



Evaluation of Therapeutic Potential of *Terminalia chebula* on Large Colon Impaction in Equines

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ABSTRACT

In the present investigation, a total of 12 equines with large colon impaction, and 6 healthy animals' ages 3 to 12 years, were selected for study. The Impaction colic cases were divided into two treatment groups, T1 and T2, and healthy control group (Hc). The indigenous preparation comprised the seed of *Terminalia chebula*, was sun-dried and grinded to a fine powder, and was administered @ 10 gm/30 kg body weight orally once daily for three days in T2 groups. Both therapeutic groups T1 and T2 were given the following standard treatment, RL and DNS @ 20 ml/ kg b.wt., Ceftriaxone 10 mg/kg b.wt., Flunixin meglumine 1.1 mg/kg b.wt., Ascorbic acid @ 20ml OD IV, Vitamin B-complex @10 ml OD IM, Antihistamines @ 10 ml OD IM for three days along with 2 litres of enteral liquid paraffin via a nasogastric tube. The therapeutic efficacy of the above therapeutic regimens was evaluated based on clinical recovery in terms of the time of defecation (hrs.) after treatment and improvement in the altered values of the clinical score, hemato-biochemical alterations, and electrolyte values towards normalcy (at par to the values in healthy control equines) on day 3rd after treatment. The blood sample was collected on the day of occurrence of Impaction on day 0 (pre-treatment) and day 3rd (post-treatment). Large colon impaction cases had significantly lower levels of sodium, potassium, chloride, and ionized calcium than the healthy animal group, whereas serum glucose, urea, creatinine, total protein, albumin, alanine ALT, AST, ALP, LDH, GGT, TNF- α , and procalcitonin, found significantly in higher levels. Therapeutic regimen adopted in the treatment of large colon impaction cases under treatment groups T2 in which *Terminalia chebula* powder (act as prokinetic) was given found to be most efficacious as evident by the improvement in clinical score in terms of the reduced colic sign, hemato-biochemical alteration and improvement in defecation time and gastrointestinal motility.

HIGHLIGHTS

- The study focused on therapeutic potential of *Terminalia chebula* on large colon impaction in equines
- *Terminalia chebula* reduced colic sign, defecation time and increased gastrointestinal motility.
- It may be recommended as adjunct prokinetic therapy in large colon impaction in equine apart from standard treatment.

Keywords: Equines, large colon Impaction, *Terminalia chebula*, haemato-biochemical parameter, clinical score and recovery

Colic means abdominal pain of digestive origin, found as the symptom of a disease of horses, donkeys, and mules. It is a multifactorial and complex disorder that ranges from mild impaction of the large intestine to severe strangulation (Nagar and Sharma, 2019). In a year, 4 to 10 instances of colic cases are predicted out of every 100 horses in the general population (Hillyer *et al.*, 2002) and about 10-

15% of colic cases repeat, with some horses experiencing 2-4 colic episodes each year (Traub *et al.*, 2001).

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Risk factors such as poor dentition, decreased water intake, coarse roughage feeding, lack of exercise, NSAID administration, parasite infestation, motility disorders, and the typical anatomy of the equine intestine makes it prone to the formation of faecoliths and frequent suffering from impactive colic (Plummer, 2009). Elevated vital parameters along with reduced GI motility and congested mucous membrane find in animal with large colon impaction (Suryawanshi *et al.*, 2019). Electrolyte abnormalities (Hyponatremia, Hypokalemia, Hypochloremia and Hypocalcemia) common in horses with impaction colic (Borer and Corley, 2006). Hemato-biochemical parameters revealed Lymphocytosis, Neutrophilia, Dehydration, Proteinemia, Albuminemia, and Uremia (Gulia *et al.*, 2018).

The essential elements for treating colic horses are pain management, gastrointestinal decompression correcting fluids and electrolyte imbalances, and improving gastrointestinal motility and inflammatory condition (Sanchez and Robertson, 2014). *Terminalia chebula* is considered the most revered medicinal plant, exhibiting a broad range of therapeutic activities. Since antiquity, the fruit of this plant has been used as a traditional medication for domestic treatment against different human ailments (Bag *et al.*, 2013). The amount, frequency, and consistency of stool were improved in patient of the Terminalia-treated group and found to have good laxative properties and also improve appetite with no adverse effect (Mukherjee *et al.*, 2006). So, it can use effectively in the treatment of constipation and other gastric problems in patients. The plant locally called Haritaki has powerful healing potential. *Terminalia chebula* (Haritaki) is known in Tibet as the “King of Medicine” (Gupta, 2012).

