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Gastrointestinal Transit of Aqueous and Crude Leaf Extracts of *Albizia zygia* in Male Albino Rats

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ABSTRACT

The treatment of diarrhea and other ailments via the use of medicinal plants by traditional medicine practitioners calls for scientific authentication. This study examined and compared the effect of aqueous and crude leaf extracts of *Albizia zygia* on gastrointestinal transit in adult rats. Forty male Wistar strain albino rats weighing between 120-250g were administered with aqueous and crude leaf extracts of *Albizia zygia* (200, 400, and 600mg/kg) in each case, normal saline and loperamide (5mg/kg) via the oral route respectively. Subsequently, 0.5ml of 3% charcoal suspension in 5% suspension of tragacanth powder was administered orally to each animal. The rats were sacrificed 30mins later and the distance traveled by the charcoal plug from the pylorus to caecum was determined. Results showed that rats pretreated with 200mg/kg of crude leaf extracts of *A. zygia* ($p<0.05$) retarded the intestinal transit of charcoal meal more than the control, loperamide, and aqueous extract groups. Furthermore, there was no significant difference in the effect produced by various doses of both extracts in comparison. Crude extract of *Albizia zygia* possesses anti-diarrhoeal property and has inhibitory effect on gastrointestinal transit in rats as 200mg/kg of the extract produced a better inhibition than loperamide. This, therefore, authenticates the folkloric practice of using it in the treatment/management of diarrhea.

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INTRODUCTION

Diarrhea is a major cause of morbidity and mortality, particularly among children in developing countries [1]. This disease may be caused by a disturbance of many digestive functions such as bile acids [2] and is characterized by increased frequency of bowel sound and movement, the discharge of semisolid or watery fecal matter from the bowel thrice, or more frequently, in 1 day and abdominal pain [3]. Diarrhea is usually accompanied by many symptoms, like abdominal discomfort, nausea, and vomiting. Diarrhea is a health problem of large concern especially in developing countries contributing to increased child death in Africa. Each year, there are approximately 4 billion cases of diarrhea worldwide leading to 4 million deaths especially among children in this age group [4]. A wide range of medicinal plants with anti-diarrhoeal properties have been widely used by traditional healers; the pharmacological evaluation of some has shown the efficacy of some traditional medicines in treating diarrhea [5]. However, most traditional remedies have not been precisely evaluated. Plants with bio-medicinal potential come as a form of alternative resource against the symptoms of several diseases, with great use in distant communities of urban centers and without attendance to health [6]. Medicinal plants have been used in healthcare since time immemorial as studies have been carried out globally to verify their efficacy and some of the findings have led to the production of plant-based medicines [7]. *Albizia zygia* (DC.) J.F. Macbr. Leguminosae subfamily Mimosoideae is a fast-growing medium-sized deciduous tree widely found in tropical Africa wherein Nigeria, different tribal groups have their indigenous names as Nyieavu (Igbo): Ayin rela(Yoruba); Madobiyarrafi (Hausa) [8]. Some pharmacological studies have been carried out on *Albizia zygia* [9], Okoye, *et al.*, (2021) reported that the crude extract of *Albizia zygia* significantly reduces gastric acid secretion with a probability of acting via inhibition of H_2 receptors or H^+, K^+ ATPase [10]. According to folkloric claims, the root bark of *A. zygia* possesses analgesic properties, used against cough, while its stem bark is used as a purgative antiseptic, aphrodisiac, to treat gastritis, fever, conjunctivitis and to overcome female sterility[11],[12].

This study was undertaken to evaluate the effect of aqueous and crude leaf extract of *Albizia zygia* on gastrointestinal transit and compare the same effect produced by the two extracts using animal model.

Figure No. 1: *Albizia zygia* plant [13]

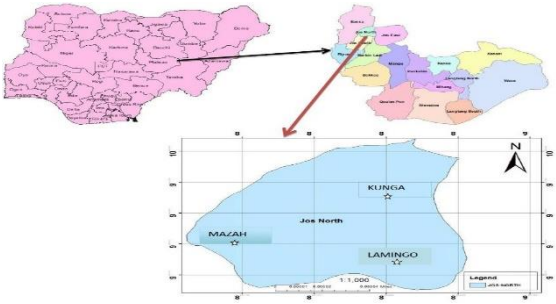

Figure No. 2: Map of Nigeria showing Plateau State and Plateau State showing Jos North LGA and site of plant material collection (Mazah) [14]

MATERIALS AND METHODS

Collection and Identification of Plant Materials

Fresh plant sample of *Albizia zygia* was collected from Mazah village, Jos North, Plateau State, Nigeria. It was identified and classified at the herbarium of the College of Forestry, Jos, Nigeria with voucher no: FHJ32321 as reported by [10].

