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Bioassay-Guided Evaluation of Anti-Diarrhoeal Activity of Sweet Potato Leaf Extracts

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Abstrac t

Diarrhoea is a global health issue affecting all regions and populations, particularly low and middle-income countries of sub-Saharan Africa and Asia from where the very young and old aged are more vulnerable. The conventional belief that extracts of sweet potato leaves are effective in the treatment of diarrhoea is not supported by any statistical evidence from the scientific community. Therefore, the present study aimed to screen the crude extracts of sweet potato for its secondary metabolites, acute toxicity, antioxidant enzyme, and antidiarrhoeal activity at 125, 250, and 500 mg/kg bw in Wistar rat models. Methanol and n-hexane extracts of sweet potato (Ipomoea batatas) leaves were tested for antidiarrhoeal activity using castor oil-induced models in rats. The most active extracts were screened for elemental compositions using standard methods. The crude extracts revealed the presence of flavonoids, saponins, alkaloids, tannins, and terpenes. The LD_{50} of the extracts was found to be greater than 5000 mg/kg body weight of the rats. The elemental analysis of the most active extract revealed the presence of zinc (Zn), potassium (K), sodium (Na), and chloride (Cl). Both extracts delayed diarrhoea onset and reduced faecal frequency and water content significantly ($p<0.05$), with the methanol extract showing greater inhibition (~66.5%) at 500 mg/kg compared to controls. Na^+-K^+-ATPase, alkaline phosphatase, and catalase activity in the small intestine increased significantly ($p < 0.05$) as the dose of crude extracts increased, whereas crude extract produced dose-specific dependent on intestinal superoxide dismutase activity and nitric oxide concentration. The GC-MS analysis carried out on the most active extract revealed that the extract is composed of gallo-tannins (71.27%), n-Hexadecanoic acid (23.53%), catechol (2.57%), methylgallate (1.59%), propanoic acid, 2-(aminoxy) (0.92%), and trigonelline (0.10%). These compounds were found to be the most abundant in the extract. Methanol and n-hexane extracts of sweet potato demonstrated significant, dose-dependent anti-diarrhoeal activity, likely mediated by modulation of intestinal motility, fluid secretion, and antioxidant pathways. These findings support the traditional use of sweet potato leaves and warrant further investigation.

Keywords: Anti-diarrhoeal activity, castor oil, diarrhea, phytochemical components, sweet potato leaves, Wistar rats

INTRODUCTION

Diarrhoea is defined as the abrupt onset of 3 or more loose stools per day. The augmented water content in the stools (above the normal value of approximately 10 mL/kg/d in the infant and young child, or 200 g/d in the teenager and adult) is due to an imbalance in the physiology of the small and large intestinal processes involved in the absorption of ions, organic substrates, and thus water (Turyare *et al.*, 2021). According to Omole et al. (2019), however, diarrhoea is not considered to be the condition that happens when breastfed newborns often empty their intestines of loose, "sticky" stools. Changing bowel movements, which are defined by increased water content, volume, and frequency of defecation, and which often occur three or more times per day, are the distinguishing features of diarrhoea. When diarrhoea occurs, the frequency of defecation increases. These alterations are what identify the diarrhoea condition. As a defining characteristic of diarrhoea, the presence of these changes is a hallmark. It has a more substantial influence on the population of children than it does on the population of adults, as stated by Burton and Singer (2014) and UNICEF (2019). It is a significant factor that leads to morbidity and mortality, and it has a greater impact on the population of children than it does on the population of adults.

It is a common symptom of gastrointestinal infection due to ingestion of many bacteria, viruses, or parasites that may be transmitted by water, food, utensils, hands, and flies (UNICEF, 2019). It is the mechanism by which the body rids itself of pathogenic organisms, with excessive stimulation of intestinal motility, leaving insufficient time for absorption of intestinal fluid (Omole *et al.*, 2019). Diarrhoea is one of the most important health problems in developing countries, affecting people of all ages (UNICEF, 2019) that results in electrolyte loss, dehydration, shock, and sometimes death (UNICEF, 2019). Diarrhoeal diseases account for 1 in 9 child deaths worldwide, making diarrhoea the second leading cause of death among children under the age of 5 (Omole *et al.*, 2019). In Nigeria, the prevalence of diarrhoeal infection is as high as 18.8%, above the average of 16%, making it one of the worst in Sub-Saharan Africa (WHO, 2017). It accounts for an annual estimated 300,000 deaths, mainly amongst children under five in Nigeria (WHO, 2017), while 7-to-12-month-old babies continue to be the most susceptible (Burton and Singer, 2014) caused mainly by poor sanitation and hygiene practices. The disease may be caused by a wide array of agents such as enteropathogenic microorganisms (*Shigella flexneri, Staphylococcus aureus, Escherichia coli, Salmonella typhi,* and *Candida albicans*) (Prasad, 2014), alcohol, irritable bowel syndrome, bile salts and hormones, secretory tumours, and intoxication (Brijesh *et al.*, 2011). As far as the treatment of diarrhoea is concerned, the primary emphasis is placed on avoiding dehydration via the use of oral rehydration solutions, intravenous fluids, and conventional drugs such as loperamide and its combination with simethicone, in addition to antibiotics such as azithromycin and ciprofloxacin. According to Charyeva et al. (2015), the usage of oral drugs is one of the various approaches that are utilised in the treatment of illnesses. For instance, metronidazole, antibiotics, and oral rehydration treatment (ORT) are all examples of drugs that fall into this category. It is reported by the World Health Organisation (2017) that diarrhoea continues to be the second greatest cause of death in children, despite the fact that oral rehydration therapy (ORT) has been advocated for and administered for more than 10 years. Even though ORT has been in operation for more than 10 years, this is the situation that has arisen.

Several adverse effects, including severe constipation, vomiting, discomfort and pain in the stomach, tachycardia or arrhythmia, and even fainting, have been reported as being generated by these alternatives at different times in time. Moreover, there is an urgent need to reignite interest in the research and development of medications that are derived from natural sources. This is a necessity that must be met immediately. This may be attributed to a number of factors, including the persistent increase in the cost of medical care, the perceived effectiveness of the therapy, the rise in the number of illnesses that are resistant to treatment, the potential for bioactivity via a variety of routes, and the economic problems that are prevalent is crucial in developing nations. With regard to the treatment of diarrhoea, the World Health Organisation (2017) asserts that it is of the utmost importance to study alternative and complementary methods of therapy. Utilising medicinal plants is one strategy that may be used.

Plants have been used as a potential source of medical ingredients for a very long time. Over the course of the last few years, there has been an increase in the level of understanding about the relevance of medicinal plants. Not only are phytopharmaceuticals easily available, but they are also affordable, risk-free, and effective therapeutic alternatives. Furthermore, no side effects are often connected with the use of phytopharmaceuticals. According to Pritish et al. (2015), the majority of pharmaceuticals that are utilised in traditional medicine, modern medicine, nutraceuticals, dietary supplements, folk remedies, pharmaceutical intermediates, and synthetic drug compounds are derived from plants. This is due to the fact that plants are the primary source of these substances.

