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ANTISPASMODIC ACTIVITY OF MUSA PARADISIACA PEEL AQUEOUS EXTRACT

Moumita Tambuli, Nayanika Dey, Namrata Thakur, Nabaneeta Ghosh, Hasnat Jahan Ali, Niharika Gupta and Ananya Bhattacharjee*

Himalayan Pharmacy Institute, Majhitar, Rangpo, East Sikkim-737136, India.

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***Corresponding Author**
Ananya Bhattacharjee
Himalayan Pharmacy Institute, Majhitar, Rangpo, East Sikkim-737136, India.

ABSTRACT

The aim of the study was to check the antispasmodic activity of the peels of *Musa paradisiaca.* Traditionally other parts of it besides peels like leaves, flowers, roots, seeds of this species have been used for various medicinal purposes. After the phytochemical screening, the contractile response of acetylcholine was evaluated on chicken ileum with the extract of banana peels to evaluate the antispasmodic effect. The contractile response of acetylcholine alone and in presence of high and low doses, i.e. 2 and 4mg/ml of aqueous extract of *Musa paradisiaca* indicated clearly decrease in the peaks which are comparable with that of the standard drug atropine indicating its antimotility effect. After addition of 4 and 2mg/mL of *Musa paradisiaca* EC50 of ACh increased, which indicates that higher concentration of ACh was required to elicit 50% of the maximum contractile response. So it can be stated that *Musa paradisiaca* can antagonize ACh-induced contraction in GIT. The antispasmodic activity of flavonoids and tannins are already well-established, and from earlier study it is also established that the high content of flavonoids and tannins are linked with reduction in motility. Hence from this study, it was concluded that aqueous extract of *Musa paradisiaca* peel possesses antispasmodic property in intestinal tissue which suggests its application as antidiarrheal drug.

KEYWORDS: *Musa paradisiaca,* Antispasmodic, Banana antispasmodic, Banana peel.

INTRODUCTION

The gastrointestinal tract is responsible and accountable for the intake and digestion of food, absorption of nutrients, as well as the excretion of end products of food digestion.[1]

Gastrointestinal disorders include the symptoms in the mid as well as lower part of the digestive tract, and gastrointestinal disorder is defined as any disease that occurs within our gastrointestinal tract. GIT is consisting of mouth, oesophagus, stomach, small and large intestine and anus. Digestive system is composed of GIT, liver, pancreas, and gall bladder. It is a network of blood vessels supplying blood to the organs. It also transports nutrients from other organs in the body. Besides that, the nerves and hormones work together to regulate the function of the digestive system.[2] The bacteria that inhibit within our GI tract play a crucial role in digestion, immune system, and health. A number of health conditions or diseases can have a serious effect on the GI tract and have a serious impact on digestion and on health.[3]

Ayurveda, an ancient traditional system of India, states that ancient Indians had a rich knowledge of medicinal value of different plants and its parts. Traditional medicines are effective and convenient source of treatment since ancient times.[4]

Different parts of the plants are generally used for the treatment of various disorders and diseases; besides that, the traditional medicines are economical too. These natural and traditional therapeutic agents have less toxic effects and they are more economic when compared to synthetic and manufactured drugs.[5]

There are numerous medicinal plants discovered and identified for the treatment of different types of diseases and disorders related to gastrointestinal tract, such as *Zanthoxylum armatum*, *Matricaria chamomilla*, *Atropa belladonna* etc.[6]

With the advancement of science, many of the crude drugs used in traditional system have been examined scientifically. *Musa paradisiaca* Linn, also known as Kadali in sanskrit is popular medicinal plant widely used in Indian traditional system of medicine for curing and preventing various ailments including gastrointestinal disorders. Unripe banana (*Musa paradisica Linn*) is an antispasmodic agent used as a home remedy. Banana has been widely used because of its nutritional and therapeutic value. It has several bioactive compounds such as phenolics, flavonoids, biogenic amines which has therapeutic effect on human body.[5]

Flavonoids, which are ample in banana fruit and peel, have been shown to be the reason for the relaxation of the smooth muscle.[7]

Hence, the aim of this study is to examine antispasmodic effects of banana peel on voluntary motility and contractility of the smooth muscle preparation of chicken ileum in vitro. This study mainly focuses and aims on antagonistic action of unripe banana peel extracts on intestinal contractions of chicken ileum.