Plant Material and Animal Preparation

Fresh leaves of *Albizia zygia* were washed with clean water, dried under room temperature in the Pharmacology Laboratory, College of Medicine and Health Sciences of Bingham University, Jos campus, Nigeria. The dried plant sample was blended into fine powder after which 490g of same was weighed and extracted via a Soxhlet apparatus using distilled water as solvent. The extract was evaporated and later dried via a desiccator with a resultant yield of 6.1g. It was later diluted to give the required doses of 200,400 and 600mg/kg. The crude extract was prepared by dispensing10ml of distilled water into 1.5g of the powdered leaves sample. Fifty-two healthy male albino rats of Wistar strain weighing between 120-250g were obtained from the Central Animal House, University of Jos, Plateau State, Nigeria. They were housed in plastic cages under standard laboratory conditions and were given rats pellet diet and water *ad libitum*. The animals were acclimatized for two weeks prior to the experiments.

Ethical Protocol

The 1996 Guide for the Care and Use of Laboratory Animals (GCULA) was strictly followed in terms of experimental procedures, and techniques while ethical approval with reference number UJ/FPS/F17-00379 was obtained from the Animal Ethics Committee of the University of Jos, Nigeria.

Phytochemical Screening and Acute Toxicity Test

Preliminary phytochemical screening on the aqueous and crude leaf extracts of *Albizia zygia* and LD_{50} determination were carried out as reported by Okoye *et al.*, 2021 [10].

Gastrointestinal Transit Experiment

The procedure was carried out according to the method of Chitme *et al.*, 2004 [15]. Forty rats were divided into eight groups of five animals each and were fasted overnight (24 hours) but with free access to water. Group 1 received 1ml of normal saline (*p.o*) and served as control, Group II received loperamide (5mg/kg *p.o*), Group III, IV, and V received Aqueous Leaf Extract of *Albizia zygia* (ALEAZ) 200, 400, 600mg/kg respectively, while Group VI, VII and VIII received Crude Leaf Extract of *Albizia zygia* (CLEAZ) 200, 400 and 600mg/kg *p.o* respectively. Five minutes later 0.5ml of 3% charcoal meal suspension in 5% suspension of tragacanth powder was administered orally to each animal. All the animals were sacrificed by stunning 30mins later while the distance traveled by the charcoal plug from pylorus to caecum was determined and expressed as a percentage of the total length of the small intestine.

Statistical Analysis

Results were expressed as mean ± S.E.M. One-way ANOVA was used for analysis followed by Tukey's multiple comparison test were used to compare means between treatment and control groups and between treatment (ALEAZ) and treatment (CLEAZ) groups. Differences between means were considered significantly different ($p< 0.05$) using Graph Pad Prism version 9.0 for Windows (Graph Pad Software, San Diego, California, USA) [10].

RESULTS AND DISCUSSION

Following reports from Okoye *et al.*, 2021 [10], aqueous and crude leaf extracts of *Albizia zygia* contained flavonoids (+), carbohydrates (+), and cardiac glycosides (+), while only the crude

extract contained terpenes even at a higher amount (++) Also, with LD_{50} ≥5000mg/kg for both ALEAZ and CLEAZ.

Effect of ALEAZ on Gastrointestinal Transit in Rats

The movement of the orally administered charcoal meal through the small intestine at doses of 200,400 and 600mg/kg was significantly decreased from 70.95% to 42.84%, 46.74%, and 45.88% respectively when compared to the control (Fig. 3). The distance traveled by the charcoal plug by rats pretreated with loperamide was 36.84% and was significantly decreased compared to control.

Effect of CLEAZ on Gastrointestinal Transit in Rats

In the groups treated with 200, 400, and 600mg/kg of the CLEAZ, the charcoal meal traveled 33.06%, 38.04%, and 35.28% of the total length of the small intestine and were significantly decreased compared with control (70.95%). A dose of 200mg/kg CLEAZ produced a better inhibition than loperamide. Also, there was no significant difference in the effect produced by 200, 400,600mg/kg of aqueous extract compared to the same doses of crude extract.