Ipomoea batatas, the species that Linnaeus referred to as sweet potatoes, is the species in question. Convolvulaceae, which is commonly known as sweet potatoes in English, "dun, adun odunkun" in Yoruba, "dankalin Hausa" in Hausa, and "nduku uto" in Igbo, was originally indigenous to Southeast Asia and India, as shown by Morales et al. (2017). Sweet potatoes are a member of the Convolvulaceae family. The fact that it is readily available, on the other hand, has led to its widespread planting in tropical and subtropical regions at the present time. It is a perennial herbaceous vine that is defined by two distinct characteristics, the first of which is its medium-sized sympetalous blossoms and the second of which is its alternating heart-shaped or palmately lobed leaves. These characteristics include the foliage and the leaves that are shaped like hearts. In most cases, the expansion of the stems occurs in a horizontal fashion, and adventitious roots are created at the nodes that are situated inside the plant itself. As the leaves make their way down the stems, they experience a twisting action as they go downward.

According to the findings of Morales et al. (2017), the length of the petiole may range anywhere from 15 to 20 inches. Several of the plant's elements have been suggested to have the potential to be used in ethnopharmacological settings for the aim of treating a wide range of ailments. According to Vishnu et al. (2019), a cold infusion of the root has the potential to be used for the treatment of a wide range of dermatological illnesses. These conditions include venereal infections, anaemia, scabies, and leprosy disorders. Since the beginning of time, the leaves have been used for the treatment of a broad variety of illnesses, including bronchitis, eye infections, colds, and even as an abortifacient. It has also been suggested that the leaf extract of sweet potato is responsible for the phenomenon. Sweet potatoes have the potential to be used as a therapeutic intervention for a broad variety of maladies, including cancer, diabetes, dysentery, and diarrhoea, as stated by Vishnu et al. (2019). Sweet potatoes have the ability to address these conditions. Sweet potato has been shown to possess a broad variety of qualities, including those that are stimulant, astringent, antibacterial, fungicidal, and tonic. These effects have been scientifically demonstrated. Sweet potato leaves have been used as a traditional treatment for a wide range of conditions, including but not limited to the following: asthma, diarrhoea, fever, nausea, gastrointestinal discomfort, and tumours (Duke and Wain, 1981).

A study carried out by Panda and Sonkamble (2012) revealed that the methanol extract of sweet potato roots exhibited gastroprotective characteristics while also protecting Wistar rats from developing ulcers that were brought on by aspirin. It has been shown that the development of these effects occurred in a dose-dependent manner. An earlier study (Osime *et al.*, 2008) found that giving sweet potato extract to rabbits led to a large increase in packed cell volume, an increase in the number of white blood cells, and an increase in the number of platelets. All of these changes occurred simultaneously. Furthermore, extracts derived from batatas leaves exhibit the potential to decrease neuroinflammatory responses in BV-2 microglial cells that have been activated by lipopolysaccharide. In order to do this, it is essential to inhibit the generation of pro-inflammatory mediators. These mediators include inducible nitric oxide synthase (iNOS), cyclooxygenase 2 (COX-2), nitric oxide (NO), and tumour necrosis factor-alpha (TNF-α respectively. According to the findings of Kim et al. (2015), a dietary supplement that contained purple sweet potato leaf extract was found to increase the activity of catalase while simultaneously lowering the levels of superoxide dismutase and glutathione peroxidase in LP-BM5 murine leukaemia virus-induced AIDS mice. The results of an in vivo study conducted by Olowu et al. (2015) indicate that a 2.5% extract of SPL can reduce blood glucose levels in diabetic rats induced by STZ as well as in healthy rats. The conventional use of a number of components of sweet potato has been backed up by data collected from a significant number of scientific studies. The use of sweet potato leaf extract as a traditional medicine for the treatment of diarrhoea is an example of this. It is my desire to demonstrate that it is effective. An experiment was conducted on rats using chemically produced diarrheal models to evaluate the effectiveness of sweet potato leaf extract as a therapy for diarrhoea. In order to determine whether or not the extract was effective, Wistar rats were utilised.

MATERIALS AND METHODS

Collection and identification of plant samples

For the purpose of carrying out this research, the leaves of sweet potatoes, which are also referred to as Ipomoea batatas, were collected at 6:20 in the morning from Ja'en Sharada Phase 3 in the Gwale Local Government Area of Kano State, Nigeria (11°40'00.1" North, 7°54'47.1" East). The following validation of these leaves was place at the Herbarium Unit of the Department of Plant Biology at Bayero University Kano. At that time, the Accession Number BUKHAN 409 was allocated to them according to the results of the validation process.

Extraction Techniques

Two hundred grams (200g) of dry powder of the plant material was subjected to successive Soxhlet extraction with solvents of increasing polarity (n-Hexane and methanol). The first 50g of the powdered plant material was placed in the extraction chamber of the Soxhlet apparatus. The extracting solvent (n-Hexane) in the flask was heated until the clear liquid contents of the chamber siphoned into the flask. Each time, 50g of the powdered plant material was extracted with 200 ml of solvent in the Soxhlet extraction process (Peter and Umar, 2018; Rahman *et al.*, 2015). The n-Hexane extract was evaporated completely to concentrate it in a vacuum by using a rotary evaporator (Buchi labortechnik AG, Switzerland) under reduced pressure set at 40 ^{0}C, followed by an oven at room temperature for 12 h (Zavala *et al.*, 2013). The residue was collected and dried at room temperature to remove n-hexane.

The plant material was then dried and extracted using methanol, following the same procedure as described before to get the methanol extract. Finally, the residue of the methanol extract was collected and dried at room temperature. After drying, the percentage yield of all extracts was determined, and the yield was calculated for n-Hexane and methanol extracts, respectively.

The solvent-free n-Hexane and methanol extracts were thereafter evaluated for the study.

Cold maceration technique

Maceration was carried out in a closed conical flask for 7 days at room temperature with frequent agitation (Handa *et al.*, 2008) using 1000 g powdered leaf samples of sweet potato and methanol (1:10 w/v). The extraction was done in an aliquot. The marc was filtered with Whatman No.1 filter paper, and the filtrate was concentrated by open-air evaporation. The concentrate (extract) was weighed, the percentage yield calculated, labelled, and stored at 4 °C in a refrigerator until required. The solvent-free methanol extracts obtained were similarly evaluated.

Phytochemical screening of the sample

To better understand the secondary metabolites that plants produce, qualitative research is carried out. An aliquot of sweet potato extract (I. batatas) with a volume of one millilitre (1.0 mL) was carried out for the purpose of determining the presence of a number of different secondary metabolites. A number of different metabolites were discovered in this research project. These included alkaloids (Hanieh *et al.*, 2010), steroids, anthraquinones (Oladiji *et al.*, 2010), saponins (Wall *et al.*, 1954), phenolics and flavonoids (Awe and Sodipo, 2001), cardiac glycosides (Awe and Sodipo, 2001), tannins, and triterpenes (Odebiyi and Sofowora, 1978). In the following, you will find a comprehensive description of the results of this inquiry.

Experimental Animals

The Animal Care and Use Research Ethics Committee (ACUREC) of Bayero University Kano, evaluated and gave its approval to research projects that investigated the moral implications of utilising animals. Not only did these experiments include the oral administration of a wide range of extracts. A permit number of BUK/DRIP/AUREC/00507 was granted to the animal research method that was carried out using Wistar rats. Rats of the species Rattus norvegicus Wistar, both male and female, were obtained from the AKTH Kano facility, which is located in the state of Kano in Nigeria. A standard variation of 6.53 grams was observed in the weight of these rats, with the average weight being 140.51 grams. The temperature was between 25 and 27 ºC, the photoperiod consisted of around 12 hours of light and dark, and the relative humidity was between 45 and 50 per cent. Every single one of the animals was housed in pristine hardwood cages that were placed in suitable conditions that offered sufficient air. Not only were the animals provided with water from the tap, but they were also provided with rat pellets that were devoid of any contamination. Top Feeds Nigeria Limited, which has its headquarters in Ibadan, Nigeria, was the company that produced these pellets. The cages were cleaned on a regular basis.