MATERIALS AND METHODS

Chemicals

All chemicals used were of analytical grade and purchased from standard companies. Acetylcholine and Atropine were purchased from S D Fine-Chem Ltd, Kolkata. All the ingredients of solution were prepared freshly before the experiment.

Plant collection

Musa paradisiaca Linn fruits were collected from Siliguri local market.

Preparation of extract

Extraction of the active compounds of the unripe *Musa paradisiaca* Linn peels was performed by the cold maceration method, to extract the water-soluble compounds. The collected fruits were disinfected by sodium hypochlorite solution (1% v/v) for 15 minutes followed by washing the fruits with water and dried with absorbent paper. The pulps were discarded, and the peels were cut and approximately collected weight was found to be 250gm. The disinfected peels (250 g) were added to 1 L of boiling distilled water and boiled for two hours, using a heating mantle. The whole product was then stored under refrigeration for 24 hours, later after 24 hours it was filtered to obtain the extract (liquid portion) and the peel was again subjected for extraction by following the same method. The extraction process was repeated for 3 times. Then the peels were discarded, the extracts obtained by three extractions were then concentrated by using water bath and weighed, followed by this the yield was calculated.[8]

Pharmacological test

Fresh ileum of healthy chickens was obtained from the nearest slaughterhouse. Terminal segments of ileum about 1– 1.5cm in length was prepared and placed in 30mL baths containing the prepared Tyrode solution (NaCl, 40; KCl, 1; $MgCl_2$, 5; NaH_2PO_4, 0.25; $CaCl_2$, 1; $NaHCO_3$, 5; glucose10). Tyrode solution containing fresh chicken ileum was kept at room temperature and oxygenated continuously. Initial tension was 2 grams. Then, fresh chicken ileum was allowed to stabilize inside the Tyrode solution. Isometric contractions were

recorded. Graded doses of acetylcholine from 1, 2, 4µg/mL were added into the organ bath to trigger contractile response. Control cumulative concentration–response curves for each acetylcholine was plotted.[9]

Aqueous extract, 2µg/mL of atropine was then added to the bath 10 min before the corresponding concentration–response curve was recorded. Each agonist was tested in the presence of aqueous extracts and standard antagonist (atropine). Anticholinergic effect of extracts and atropine were evaluated against a fixed minimally effective dose of acetylcholine from 1 to 4µg/mL. Antispasmodic effects of extracts were evaluated against a fixed minimally effective dose of acetylcholine from 1 to 4µg/mL. Spasmolytic effects on contractile response caused by extracts and standard antagonists were plotted in graphs.[9]

RESULTS AND DISCUSSION

Preliminary qualitative phytochemical analysis: Results of the preliminary phytochemical investigation of aqueous extract of *Musa paradisiaca* exhibited presence of flavonoids and tannins.

Specifications: The environmental conditions were maintained during the experiment were as follows: the bath volume was 30ml, speed of recording was 0.25mm/sec, equilibrium time was 30 minutes, the interval between dose is 1minute, and the dosing method was cumulative.

Table no. 1: Environmental conditions maintained during the experiment.

Experimental conditions	
Bath volume (ml)	30
Speed of recording paper(mm/sec)	0.25
Equilibrium time (min)	30
Interval between dose (min)	1
dosing method	cumulative

Response for different doses of acetylcholine Alone and In the presence of HDMP, LDMP, Atropine

Concentration-response curve in Figure 3 showed that both 4 and 2mg/mL of *Musa paradisiaca* as well as 2µg/mL atropine caused concentration dependent decrease in contractile response as compared to concentration-response curve of Ach alone.