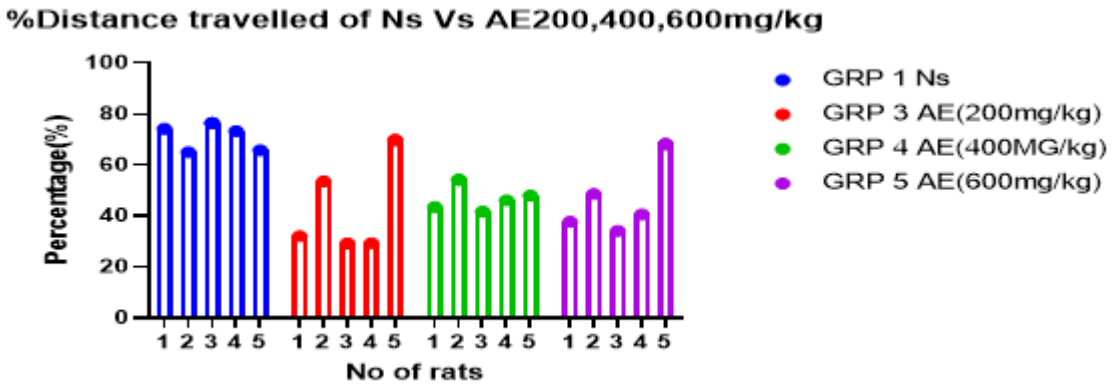

Figure 3: Percentage distance traveled by a charcoal meal of Normal Saline (Control) versus ALEAZ 200, 400, 600mg/kg

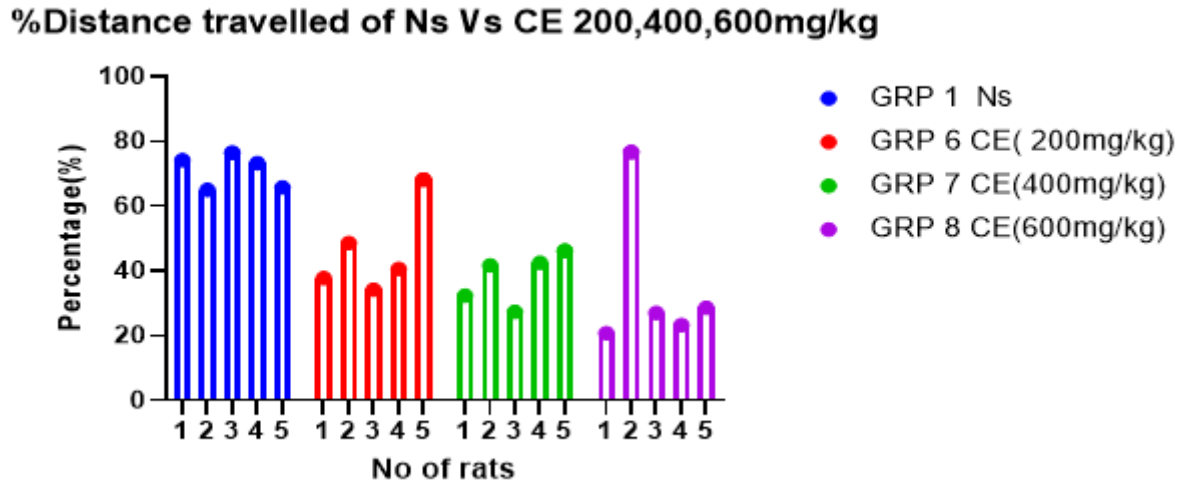

Figure 4: Percentage distance traveled by a charcoal meal of normal saline compared to CLEAZ 200, 400, 600mg/kg