Antidiarrheal activity test

Thirty-six healthy Wistar rats were fasted for 8 hours prior to the experiment but allowed free access to water. The experimental rats were completely randomised into nine groups of four animals each. The procedure described by Bajad et al. (2001) was adopted with slight modification. Animals in group I (administered 1.0 mL of distilled water) served as normal control, animals in group II (administered 1.0 mL of distilled water), as negative control while those in groups III (positive control), IV, V, and VI (test groups) received 1.0 mL each corresponding to 2.5 mg/kg body weight of loperamide (a reference drug), 125, 250, and 500 mg/kg of the extracts respectively. Thirty minutes after administration, all the animals were orally administered 1 mL of castor oil and thereafter placed in cages lined with pre-weighed transparent paper. During the 6-hour observation period, the time of onset of diarrhoea, the total number of faeces, diarrhoeal faeces, total weight of faeces, and percentage inhibition of diarrhoeal defecation in each group were computed. The weight of the faeces was obtained from the difference in the preweighed transparent paper and the fresh weight of the stool. The dry weight of the faeces was obtained by drying the fresh faeces in the laboratory oven (Uniscope Laboratory oven, SM9053, Surgifriend Medicals, England) at 100°C until a constant weight was obtained. The difference in the fresh weight of the faeces and the dry weight of the faeces gives the water content of the faeces. At the end of the 6-hour exposure period, the animals were sacrificed, and small intestine supernatants were prepared. The percentage of inhibition was calculated as follows;

$$\% \, inhibition = \frac{(\text{Mean defecation of control group} - \text{Mean defecation of treated group})}{\text{Mean defecation of control group}} \times 100$$

Preparation of small intestine supernatants.

The method described by Akanji and Yakubu (2020) was used.

The small intestine was removed after dissecting the animal. This took place while the animals were under the influence of ether.

The contents of the small intestine were evacuated, absorption was conducted on blotting paper, and a Teflon homogeniser was used to homogenise the mixture in a 0.25 M sucrose solution with a weight-to-volume ratio of 1:4. The homogenate was subjected to centrifugation at a force of 894 ×g for a duration of fifteen minutes, the supernatant were separated from the mixture. The supernatant was used for the purpose of evaluating the levels of protein (Gornall *et al.*, 1949) and nitric oxide (Wo *et al.*, 2013), in addition to the activities of sodium-potassium ATPase (Bewaji, 1985), intestinal alkaline phosphatase (Wright *et al.*, 1972), superoxide dismutase (Misra and Fridovich, 1972) and catalase (Beers and Sizer, 1956).

Castor oil-induced intestinal fluid accumulation.

Chitme et al. (2004) provided an overview of the approaches that were used. The animals were refrained from consuming any food or liquids for a period of six hours prior to the start of the experiment. They were nonetheless allowed to consume as much water as desired. Immediately after the selection of four animals at random for each group, the animals were confined to the cages that had been specifically selected for them. With regard to the animals that were a part of the normal control group (group 1), one millilitre of distilled water was given to them. On the other hand, 1.4 millilitres of water was given to the animals in the negative control group (group 2), and the animals in the Castor oil + Loperamide group were treated in the same manner. When it came to Group 3, the dose of atropine sulfate that was given to them was 2.5 milligrams per kilogram of body weight, and the volume of the solution that was given to them was 1.0 mL. Over the course of the trial, rats were given oral dosages of the extracts that ranged from 125 to 500 mg/kg. The individuals who took part in the trial were identified as belonging to groups 4, 5, and 6. One millilitre of castor oil was administered orally to each and every rat in each group, with the exception of Group 1, which was considered to be the normal control group. In accordance with the procedures that were described by Akanji and Yakubu (2000), the pylorus and caecum of the small intestine were ligated after a period of thirty minutes, and then each rat was put to death shortly thereafter. Immediately after the removal of the small intestine, the contents of the intestine were expelled into a graded cylinder. Following the excision of the small intestine, this procedure was carried out. The volumes and masses of the contents of the digestive system were recorded, and then those data were used to compute the percentage of inhibition of intestinal content. This was done in order to determine the percentage of reduction in intestinal content.

Inhibition of intestinal content %=Mass of intestinal fluid (g) $\frac{\text{Control} - \text{Treated}}{\text{Control}} \times 100$

Elemental analysis

The cold macerated methanol leaf extract of sweet potato (Ipomoea batatas) was burnt in an oven at a temperature of 540 ^{0}C for a period of three hours. The amount of each extract was five grams (5 g). Throughout the whole of the experiment, the temperature was kept constant. On the subsequent phase, 0.5 grams of the ashed extracts that had been allowed to cool were digested by boiling them for two hours with a mixture of 10 mL of hydrochloric acid (HCl), nitric acid (HNO_3), and perchloric acid ($HClO_4$). This process was repeated until the extracts were completely digested. The extracts were subjected to this procedure many times until they were thoroughly digested. Once the digested mixes were reduced to a volume of 5 millilitres by rotary evaporation, the volume was then modified to 10 millilitres through the incorporation of 2 millimolar hydrogen nitrate, and finally, 30 millilitres of purified water was added to the combination. A beaker with a capacity of 100 mL was used for the subsequent phase, which included placing the mixtures inside. Atomic absorption spectrophotometry (AAS) was used. This was accomplished by using the A source. The analysis was carried out using the Analyst 400 Model at a wavelength, temperature, and light current that are appropriate for the elements. The presence of chloride (Cl), zinc (Zn), sodium (Na), and potassium (K) was measured by evaluating blank samples of the reagent that were prepared and analysed in each methanol extract of sweet potato leaves (AOAC, 1998).

Gas chromatography-mass spectrometry (GC-MS) analysis

GC-MS analysis, a mass spectrometer was used in conjunction with a 7890A gas chromatograph system that Agilent Corporation produced in the United States of America. This mass spectrometer utilised a fused silica column manufactured by HP-5 MS. This particular column had a length of 30.0 meters and a diameter of 250 micrometres. It was constructed out of phenyl methyl siloxane at a concentration of 5%. The thickness of the film was 0.25 micrometres.

Attachment of the column was necessary in order to establish a connection between the column and a 5675C Inert MSD that was equipped with a Triple-Axis detector. In order to determine the flow rate of helium, which was used as the carrier gas, the flow rate was monitored and computed at a rate of one millilitre per minute.

There is a pressure of 16.2 pounds per square inch, temperatures of 250 degrees Celsius for the ion source, and temperatures of 300 °C for the interface. All of these temperatures reflect the atmosphere. Every one of these temperatures has been attained with success. The temperature of the injection is set to 300°C, and the injector has a capacity of one microliter. It runs in split mode with a split ratio of one to fifty. The output was measured to have a diameter of 1.8 millimetres based on the measurements. The temperature of the column increased from 36 °C to 150 °C during the course of five minutes, with the rate of increase being four degrees Celsius per minute. Over the course of one minute. Over the course of five minutes, a temperature increase of 20 °C per minute was initiated and maintained at a constant level for the whole period of the experiment. It took a total of 47.5 minutes to complete all of the stages involved in the elution process. The percentage of each component was determined by analysing the average peak area of each component in relation to the total areas.