MATERIALS AND METHODS

Study plan and sample collection

The present study was investigated on clinical case of large colon impaction in equines reported at Veterinary clinical complex (VCC), DUVASU, Mathura and screening of animals was also done in Mathura and its adjoining areas with the help of Brooke hospital for animals. A total of 12 equine colic cases diagnosed for large colon Impaction taken from TVCC and Local equines owner in collaboration with Brook hospital aged between 3- 12

years and 6 healthy animals were selected from Livestock Farm Complex of the institute as healthy control group.

The selection of animal was done as per the history of colicky sign (anxiety, pawing or stamping, flank watching, kicking at the abdomen, rolling, lying down and getting up, grunting, excessive sweating, sham drinking, frequent attempts to urinate, lack of defecation) and based on positive finding of obstructed lumen of the left ventral large colon or pelvic flexure on rectal examination and pulse rate <60.

The large colon Impaction colic cases were divided in following groups for therapeutic evaluation.

Table 1: Different therapeutic regimens

Groups (n=6)	Therapeutic regimens
I (Hc)	Healthy equines kept as control
II (T-I)	Equines with large colon Impaction treated with standard treatment, Fluid therapy, Ceftriaxone (Antibiotic) Flunixin meglumine (NSAID), Ascorbic acid, Vitamin B-complex, Antihistaminic, fenbendazole, and two liters enteral liquid paraffin via nasogastric tube.
III (T-II)	Equines with large colon Impaction treated with <i>Terminalia chebula</i> powder @ 10 gm/30 kg body weight orally along with standard treatment.

Standard treatment include parenteral fluid therapy (RL and DNS @ 20 ml/ kg b.wt., BD IV), Ceftriaxone (10mg/ kg b.wt., OD IV for 3 days), Flunixin meglumine (1.1 mg/kg b.wt., BD IV for 3 days), Ascorbic acid (20 ml OD IV), Vitamin B-complex (10ml OD IM for 3 days), Antihistamines (10 ml OD IM). Both therapeutic groups were given the standard treatment along with 2 liters enteral liquid paraffin via nasogastric tube.

Clinical observations and blood sampling was done on the day of presentation of case (day 0) pre-treatment and on (day 3rd) post treatment. Complete Clinical examination of all affected large colon Impaction cases were made, and following parameters viz. temperature, heart rate, respiration rate, capillary refill time, gut sound, and rectal examination were recorded in individual cases.

Preparation of medicaments

The indigenous preparation in the present study comprised of seed of *Terminalia chebula*. It was prepared by collecting

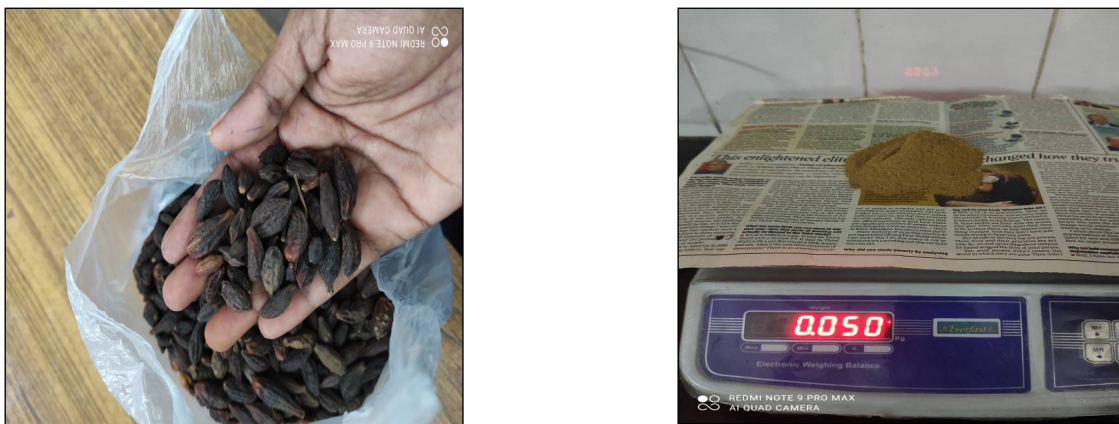


Fig. 1: Dried seeds of *Terminalia chebula* and its fine powder

fresh seed from tree, which was sun dried and grinded to fine powder. It was administered @ 10 gm/30 kg body weight orally once daily for three days in T2 group.