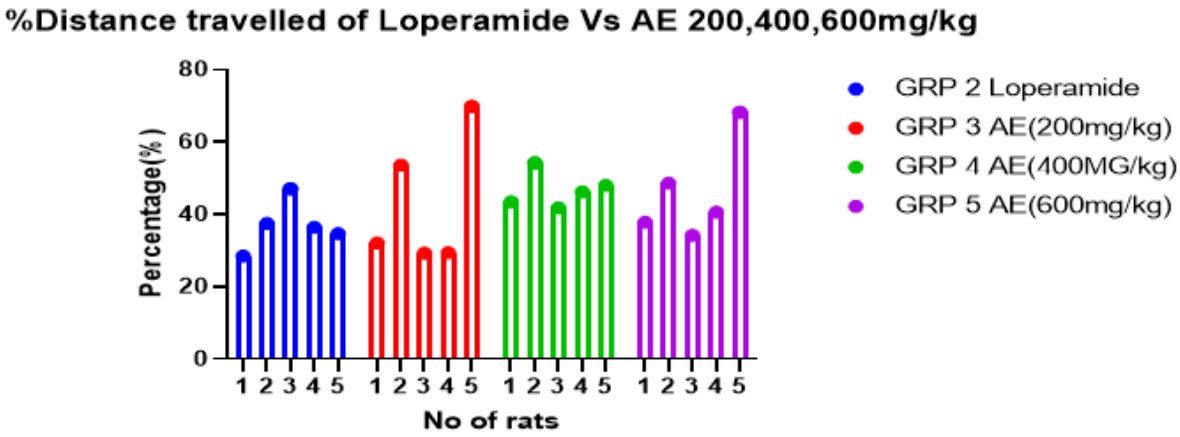

Figure 5: Percentage distance traveled by a charcoal meal of loperamide versus ALEAZ 200, 400, 600mg/kg

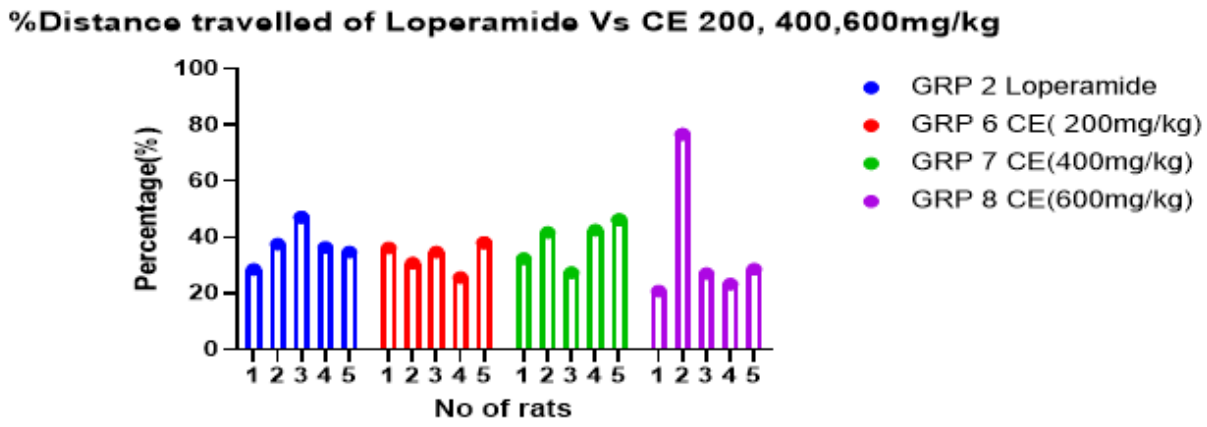

Figure No. 6: Percentage distance traveled by charcoal meal of loperamide versus CLEAZ 200, 400, 600mg/kg

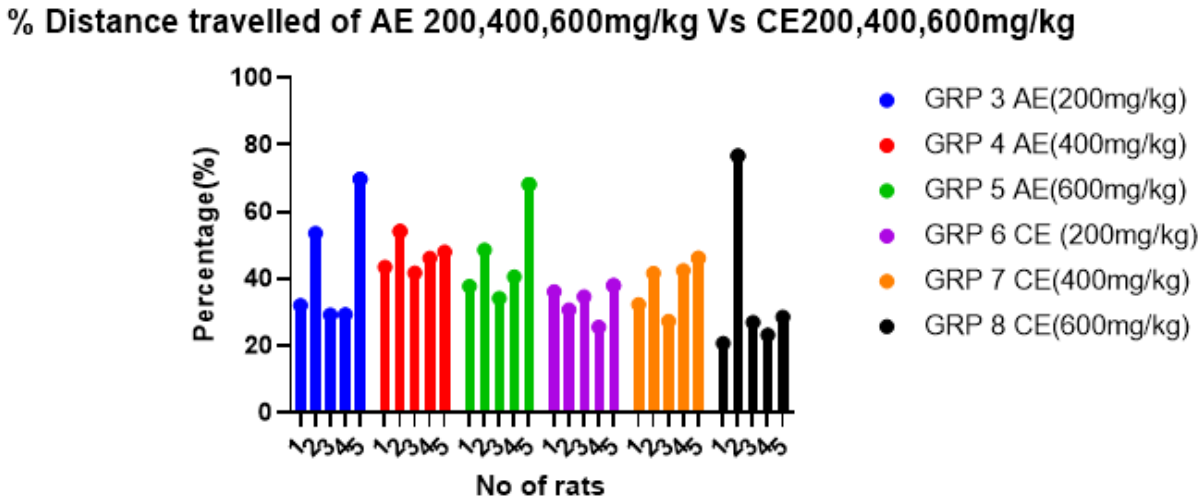

Figure No. 7: Percentage distance traveled by a charcoal meal of ALEAZ 200, 400, 600mg/kg versus CLEAZ 200, 400, 600mg/kg