Identification of compounds

Utilising the database that is maintained by the National Institute of Standards and Technology (NIST) allowed for the examination of the mass spectra as well as the identification of the components based on their retention indices. This was made possible by the use of the database. The collection has around 62,000 different designs of main chemicals, each of which is unique in its own way. After they were collected, the spectra of the unidentified components obtained were compared with the reference mass spectra of components already known to be present in the NIST database.

Data analysis

Data were presented as mean ± standard deviation (S.D) of three (3) experiments and were subjected to one-way analysis of variance and Tukey's post hoc test. The data were considered statistically significant at $p < 0.05$ using Statistical Package for Social Sciences, version 20.0 (SPSS Inc., Chicago, IL, USA).

RESULTS AND DISCUSSION

Numerous different metabolites were found to be present in the methanolic and n-hexane extracts, as shown by the results of the phytochemical analysis. These include alkaloids, flavonoids, tannins, phenols, saponins, cardiac glycosides, terpenoids, steroids, and polyphenols. Anthraquinones, anthocyanins, cardiotonic glycosides, and coumarins were not discovered in the methanolic extract used in our experiment (Table 1). On the other hand, terpenoids were discovered in the n-hexane extract. Under the conditions of our experiment, we found negative results for every other metabolite. When it comes to the presence of flavonoids, the data that we obtained are in accordance with the findings that Luo et al. (2005) made. Flavonoids were found to include tiliroside, astragalin, rhamnocitrin, rhamnetin, and kaempferol, among others. In their 2009 study, Ling-Yuz and colleagues found that the plant contained a variety of chemicals, including steroids, terpenes, and flavonoids, which were isolated from the plant (Ling-Yuz et al., 2009) Tetracosane, myristic acid, beta-sitosterol, beta-carotene, daucosterol, and quercetin were some of the components that were included in this composition. A number of findings concerning polyphenols were made by Yin et al. (2008). Citrusin, caffeic acid, 3,4-di-O-caffeoylquinic acid, and 1,2,3,4-tetrahydro-beta-carboline-3-carboxylic acid are some of the polyphenols that are included in this category. These findings were mentioned in the works of both Panda and Sonkamble (2012) and Hossain (2019), in their separate publications.

Table 1: Qualitative phytochemical constituents of methanol and n-hexane leaf extracts of Sweet potatoes (*Ipomoea batatas L)*

Constituents	Inference	
	SPMLE	SPnHLE
Alkaloids	+	-
Cardiac glycosides	+	-
Coumarins	+	-
Flavonoids	+	+
Phenolics	+	-
Saponins	+	-
Tannins	+	-
Terpenoids	+	+

Key: SPMLE = *Sweet Potato* Methanol Leaf Extract, SPHLE =*Sweet Potato* n-Hexane Leaf Extract, and (+) = Detected (-) = Not detected

Effects of extracts from Sweet potato leaves on chemically-induced diarrhoea

To determine whether a test extract is effective in terms of its overall antidiarrheal qualities, a model of diarrhoea caused by castor oil was constructed. It is possible to utilise this model to assess whether or not the drug being tested is effective. The time at which diarrheal stools first emerged, the frequency and weight of faecal excretions, and the volume of intestinal fluid that was evacuated were recognised as the key characteristics of diarrhoea, according to the results of a study that was carried out by Sisay et al. (2017). These characteristics were shown to be the most prominent characteristics of diarrhoea. Castor oil is the cause of diarrhoea, which may be connected to the actions of ricinoleic acid. This acid is responsible for the irritation and inflammation of the intestinal mucosa, which eventually results in the production of prostaglandins (PGE2α). Research carried out by Rajat et al. (2013) and Wansi et al. (2014) discovered that the creation of PGE2 resulted in an increase in the activity of the gastrointestinal system, as well as an increase in the secretion of water and electrolytes. The findings of the aforementioned researchers confirmed this. As a consequence of this, the organism exhibited increased motility, which in turn resulted in an increase in the quantity of fluid that was generated by the digestive system. Wansi et al. (2014) discovered that the reduction in prostaglandin synthesis that occurred in instances of castor oil-induced diarrhoea resulted in an extension of the duration of the diarrhoea. Throughout the course of the experiment, it was shown that the oral administration of castor oil to normal rats at a dose of 5 milligrams per kilogram of body weight resulted in a substantial quantity of diarrhoea. This was the case because the rats were given the oil. With a total faecal frequency of 6.22±0.34 and a faecal water content of 2.24±0.1 during the length of the experiment, it was discovered that the commencement of diarrheal faeces began at 59.2±0.3 minutes. Additionally, the faecal water content was found to be 2.24±0.1. Given this circumstance, it was abundantly evident that the animals being handled were suffering from diarrhoea and needed medical attention. An antidiarrheal drug known as loperamide, when provided orally at a dose of 2.5 milligrams per kilogram of body weight, considerably increased the length of time it took for diarrheal stools to form, extending the entire duration of the operation to 147.3 minutes. This correlated with a substantial reduction in diarrheal metrics, yielding a total faecal frequency of 1.87±0.05 and a faecal water content of 0.23±0.0, in contrast to the negative control, which exhibited a decreased onset time of 59.2±0.3 minutes and significantly elevated diarrheal metrics, including a total faecal frequency of 6.22±0.34 and a faecal water content of 2.24±0.01 mL.

It was found that the oral administration of methanol and n-hexane leaf extracts at a dosage of 125 mg/kg body weight significantly delayed the latency for the initiation of diarrhoea and faecal output, in addition to other diarrheal parameters, in a manner that was dose-dependent (Table 2). When supplied at a maximum oral dose of 500 mg/kg body weight, both extracts substantially lengthened the onset of diarrhoea and faeces. As a result of the administration of the extracts, the corresponding times were increased to 106.50±2.62 and 79.41±2.61 minutes, respectively. At the same time, they were able to achieve a significant reduction in all of the diarrheal parameters with total frequencies of 3.81±0.34 and 2.28±0.10, as well as 5.17±0.32 and 4.11±0.05, in addition to faecal water content measured in mL at 0.64±0.02 and 0.25±0.00, 1.74±0.05 and 1.25±0.06, respectively. When compared to the negative control, which demonstrated a longer appearance time and larger amounts of diarrheal indicators (Table 2), there was a significant difference. The percentage reduction in faeces that occurred as a consequence of the administration of loperamide, methanol, and n-Hexane leaf extracts at oral dosages of 125, 250, and 500 mg/kg body weight, respectively, is given in Table 3. This decrease may be attributed to the administration of these three substances. The administration of loperamide orally to rats that were suffering from diarrhoea at a dose of 2.5 milligrams per kilogram of body weight resulted in a 70% reduction in the amount of stools that diarrheal rats characterised. Maximum oral dosages of 250 and 500 mg/kg body weight of methanol and n-hexane leaf extracts, respectively, resulted in percentage declines of 54.50% and 66.55%, and 24.43% and 33.92%. These drops were seen in rats that were given the extracts. The rats that were administered the extracts exhibited these percentage decreases in their survival rates. It would seem that there is a connection between the inhibitory impact that methanol and n-hexane leaf extracts have on diarrheal faeces and the dosage that is administered to the individual. A more substantial decrease in the number of involuntary bowel movements was seen as a consequence of the administration of the methanol extract at a dosage of 500 mg/kg. According to the data shown in Table 2, the

efficacy of n-hexane was lower than that of its methanol extract. Additionally, it was shown that the effectiveness of these medications was connected to the composition of the components that comprised the chemical under investigation. To be more precise, the leaf extract that was extracted using methanol included a high concentration of flavonoids, tannins, phenolic compounds, and saponins, while the extract that was extracted using n-hexane contained a high concentration of terpenoids. Both extracts were obtained from the same plant.