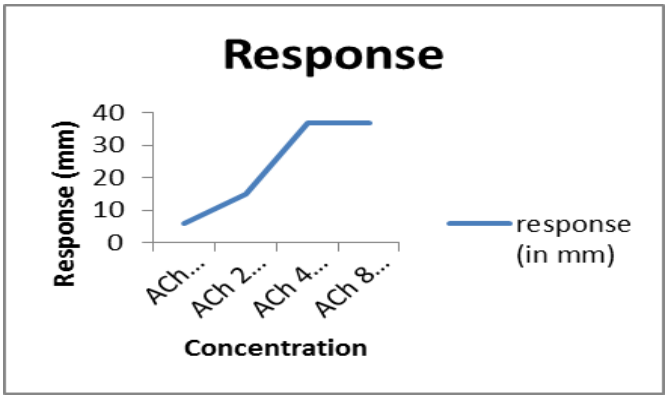

Figure no. 1: Response for different doses of acetylcholine (mm).

Table no. 2: Response for different doses of acetylcholine (mm).

Treatment	Response (in mm)
ACh 1µg/mL	6
ACh 2 µg/mL	15
ACh 4 µg/mL	37

Table no. 3: Contractile response of acetylcholine Alone and In the presence of High and Low dose of aqueous extract of *Musa Paradisiaca* and Atropine on chicken ileum.

Treatment	Response (in mm)	Ach+HDMP (in mm)	Ach+LDMP (in mm)	Ach+Atropine (in mm)
ACh 1µg/mL	6	1	1	1
ACh 2 µg/mL	15	3	4	2
ACh 4 µg/mL	37	5	15	3

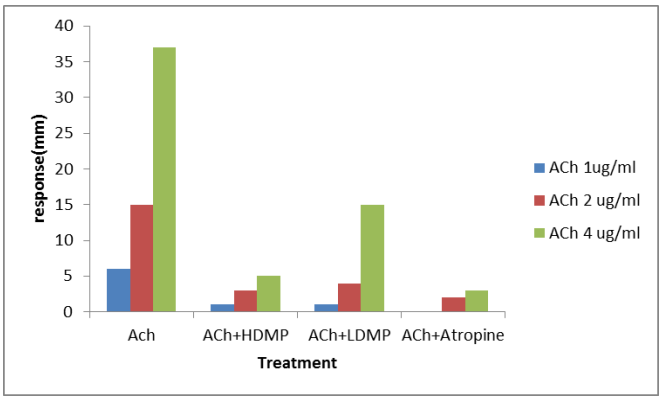

Figure no. 2: Contractile response of acetylcholine Alone and In the presence of High and Low dose of aqueous extract of *Musa Paradisiaca* and Atropine on chicken ileum.

Half Maximal Response (EC50) for acetylcholine alone and in the presence of High and Low dose of aqueous extract of *Musa Paradisiaca* and Atropine

According to the determination of EC50, EC50 of ACh alone was 2.2µg/mL. After addition of 4 and 2mg/mL of *Musa paradisiaca* EC50 of ACh increased. In the presence of HDMP

and LDMP, EC50 were 12.8 and 4.7 µg/mL respectively. EC50 of ACh in the presence of 2µg/mL atropine was 21µg/mL.

Table no. 4: Half Maximal Response (EC50) for acetylcholine Alone and In the presence of High and Low dose of aqueous extract of *Musa Paradisiaca* and Atropine on chicken ileum.

Treatment	EC50 (µg/mL)
ACh 1-4µg/mL	2.2
ACh+HDMP 4mg/mL	12.8
ACh+LDMP 2mg/mL	4.7
Atropine 2µg/mL	21

Force of contraction in gram generated by chicken ileum in response to addition of ACh, high and low dose of aqueous extract of *Musa paradisiaca* and Atropine

The peaks presented in Figure 3 showed the force of contractions in chicken ileum generated by graded doses of ACh from 1, 2 and 4 µg/mL. After addition of 4 and 2mg/mL of *Musa paradisiaca* as well as 2 µg/mL atropine, there were significant reductions in the peaks.