The toxicity test revealed no observable adverse effect or mortality up to 5000mg/kg. According to Lorke (1983) in Builders *et al.*, 2016 [16], the extract is suggested to be safe which is in agreement with its use in traditional medicine. The Phytochemical evaluation showed the presence of flavonoids, carbohydrates, and cardiac glycosides in both the aqueous and crude leaf extract. However, only the crude extract contained terpenes even at a higher amount. Flavonoids are compounds that exhibit remarkable relaxant activity on the intestinal smooth muscles [17]. Also, flavonoids inhibit acetylcholine release in the gastrointestinal tract, prevent

intestinal motility and hyper-secretion. The anti-motility property of the extract may be due to this constituent [18].

The activated charcoal cannot be absorbed in the intestine and, therefore, hinders the absorption of chemicals and other substances by the adsorption process [19]. Loperamide, through peripheral activation of the μ-opiate receptor in the myenteric plexus, decreases propulsion in the gastrointestinal tract [20]. The delay in transit leads to increased net uptake of fluid and electrolytes by the mucosa as a result of increased contact time. It also hinders the release of acetylcholine from the enteric nervous system and slows the intestine peristaltic activity increasing water and electrolyte reabsorption through the bowel [21]. The aqueous and crude extracts at doses of 200, 400,600mg/kg significantly retarded intestinal transit compared to control (*Figure 3 and 4*) and the crude extract a dose of 200mg/kg produced a better inhibition than loperamide. This is in line with many reports, according to literature, demonstrating that gastrointestinal transit can be decreased by several medicinal plant extracts such as *Vitis vinifera* and *Psidium guajava* [22]. Furthermore, the aqueous and crude extracts at a dose of 200mg/kg inhibited the transit of charcoal meal more than 400 and 600mg/kg of the same extracts (*Figures 3 and 4*). This observation could be due to 'therapeutic window' effect as suggested by Tripathi (2013) [23]. In other words, it could be that the extract has reached its maximum effect at a dose of 200mg/kg. Also, there was no significant difference in the reduction of charcoal motion produced by loperamide compared to various doses of the extracts (*Figure 5 and 6*). Similarly, 200, 400,600mg/kg of the aqueous extract did not cause significant travel of the charcoal meal compared to the same doses of the crude extract (*Figure 7*). In this study, loperamide reduced intestinal motility and fluid accumulation. Therefore, the ALEAZ and CLEAZ could possess antidiarrhoeal action similarly to loperamide.

CONCLUSION

Crude extract of *Albizia zygia* possesses anti-diarrhoeal property and has an inhibitory effect on gastrointestinal transit in rats as 200mg/kg of the extract produced a better inhibition than loperamide. This, therefore, authenticates the folkloric practice of using it in the treatment/management of diarrhoea.

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CONFLICT OF INTEREST

Authors hereby declare no conflicting interest.