A statistically significant difference ($P > 0.05$) was seen between the reductions that were observed with the administration of 500 mg/kg body weight of methanol leaf extract and those that were administered with the standard drug, loperamide. This difference was observed in the decreases that were observed. These drops were demonstrated to be much more severe when taken into consideration in comparison to the losses that were discovered with the other dose levels. The inhibition of defecation that was observed suggested a dose-dependent increase for each extract. The results showed that the group that received 500 mg/kg body weight of methanol leaf extract exhibited the highest level of inhibition, which was assessed at 66.55%. According to the findings, this outcome was comparable to the 70% inhibition that was obtained in rats that had diarrheal episodes that were produced by castor oil and were treated with loperamide (the group that served as the positive control).

An increase in the activity of sodium-potassium ATPase in the small intestine was seen after the administration of methanol leaf extracts at concentrations of 143.72±5.93, 161.86±8.21, and 173.67±5.13, respectively. This increase was statistically significant ($P < 0.05$). Raise of this magnitude was seen in a dose-dependent manner. When it came to reducing the levels of nitric oxide ($P < 0.05$), the extract demonstrated an effect that was both simultaneous and dose-dependent. According to the findings, the Administration of 500 mg/kg of methanol extract of sweet potato resulted in a reduction in the amount of nitric oxide that was experienced. The values that were obtained for this decrease were 26.07±3.39 and 26.30±2.97, respectively. The decrease observed in rats given loperamide was equivalent to the reduction reported in this study. This finding is consistent with the hypothesis, as shown by the research findings of Yakubu and Salimon (2015).

Table 2: Effect of Sweet potato methanol and n-Hexane leaf extracts on castor oil-induced diarrhea in albino rats.

Groups	Extract/Drug	Doses (mg/kg body weight)	Onset time of Faecal	Total Faecal frequency	Water Content of Faeces (ml)	Reduction of Defecation (%)	Intestinal nitric oxide (µmol/L)	Na^+/K^+ ATpase (µmol Pi/mg protein/hr)
I	(Distilled water)	0	0	1.21 ± 0.03	0.11 ± 0.01	100	8.11±1.20	145.03 ± 7.48
II	Distilled water + castor oil)	0	$59.10+0.00^{a}$	$6.22+0.34^{g}$	$2.24+0.01^{f}$	0.00	$127.29+8.95^{f}$	$89.18+7.36^{a}$
III	Loperamide + castor oil	2.5	$147.30+3.74^{g}$	$1.87+0.05^{a}$	$0.23+0.00^{a}$	70.00^{f}	$26.07+3.39^{a}$	$170.22+8.89^{f}$
IV	Methanol Leaf Extract	125	$72.30+3.00^{d}$	$3.81+0.34^{d}$	$0.64+0.02^{d}$	38.74^{d}	$50.10+6.26^{c}$	$143.72+5.93^{d}$
V		250	$97.40+2.61^{e}$	$2.83+0.30^{c}$	$0.37+0.00^{b}$	54.50^{e}	$40.10+4.52^{b}$	$161.86+8.21^{e,*}$
VI		500	$106.50+2.62^{f}$	$2.28+0.10^{b,*}$	$0.25+0.00^{a,*}$	$66.55^{f,*}$	$26.30+2.97^{a,*}$	$173.67+5.13^{f,*}$
VII	n-Hexane Leaf Extract	125	$70.10+3.67^{a}$	$5.17+0.32^{f}$	$1.74+0.05^{e}$	17.00^{a}	$73.67+2.28^{e}$	$115.45+6.01^{b}$
VIII		250	$72.37+2.69^{b}$	$4.70+0.21^{e}$	$1.66+0.03^{d}$	24.43^{b}	$58.40+3.24^{c}$	$129.54+7.30^{c}$
IX		500	$79.41+2.61^{c}$	$4.11+0.05^{d}$	$1.25+0.06^{c}$	33.92^{c}	$38.52+1.32^{b}$	$141.37+7.49^{d}$

[1]n=3 Values are the mean of three replicates ± S.D;
Mean values with different superscripts down the column are significantly different ($p < 0.05$).
* Superscripts show no significant difference as compared with the Castor oil + Loperamide *group*.

Intestinal alkaline phosphatase acts as a barrier that blocks the entrance of pathogens and toxins through the mucosa of the gut, while at the same time managing to retain its absorptive function (Lalles, 2014; Jan *et al.*, 2017). This is accomplished so that the mucosa of the gut may continue to function normally. In a person who is experiencing diarrhoea, the function of the gut barrier is damaged, which in turn leads to a decrease in the amount of alkaline phosphatase that is expressed in the digestive system. This occurs as a consequence of the fact that the gut barrier is affected. Fig. 1. Upon examination of the results shown in Figure 1, it is evident that the dosages of crude extract, which were 250 mg/kg for group V and 500 mg/kg for group VI, demonstrated a significant increase ($p < 0.05$) in the activity of intestinal alkaline phosphatase.

On the other hand, the enzyme activity did not significantly increase as a consequence of the dosage of 125 mg/kg as administered. This demonstrates that there was no increase in the enzyme activity. As can be seen in Figure 1, the reactivation of intestinal alkaline phosphatase in rats that had diarrheal episodes after being treated with crude extract suggests that the crude extract had a protective impact on the intestinal mucosa, which in turn reduced the severity of the diarrheal episode (Salimon and Yakubu, 2020). This was found in rats that had diarrheal episodes after being treated with crude extract.

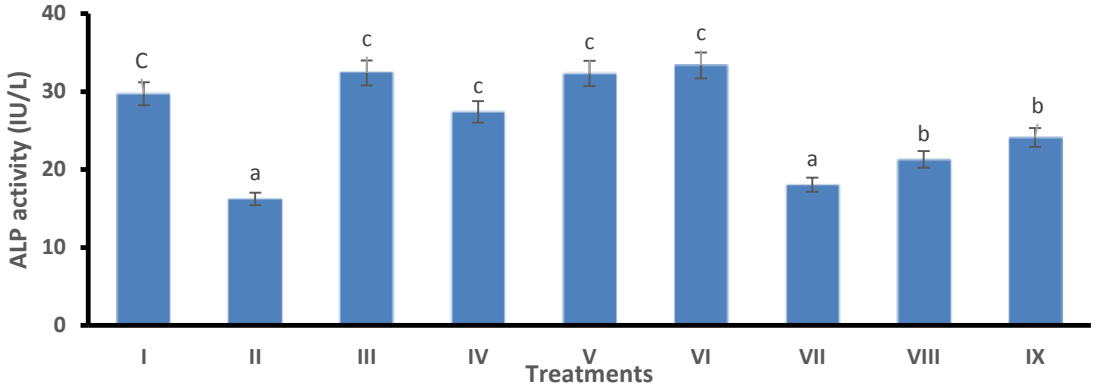

Fig.1. Effects of Sweet Potatoes methanol and n-Hexane leaf extracts on intestinal alkaline phosphatase (ALP) activity.