Clinical scores in large colon impaction in equines

The clinical scores (0-3 basis) were recorded as per the scoring criteria (Jennings *et al.*, 2014) with slight modifications pre-treatment (on day 0) and (on day 3rd) post treatment.

Haemato- biochemical parameter

Blood sample was collected on the day of occurrence of Impaction at day 0 (pre-treatment), and on day 3rd (post treatment) after recovery. The hematological investigation was carried out by Hematology analyzer (Nihon Kohden MEK6420P cell counter). Total 10 ml blood was collected aseptically from jugular vein of affected horses, of which 2 ml was mixed with di sodium salt of EDTA as an anticoagulant for hematological examination. The hematological attributes included Hemoglobin (Hb) concentration (g/dl), Total erythrocyte count ($10^6/\mu\text{l}$), packed cell volume (%), Differential leukocyte count ($10^3/\mu\text{l}$), Platelets count ($10^3/\mu\text{l}$) were analyzed using standard methods. Serum total protein (g/dl), Serum albumin (g/dl), Serum glucose (mg/dl), Serum creatinine (mg/dl), Serum alkaline aminotransferase (IU/L), Serum aspartate aminotransferase (IU/L), Serum alkaline phosphatase (IU/L), Serum urea nitrogen (mg/dl), Serum sodium, potassium, chloride (mEq/L), Serum ionized calcium (mg/dl), Serum TNF – α (ng/ml), Serum procalcitonin (pg/ml),

Serum lactate dehydrogenase (IU/L), Serum γ -glutamyl transferase (IU/L) were analysed using standard methods.

Blood serum for biochemical analysis

A total of 5 ml blood was collected from each animal in a sterilized glass at each of specified intervals for serum biochemistry. Blood was allow to coagulate by keeping the tubes in slants and serum was separated by centrifuging at 3000 rpm for 15 min and then stored at -20° in aliquots for biochemical analysis using diagnostic reagent commercial kits (Arkray) on Semi automated biochemical analyzer. Total protein and Albumin, Serum glucose, BUN, creatinine and serum ALT, AST, ALP enzymes estimations were done using diagnostic reagent kits (Arkray) on Semi automated biochemical analyzer (model Erba MannheimCHEM-7 plus v2) as per the Recommendation of the manufacturers. Fully automated HDC-Lyte expand Na/K/Cl/Ca/Li Analyzer were used for estimation of serum sodium, potassium, chloride (C), and calcium parameter using kit delivered by HDC-Lyte company.

Estimation of serum tumor necrosis factor α , procalcitonin, γ -glutamyl transferase (GGT), lactate dehydrogenase (LDH) status

For the assessment of pattern of cytokine production serum was separated and stored at -20° for estimation of pro-inflammatory cytokines. Pro inflammatory (TNF- α) and enzymatic level were measured in serum of equines using equines specific quantitative ELISA kits (Bioassay

Technology Laboratory, Shanghai, china) and standard procedure of estimation was followed as provided in kits literature. Curve expert basic version 1.4 software was used to draw standard curve for ELISA.

STATISTICAL ANALYSIS

Statistical analysis of all the data to test significance of means was done as per the method described by Snedecor and Cochran (1994) by using SPSS v16.0.

RESULTS AND DISCUSSION

Clinical score

The clinical scores (0-3 basis) were recorded as per the scoring criteria (Colicky signs score, Sweating score, Demeanour score, Intestinal sound score) provided by (Jennings *et al.*, 2014) with slight modifications pretreatment (on day 0th) and (on day 3rd) post treatment.

Colicky signs score

The Mean \pm SE value of colicky signs score (0-3) in treated groups was found to be significantly higher in both T1 and T2 groups of large colon impaction than in the healthy control group on day 0 (pre-treatment). There was a significant decrease in colicky signs score on day 3rd (post-treatment) with highest recovery observed in treatment group 2 (T2). Therefore, in terms of improvement in colicky signs score in the treated group of large colon impaction in equines, the best recovery was assessed in T2 group.