REFERENCES

1. Bryce J, Boschi-Pinto C, Shibuya K, Black RE. WHO: Child Health Epidemiology Reference Group. WHO estimates the causes of death in children. Lancet 2005;365:1147–1152.
2. Odunsi-Shiyanbade ST, Camilleri M, McKinzie S, Burton D, Carlson P, Busciglio IA, Lamsam J, Singh R, Zinsmeister AR. Effects of chenodeoxycholate and a bile acid sequestrant, colesevelam, on intestinal transit and bowel function. *Clin Gastroenterol Hepatol* .2010;8:159–165.
3. Suleima MM, Dzenda T, Sani CA. Antidiarrhoeal activity of the methanol stem-bark extract of Annona senegalensis Pers. (Annonaceae). *J Ethnopharmacol* .2008;116:125–13.
4. Azubuike JC, Nkagineme KE. Pediatrics and child health in a tropical region. 2007; 4-13
5. De Wet H, Nkwanyana MN, van Vuuren SF. Ethnopharmacological communication medicinal plants used for the treatment of diarrhoea in Northern Maputaland, KwaZulu-Natal Province, South Africa. *J Ethnopharmacol*. 2010; 130(2): 284-289.
6. Lima RBS, LFR Silva, Melo MRS, Costa JS, NS Picanco, Lima ES, *et al.* Atividade anti-malaria *in vitro* e *in vivo* de plantas da *Amazonia brasileira.* Malaria J.2015; 14 (508); 1-14.
7. Sofowora A, Ogunbodede E, Onayade A. The role and place of medicinal plants in the strategies for disease prevention. *Afr J Tradit Complement Altern Med*. 2013;10(5):210-229. Published 2013 Aug 12. doi:10.4314/ajtcam.v10i5.2.
8. Schoppa T, Pachaly P,. Inhattstoffe von Albizia zygia.Archiv der Pharmazie.1981;14:18-25.
9. Pachaly P, Redeker F, Schoppa T. Inhaltsstoffe von Albizzia zygia, 2. Arch Pharm. 1983;316:651–652.
10. Okoye NP, Oto-Obong VI, Ogundeko TO, Bulus D, Kamoh NL, Ogbole EA, Onuwe AA, Amadi K. Comparative effect of aqueous and crude leaf extract of *Albizia zygia* on gastric acid secretion in male wistar strain albino rats. *Int. Journal of Pharmaceutical Research and Application*. 2021; 6 (3): 1350-1356.
11. Note OP, Chabert P, Pegnyem DE, Weniger B, Dubois ML, Lobstei A. Structure Elucidation of New Acacic acid-type Saponins from Albizia coriaria. *Journal of Magnetic Resonance in Chemistry*.2010;48:829-836.
12. Abere TA, Ibanishuka P, Jesuorobo RI. Analgesic and Toxicological Evaluation of Stem Bark of Albiziazygia Benth (MImosoideae). IOSR Journal of Pharmacy and Biological *Sciences*.2014 ;9:26-31.
13. http://www.westafricanplants.senckenberg.
14. Ishaya M, Mwansat GS, Ombugadu A, Njila H L, Mafuyai MJ Lapang MP. A comparison of pitfall traps and hand-picking techniques for studying macroathropods abundance in vegetable plots and the influence of abiotic factors on their abundance in Jos, Nigeria. J. Agric Sci. and Prac. August, 2018; 3(4): 79-89, https://doi.org/10.31248/JASP2018.088 ISSN 2536-7072.
15. Chitme HR, Chandra M, Kaushik S. Studies on anti-diarrhoeal activity of *Calotropis gigantea* R.Br. in experimental animals. J Pharm Pharm Sci. 2004;7(1):70-5. PMID: 15144737.
16. Builders MI, Builders PF and Ogundeko TG. (2016) Anti-ulcer activity of the stem bark of African locust bean tree in rats. *Int. J. Phytotherapy Research*.2016; Vol.6, issue 4.
17. Ali N, Ali Shah SW. Antispasmodic activity of *Teucrium stocksianumboiss.* 2011;24(2):171-4.
18. Dosso K, N'guessan BB, Bidie AP, Gnangoran BN, Méité S, N'guessan D, Yapo AP, Ehilé EE. Antidiarrhoeal activity of an ethanol extract of the stem bark of *Piliostigma reticulatum* (Caesalpiniaceae) in rats. *Afr J Tradit Complement Altern Med* . 2012; 9(2):242–249.
19. Bello FH, Maiha BB, Anuka JA. The effects of methanol rhizome extract of *Nymphaea lotus* Linn. (Nymphaeaceae) in animal models of diarrhoea. *J Ethnopharmacol* .2016;190:13–21.
20. Awouters F, Megens A, Verlinden M, Schuurkes J, Niemegeers C, Paul AJ. Loperamide. Survey of Studies on Mechanism of its Antidiarrheal Activity. *Digestive Diseases and Sciences*.1993; 38(6):977- 995.
21. Lutterodt GD. Inhibition of microlax-induced experimental diarrhoea with narcotic-like extracts of *Psidium guajava* leaf in rats. *J Ethnopharmacol*.1992;37(2):151–157.

22. Ojewole JA, Awe EO, Chiwororo WD: Antidiarrhoeal activity of *Psidium guajava* Linn. (Myrtaceae) leaf aqueous extract in rodents. *J Smooth Muscle Research.*2008;44(6):195-207.
23. Tripathi KD. Essential of Medical Pharmacology; Pharmacodynamics, 7th Ed. India: Jaypee brothers, 2013.