Values are means of three replicates ± S.D;

Bars with different superscripts are significantly different ($p < 0.05$).

Key:

Group I: Distilled water
Group II: Castor oil + distilled
Group III: Castor oil + Loperamide
Group IV: 125mg/kg (body weight) *MLE*
Group V: 250mg/kg (body weight) *MLE*
Group VI: 500mg/kg (body weight) *MLE*
Group VII: 125mg/kg (body weight) *n-HLE*
Group VIII: 250mg/kg (body weight) *n-HLE*
Group IX500mg/kg (body weight) *n-HLE*

It is possible to see that the reduction in superoxide dismutase (SOD) and catalase (CAT) in rats that were treated with extract demonstrates a mitigation of the negative effects that oxidative stress has on enterocytes, which in turn preserves the integrity of the intestinal mucosa (Salimon and Yakubu, 2020). This decrease in SOD and CAT levels can be seen in Figures 2 and 3. One piece of evidence that demonstrates this is the fact that the rats show a decrease in both of these enzymes.

According to a study that was conducted by Rao et al. (2018) at the University of California, San Francisco, the gastrointestinal system is responsible for the generation of a substantial category of reactive oxygen species known as superoxide radicals. This research was published in the journal Scientific Reports. There is a potential that the significant decrease in superoxide dismutase activity that was seen in rats who were given crude extracts might be attributed to a reduction in the formation of superoxide radicals. There is a correlation between a rise in the amount of superoxide radicals and an increase in the levels of superoxide dismutase that are present in the cells. In a study that was conducted by Shoba and Thomas in 2001, it was discovered that a higher level of superoxide dismutase activity is associated with a greater amount of fluid accumulation that is brought about by castor oil. It was shown by the fact that the two variables were discovered to be connected to one another. Castor oil is responsible for a considerable amount of intraluminal fluid build-up, which would be decreased as a result of the decrease in superoxide dismutase activity that was identified. The results of this experiment are in accordance with the findings of Salimon and Yakubu (2020), with the exception that mango leaf extract was used instead of sweet potato (I. batatas) leaf extract.

According to Rtibi et al. (2017), the diarrhoea that is caused by castor oil also results in a reduction in the activity of the enzyme catalase, which in turn results in oxidative stress. All of these factors contribute to the development of diarrhoea. The findings of this study make it evident that an increased catalase activity is an essential defence mechanism that protects the intestinal tract from developing hypersecretion as a result of oxidative stress.

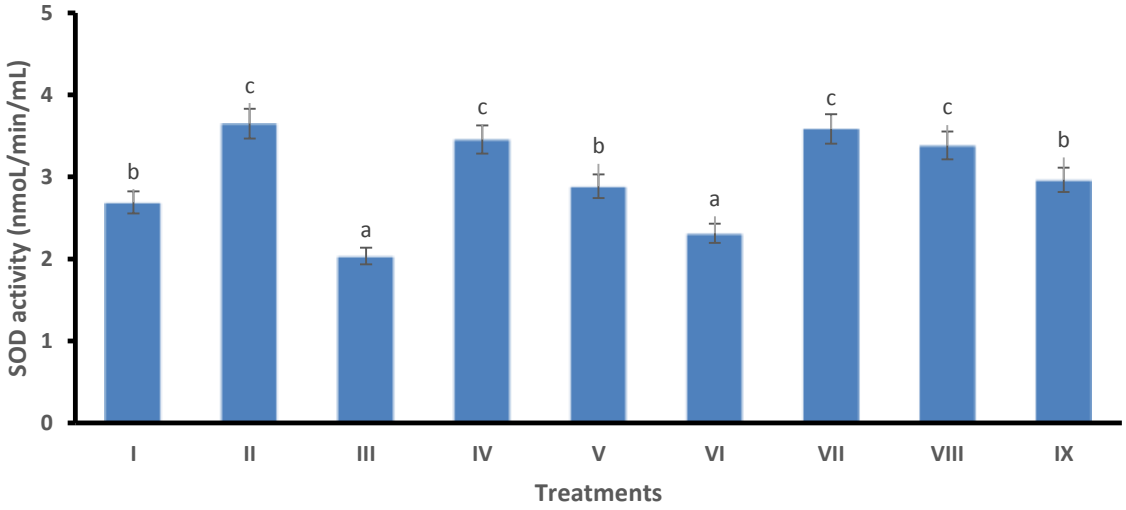

Fig.2. Effects of Sweet potato methanol and *n-HLE*s on intestinal superoxide dismutase (SOD) activity.

Values are means of three replicates ± S.D;

Bar with different superscript are significantly different ($p < 0.05$).

* Superscripts show no significant different as compared with Castor oil + loperamide *group*

Key

***Group* I:** Distilled water

***Group* II**: Castor oil + distilled

***Group* III:** Castor oil + Loperamide

***Group* IV:** 125mg/kg (body weight) *MLE*

***Group* V:** 250mg/kg (body weight) *MLE*

***Group* VI:** 500mg/kg (body weight) *MLE*

***Group* VII:** 125mg/kg (body weight) *n-HLE*

***Group* VIII:** 250mg/kg (body weight) *n-HLE*

***Group* IX**500mg/kg (body weight) *n-HLE*

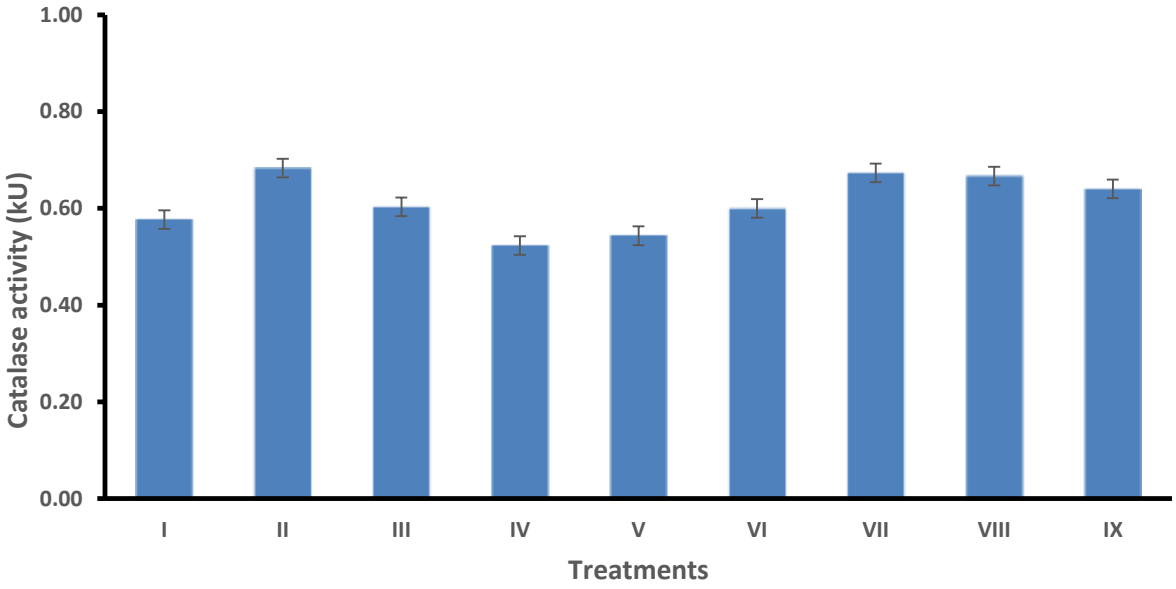

Fig. 3. Effects of Sweet potatoes (*Ipomoea batatas)* methanol and *n-HLE*s on intestinal catalase (CAT) activity.