Sweating score

The Mean \pm SE value of Sweating score (0-3) in treated groups was found to be significantly higher in both T1 and T2 groups of large colon impaction than in the healthy control group on day 0 (pre-treatment). There was a significant decrease in sweating score on day 3rd (post-treatment) with highest recovery observed in treatment group 2 (T2). Therefore, in terms of improvement in sweating score in the treated group of large colon impaction in equines, the best recovery was assessed in the T2 group.

Demeanour Score

The Mean \pm SE value of demeanour score (0-3) in treated groups was found to be significantly higher in both T1 and T2 groups of large colon impaction than in the healthy control group on day 0 (pre-treatment). There was a significant decrease in demeanour score on day 3rd (post-treatment) with highest recovery observed in treatment group 2 (T2). Therefore, in terms of improvement in demeanour score in the treated group of large colon impaction in equines, the best recovery was assessed in the T2 group.

Intestinal sound score

The Mean \pm SE value of intestinal sound score (0-3) in treated groups was found to be significantly lower in both T1 and T2 groups of large colon impaction than in the healthy control group on day 0 (pre-treatment). There was a significant increases in intestinal sound score on day 3rd (post-treatment) with highest recovery observed in treatment group 2 (T2). Therefore, in terms of improvement in Intestinal sound score in the treated group of large colon impaction in equines, the best recovery was assessed in the T2 group.

In the present study, significant improvement in these clinical scores suggests that therapeutic regimens applied are effective in treating large colon impaction, and the best recovery was reported in treatment group T2, in which a powder of *Terminalia chebula* was given. All clinical parameters stabilize after treatment and find the best recovery in treated groups T2. Hence findings revealed that the powder of seeds of *T. chebula* was found to be effective and proved to be a potent prokinetic drug. These findings observed in the present investigation are corroboration with the findings earlier reported (Gulia *et al.*, 2018).

The temperature, heart rate, respiration rate, and capillary refill time, significantly higher in both treated groups of large colon impaction than in the healthy control group on day 0 (pre-treatment). There was significant decrease in rectal temperature, heart rate, respiration rate, and capillary refill time on day 3rd (post treatment) with the highest recovery was observed in treatment group 2.

Haemato - biochemical alteration

Total leukocyte count in treated groups was found to be significantly higher in both T1 and T2 groups of large colon impaction in equines than in the healthy control group on day 0 of occurrence (pre-treatment). There was a significant decrease in total leukocyte count on day 3rd (post-treatment) with the highest recovery observed in treatment group 2 (T2).

In the present study, (Mean \pm SE) value of Hb, TEC & PCV in treated groups was found to be significantly higher in both T1 and T2 groups of large colon impaction than in the healthy control group on day 0 of impaction (pre-treatment). There was a significant decrease in Hb, TEC & PCV on day 3rd (post-treatment), with the highest recovery observed in treatment group 2 (T2). The increased mean Hb, TEC & PCV values found under the study in large colon impaction mainly due to haemo-concentration i.e. associated with pain or stress which causes the spleen to contract and compartmental fluid shifts that cause dehydration and hypovolemia (Gagandeep *et al.*, 2017; Orsini *et al.*, 2011; Constable *et al.*, 2016). The value of platelet count in treated groups was found to be significantly lower in both T1 and T2 groups of large colon impaction than in the healthy control group on day 0 (pre-treatment). There was a significant increase in platelet count on day 3rd (post-treatment) with highest recovery was observed in treatment group 2 (T2). The main cause cited by (Alsaad and Nori, 2009) i.e. releasing endogenous mediators, such as platelet activating factor that causes inflammatory disorders in the coagulation system, resulting in disseminated intravascular clotting which was controlled and returned to normal three days of post-therapy.

Biochemical alteration

In the present investigation (Mean \pm SE) value of serum total protein, Serum albumin, Glucose, ALT, AST, ALP, LDH, GGT, BUN, and Creatinine concentration in treated groups were found to be significantly higher in both T1 and T2 groups of large colon impaction in equines than a healthy control group on day 0 impaction (pre-treatment). There was a significant decrease in these parameters on day 3rd (post-treatment) with highest recovery was observed in treatment group 2 (T2). An increase in both PCV and total

protein concentration in impaction and obstructive colic was indicative of severe dehydration. Although the cause of hyperglycemia is unknown, it has been proposed that horses who experience colic temporarily exhibit insulin resistance, which raises blood sugar levels (Hassel *et al.*, 2009).

