising of Cflox TZ) and T4 (Psidium guajava aqueous extract @ 500 mg /kg b.wt ) have given excellent results.

Whereas, in the group T2 and T3 in which Psidium guajava was given@ 300 mg /kg b.wt in the form of leaf powder and in the form of aqueous extract @ 300 mg /kg b.wt respectively gave appreciable results. During the study no significant effect was observed in any of the group as regard the form in which the Psidium guajava was given.
6.2 Conclusions

- The overall prevalence of *E.coli* F5 antigen was observed to be 50 per cent in diarrhoeic calves using immuno-chromatography.

- Among the clinical parameters, no significant changes were observed in body temperature, pulse and respiration rate of the ailing animal as compared with healthy animals.

- Analysis of haematological and biochemical parameters revealed significant difference in haemoglobin, packed cell volume, total erythrocyte count, total albumin, globulin and chloride whereas, no significant alteration were observed in potassium, sodium and A:G ratio.

- Group T1 (Cflox T-z) was found to be 100 per cent efficacious followed by group T4 (*Psidium guajava* aqueous leaf extract @ 500mg/kg) which was 85 percent efficacious, then group T3 (*Psidium guajava* aqueous leaf extract @ 300mg/kg) which was 65 per cent efficacious as evident by the improvement of clinico-haematobiochemical parameters. However, In group T2 the efficacy of *Psidium guajava* leaf extract @ 300mg/kg was observed as 50 per cent.
6.3 Suggestions for further work

On the basis of findings of present study the suggestions for further work are as under -

• This work can further be extensified by increasing the area of study taking latest herbal drug keeping in view the cost and efficacy.

• Therapeutic evaluation of *Psidium guajava* (Guava) in different forms may be done as anti-diarrhoeal in other species.

• The work can be undertaken using *Psidium guajava* in diarrhoea of various etiology in calves/kids.
7. REFERENCES