Values are mean of three replicates ± S.D;

Bar with different superscripts is significantly different ($p < 0.05$).

Key

***Group* I:** Distilled water

***Group* II**: Castor oil + distilled

***Group* III:** Castor oil + Loperamide

***Group* IV:** 125mg/kg (body weight) *MLE*

***Group* V:** 250mg/kg (body weight) *MLE*

***Group* VI:** 500mg/kg (body weight) *MLE*

***Group* VII:** 125mg/kg (body weight) *n-HLE*

***Group* VIII:** 250mg/kg (body weight) *n-HLE*

***Group* IX**500mg/kg (body weight) *n-HLE*

Effects of the methanol and n-Hexane extracts of sweet potato leaves on castor oil-induced intestinal fluid accumulation in rats.

Castor oil was used to induce entero-pooling in rats so that the effects of methanol and n-hexane extracts from the leaves of Ipomoea batatas could be more accurately evaluated. The administration of loperamide at an oral dosage of 2.5 mg/kg body weight, in conjunction with the administration of methanol and n-hexane leaf extracts at maximum oral doses of 250 and 500 mg/kg body weight, resulted in significant percentage reductions in both the average volume of small intestine content (AVSIC) and the average weight of small intestine content (AWSIC) in comparison to the control group. A comparison was made between the two groups. A contrast was drawn between the two groups that were compared.

Upon analysis of the data, it was discovered that the percentage inhibitions of AVCSI for methanol and n-hexane were 46.52 ± 1.85% and 57.18 ± 2.35%, 30.80 ± 1.98% and 33.33 ± 1.62%, respectively. There was a change that was shown to be statistically significant at a value of 60.16 ± 2.12% ($p < 0.05$), which indicates that the result was beneficial. The percentage reductions varied from 46.62% to 57.18% for the methanol leaf extract and from 31.80% to 33.33% for the n-hexane (Table 3). It was shown that the leaf extracts that were prepared using methanol had the greatest levels of activity for AVSIC (35.5, 46.52, and 57.18%, respectively). The extract that was prepared using n-hexane had the second highest levels of activity, with 21.14, 31.80, and 33.33%, respectively. Taking this into consideration, it is possible to draw the conclusion that the leaf extracts that were obtained from methanol have a great potential to lower these parameters to a large degree. In comparison to the n-hexane extract, which revealed much lower levels of activity, the methanol leaf extract exhibited significantly higher levels of biological activity across all evaluated parameters. The use of this organic solvent is often regarded as the method that has produced the most favourable outcomes when it comes to the extraction of active components in significant amounts. The findings indisputably supported the hypothesis that tannins play a substantial role in the expression of all evaluated activities. Therefore, there is little question that tannins play a large role in the expression of that activity. Due to the fact that this demonstrates that tannins are responsible for these effects, it is conceivable that tannins are the primary active component that is responsible for the antidiarrheal qualities of the plant part that was investigated. According to the findings of a number of additional studies, including those carried out by Labu et al. (2015), Barbara de Servi (2017), and Cimanga et al. (2019), amongst others, these findings were in accord with the findings of the aforementioned studies. The biological activities that were evaluated during the course of this inquiry offered consistent confirmation that all of the samples from sweet potato displayed activity that was equivalent to one another.

Tannins and phenolics, both of which are found in plant extracts, have the ability to slow down the generation of autacoids and prostaglandins, which in turn reduces the motility and secretion that are associated with castor oil-induced diarrhoea. Tannins are the compounds that are responsible for the production of protein tannates. The capacity of these tannates to stick to the intestinal mucosa makes it possible for them to minimise the amount of secretion that occurs. According to the findings of the research that was carried out by Cimanga et al. (2019), there is a connection between the calming effects of tannins and phenols and the enhancement of this activity.

In accordance with the findings of Hamalainen et al. (2011). The results of the study showed that sweet potato samples showed a reduction in all oral doses evaluated. This indicates that the effect was much improved in comparison to the group that acted as the negative control. The effectiveness of sweet potato leaves can be attributed to the presence of a variety of phytochemical constituents. It is important to note that the reduction in intestinal fluid accumulation, which was 57.18%, was lower than the 66.45% that was reported by Salimon and Yakubu (2020). The anti-enteropooling impact that was shown by the methanol leaf extract at a dosage of 500 mg/kg body weight is consistent with the findings that Yakubu and Salimon (2015) had previously obtained concerning the volume and mass of fluid in the small intestine. There is a high probability that the extraction methods considered in this research are connected to the mechanisms responsible for the significant variance in the inhibition of intestinal fluid evaluated. Although the mechanisms that are responsible for the considerable variation in the assessed inhibition of intestinal fluid are not yet identified, this is the case despite the fact that the variance is large.

Table 3. Effects of the Methanol and n-Hexane Extracts of Sweet Potatoes *Ipomoea batatas* Leaf on Castor Oil-Induced Entero-Pooling in albino rats

Treatments	Extract/Drug	Doses (mg/kg body weight)	Mass of Intestinal Fluids (g)	Volume of Intestinal Fluids (mL)	Reduction of intestinal Content (%)
Group I	Normal Control (Distilled water)	0	1.03 ±0.02	0.23 ± 0.05	100
Group II	Negative Control (Castor oil + distilled water)	0.00	3.69 ±0.03^{f}	3.23 ± 0.05^{e}	0.00
Group III	Positive Control (Atropine sulphate)	2.5	1.47 ±0.03 ^{a}	1.27 ± 0.05^{a}	60.16 ± 2.12 ^{d}
Group IV	Methanol Leaf Extract	125	2.38 ±0.05^{d}	2.03 ± 0.05^{b}	35.5 ± 1.36 ^{b}
Group V		250	1.97 ±0.03^{c}	1.77 ± 0.05^{b}	46.52 ± 1.85 ^{c}
Group VI		500	1.58± 0.05 ^{a} *	1.53 ± 0.05^{a,} *	57.18 ± 2.35 ^{d,} *
Group VII	n-Hexane Leaf Extract	125	2.91 ±0.04^{e}	2.68 ± 0.04^{d}	21.14 ± 2.20 ^{a}
Group VIII		250	2.52 ±0.03^{d}	2.33 ± 0.05^{c}	31.80 ± 1.98 ^{b}
Group IX		500	2.46 ±0.04 $^{d, e}$	2.27 ±0.09^{c}	33.33 ± 1.62 ^{b}

[1]n=3 Values are mean ± S.D; Mean n=3

p < 0.05, different superscripts down the column are significantly different.

[3]* Superscripts show no significant difference compared to the Positive control *group*.

The leaf of sweet potatoes contains a number of components, including zinc (2.255 mg/100 g), sodium (66.75 mg/100 g), potassium (120.36 mg/100 g), and chloride (0.110 mg/100 g). All of these elements are possible to find in sweet potatoes. All components continue to be within the permissible level specified by the World Health Organisation (WHO). Zinc supplementation at a level of twenty milligrams per day for ten days in children who are over two months old may be crucial in the treatment and prevention of severe diarrhoea, according to research on pediatric populations. Research reveals that there is a reduction in the duration of episodes of diarrhoea and the severity of those bouts, as well as a reduction in the likelihood of dehydration by 20% to 40%. Additionally, there is a reduction in the likelihood of experiencing diarrhoea (Wendy and Andrew, 2014).