The value of serum blood urea nitrogen (BUN), and serum creatinine in treated groups was found to be significantly higher in both T1 and T2 groups of large colon impaction than in the healthy control group on day 0 impaction (pre-treatment). There was a significant decrease in serum blood urea nitrogen and Serum creatinine on day 3rd (post-treatment) with highest recovery was observed in treatment group 2 (T2). Increased BUN and creatinine (Azotemia) in all types of colic could be due to dehydration and decreased filtration across the glomerulus (Orsini, 2011; Lester *et al.*, 2015).

Horses with impaction had higher levels of alkaline phosphatase (ALP), an enzyme that is found in the intestinal mucosa but is not particularly relevant. A higher level of serum ALP is linked to more severe gastrointestinal damage, which increases the likelihood of requiring surgery and worsens the prognosis (Saulez *et al.*, 2004).

Serum electrolytes status

The (Mean \pm SE) value of serum Na, K, Cl, and ionic Ca in treated groups were found to be significantly lower in both T1 and T2 groups of large colon impaction than in a healthy control group on day 0 (pre-treatment). There was a significant increase in serum Na, K, Cl, and ionic Ca on day 3rd (post-treatment) with highest recovery was observed in treatment group 2 (T2). Calcium plays a major role at the stage of coagulation, especially in the process of shrinkage of the fibrin clots and that might lead to a decrease in its level in the bloodstream, (Borer and Corley, 2006; Doxy, 2006). Hypokalaemia is common in horses with more long-standing colic, for instance, impaction of the large colon that has not been eaten for several days (Radostitis *et al.*, 2007). A significant decrease in chloride levels in the obstructive and spasmodic colic groups could be due to excessive loss or decreased absorption of chloride in enteritis and gastrointestinal tract disorders (Gagandeep *et al.*, 2017).

Estimation of γ -Glutamyltransferase (GGT), Lactate Dehydrogenase (LDH) status

The (Mean \pm SE) value of serum LDH & GGT in treated groups was found to be significantly higher in both T1 and T2 groups of large colon impaction than in the healthy control group on day 0 (pre-treatment). There was a significant decrease in serum LDH & GGT on day 3rd (post-treatment) with highest recovery observed in treatment group 2 (T2). The result observed in the present study is in corroboration with the findings early reported by (Gulia et al., 2018), which indicated liver dysfunction in large colon impaction horses. Serum enzyme activities are most beneficial in assisting to diagnose or treat horses with colic. Serum γ -glutamyl transferase (GGT) activity is elevated in around 50% of horses with a displacement of the colon. (Satué et al., 2022) reported enzymatic changes at the blood level are associated with different types of liver pathologies (infectious, inflammatory, metabolic, toxic, etc. whereas GGT and LDH indicate an acute course of disease related to GIT.

Estimation of Serum Tumor Necrosis factor α and Procalcitonin status

The (Mean \pm SE) value of serum TNF α and Procalcitonin concentration in treated groups was found to be significantly higher in both T1 and T2 groups of large colon impaction than in the healthy control group on day 0 (pre-treatment). There was a significant decrease in serum TNF α and procalcitonin concentration on day 3rd (post-treatment) with highest recovery was observed in treatment group 2 (T2). Procalcitonin in plasma is a promising indicator for endotoxemia in equine colic (Rieger et al., 2014 ; Kilcoyne et al. 2020). In patients with horse colic, endotoxemia was assessed using a sepsis scoring system. Increased procalcitonin (PCT) concentration is due to bacterial endotoxin and inflammatory cytokines. In horses' GI diseases, hypersecretion of fluid, motility disturbances, altered microbial flora and impaired mucosal barrier may lead to absorption of endotoxin reported by (Bonin, et al., 2007). TNF levels are higher in horses with intestinal inflammatory diseases or strangulating intestinal blockage (Morris et al. 1991; Barton and Collatos, 1999).

CONCLUSION

The Evaluation of the therapeutic potential of *Terminalia chebula* on large colon impaction in equines and the therapeutic efficacy of various therapeutic regimens adopted in the treatment of large colon impaction in equines in treatment groups were studied and it was observed that large colon impaction cases under treatment groups T2 in which *Terminalia chebula* powder (act as prokinetic) was given found to be most efficacious as evident by the improvement in clinical score in terms of reduced clinical colic sign, hemato-biochemical alteration and improvement in defecation time and gastrointestinal motility. Therefore it may be recommended as adjunct prokinetic therapy in large colon impaction in equine apart from standard treatment.

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