Diets that are rich in potassium have been shown to have the potential to reduce the number of cases of diarrhoea and hypertension, according to some data. The epidemiological studies and the study that was conducted on animals are the sources of this proof. In the course of this investigation, it was found that the leaves of the sweet potato plant contain 120.36 milligrams of potassium for every one hundred grams of the plant. As a result of this, the leaves of the sweet potato plant can provide a substantial quantity of potassium to those who are experiencing diarrhoea. The findings of the investigation by Chuku and Ugorji (2012) are in accord with this statement.

Table 5 Elemental constituents of the methanol extract of sweet potato leaves

Elements	Concentration (mg/100g)	WHO Standard mg/100g
Chloride	0.79 ± 0.01	0.72-250
Potassium	120.36 ± 0.31	10-100
Sodium	66.75 ± 0.21	400-500
Zinc	2.25 ± 0.10	150-200

Gallo-tannins are the members of the bioactive components that have been found, and they are the ones that are accountable for the largest percentage peak area. The n-hexadecanoic acids, catechol, and methyl-gallate come next in the sequence of compounds. On the other hand, the alkaloid trigonelline, which is generated from plants, is connected to the percentage peak that shows the least amount of variation. In accordance with the findings of Musa et al. (2023), the tannins that are present in the crude extracts have the potential to exhibit antidiarrheal, anti-diabetic, and antioxidant properties, in addition to having the capability to enhance the healing process of wounds.

The mechanism of action of methyl gallate, which is categorised as a hydrolysable tannin, is that it denaturates the protein components of the intestinal mucosa and creates protein tannates, as stated by Yakubu and Salimon (2015). However, the mechanism of action of methyl gallate is not fully understood. It is possible that this is one of the factors that contributes to the benefits that it offers in terms of reducing the risk of diarrhoea. The intestinal motility that was generated by castor oil in Swiss mice was greatly decreased as a consequence of the administration of methyl gallate orally at dosages of 100 mg/kg and 300 mg/kg, respectively. This was the case because of the administration of methyl gallate. 74.5% and 58.82% of these decreases in peristalsis were respectively lowered. Both of these reductions were decreased. Acetylcholine (Ach) and calcium chloride were the two chemicals that were responsible for the contractions of the jejunum; yet, this molecule was also able to prevent those contractions from taking place. It has been determined from the findings of this study (Anzoise *et al.*, 2018) that methyl gallate has advantages in the therapeutic setting that was investigated. During the course of the experiment, a preclinical model of intestinal illness was used (Anzoise *et al.*, 2018).

N-Hexadecanoic acid has been shown via extensive study to play a role as an inhibitor of phospholipase A2, therefore inhibiting the occurrence of lipid peroxidation. The enzyme phospholipase A_2 is inhibited in its activity by N-hexadecanoic acid, which is a competitive inhibitor of the enzyme. Therefore, the quantity of arachidonic acid metabolites that are formed downstream is lowered when phospholipase A_2 is inhibited. This, in turn, leads to a reduction in the amount of cyclooxygenase (COX) II that is produced. According to the findings of an experiment that was carried out by Boot et al. (2016), n-hexadecanoic acid has the capacity to effectively inhibit cyclooxygenase. A study carried out by Starlin et al. (2019) and Idu et al. (2021) has shown that n-Hexadecanoic acid methyl ester has properties that protect against anaemia, reduce cholesterol levels, and serve as an antioxidant. These findings are in agreement with the findings of the study. The capacity to cure hemolytic anaemia, serving as an antibacterial and antifungal agent, preventing cancer, decreasing inflammation, and showing antioxidant activity are some of the features that are connected with n-hexadecanoic acid. Other properties include the ability to reduce inflammation.

Catechol is a flavonoid. Flavonoids inhibit intestinal motility and hydroelectrolytic secretions (Boot *et al.*, 2016). Catecholamine, an organic compound that has a catechol ring and amine, stimulates electrogenic NaCl absorption and decreases electrogenic Cl secretion by interaction with a-adrenoreceptors on enterocytes (Fiztgeral, 2011). It acts at the a-adrenergic receptor coupled with the G-proteins to antagonise cAMP production. Donowitz et al. (1982) reported that the catechol moiety is important for maximal agonist activity at the a-adrenoreceptors. Fluid secretion in many secretory diarrhoeas is caused by activation of chloride channels by cyclic nucleotides such as cAMP (Thiagarajah *et al.*, 2014). In a variety of kinds of diarrhoea, this is the result that may be expected.

Table 6: Chemical profile of methanol extract of sweet potato leaf using GC-MS.

S. No	RT	Sample Component	Peak Area	Area Percentage
1	6.677	Gallotannins (pyrrogallol)	61963670.43	71.27
2	11.306	n-Hexadecanoic acid	20460473.25	23.53
3	5.144	Catechol	2230706.21	2.57
4	11.461	Benzoic acid,3,4,5-trihydroxy(methyl-gallate)	1378446.53	1.59
5	8.749	Propanoic acid, 2-(aminoxy)	801170.85	0.92
6	4.40	Trigonelline (alkaloid)	877001.03	0.10
7	5.424	Phenol,4-(methylthiol)	23711.18	0.02

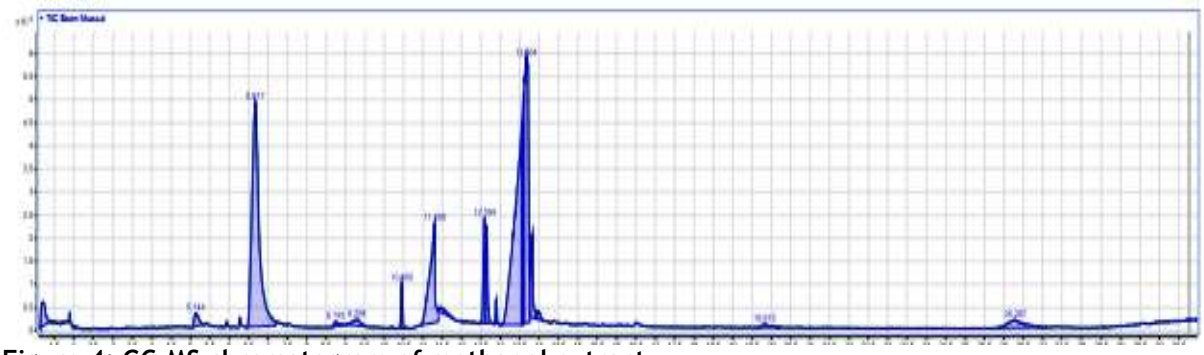

Figure 4: GC-MS chromatogram of methanol extract

CONCLUSION

Methanol and n-hexane extracts of sweet potato demonstrated significant, dose-dependent anti-diarrhoeal activity, likely mediated by modulation of intestinal motility, fluid secretion, and antioxidant pathways. These findings support the traditional anti-diarrhoeal use of sweet potato leaves and warrant further investigation.

Conflict of Interest

The authors declare that the study was carried out without any business or financial connections that may be seen as a possible conflict of interest.

Acknowledgment

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