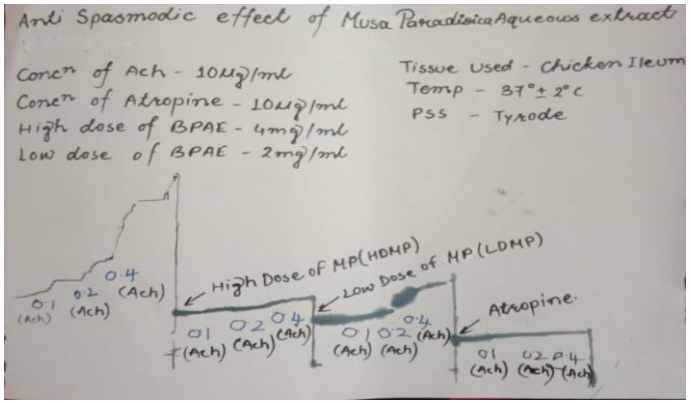

Figure 3: Force of contraction in gram generated by chicken ileum in response to addition of ACh, High and Low dose of aqueous extract of *Musa Paradisiaca* and Atropine.

The aim of the present study was to evaluate the antispasmodic activity of *Musa paradisiaca* peel aqueous extract. Acetylcholine exhibited concentration dependent increase in contractile response of chicken ileum. At 4 µg/ml the contraction was maximum. Washing out for about 3 to 5 minutes was done before the addition of different concentration of extract and antagonist in order to ensure recovery of the contractile response.

Concentration-response curve showed that both 4 and 2mg/mL of *Musa paradisiaca* as well as 2µg/mL atropine caused concentration dependent decrease in contractile response as compared to concentration-response curve of Ach alone. At higher dose of the extract it was seen that contraction was largely inhibited than the lower dose.

M_2 and M_3 receptors are mainly responsible for intestinal contractions exhibited by acetyl choline. It is reported that both M_2 as well as M_3 receptors are present in isolated preparation of intestinal smooth muscles.

Therefore, it can be assumed that here acetylcholine binds to M2 receptors to inhibit relaxant effect caused by cyclic adenosine monophosphate (cAMP) and binds to M_3 receptors to facilitate phosphoinositide hydrolysis and causes intestinal contractions.[10]

It can be assumed that both high and low doses of *Musa paradisiaca* blocked the M_2 and M_3 receptors to inhibit intestinal contractions.

Force of contraction induced by ACh in the presence of 4 and 2mg/mL of *Musa paradisiaca* as well as 2µg/mL atropine is less than that induced by ACh alone. These findings suggested that high and low dose of *Musa paradisiaca* extract and atropine may inhibit muscarinic receptors and decrease intestinal contractions. It is reported that inhibition of muscarinic receptors in GIT can lead to relaxation of intestinal smooth muscles.[11]

According to the determination of EC50, EC50 of ACh alone was 2.2µg/mL. After addition of 4 and 2mg/mL of *Musa paradisiaca* EC50 of ACh increased. In the presence of HDMP and LDMP, EC50 were 12.8 and 4.7 µg/mL respectively. EC50 of ACh in the presence of 2µg/mL atropine was 21µg/mL. Increase in EC50 indicates that higher concentration of ACh was required to elicit 50% of the maximum contractile response. In other words, *Musa paradisiaca* can antagonize ACh-induced contraction in GIT.

The peaks presented in Figure 3 showed the force of contractions in chicken ileum generated by graded doses of ACh from 1, 2 and 4 µg/mL. After addition of 4 and 2mg/mL of *Musa paradisiaca* as well as 2 µg/mL atropine, there were significant reductions in the peaks. These reductions indicate that 4 and 2mg/mL of *Musa paradisiaca* and atropine antagonized ACh-induced intestinal contractions.

Several studies were found to prove the presence of flavonoids in *Musa paradisiaca* peel.[12]

The antispasmodic activity of flavonoids is already well-established.[13] From earlier study it is also established that the antidiarrhoeal activity is directly linked with high content of flavonoids and tannins.[14]

Hence, from our experiment it was proved that peel of *Musa paradisiaca* possess anti spasmodic effect probably due to the presence of phytochemicals like flavanoids and tannins.

CONCLUSION

Results from the present work has demonstrated that both 4 and 2mg/mL of *Musa paradisiaca* aqueous extract showed concentration dependent reduction in the contraction of the chicken ileum induced by acetylcholine, hence it has exhibited antispasmodic activity.

Force of contraction induced by ACh in the presence of high and low doses of *Musa paradisiaca* as well as atropine is less than that induced by ACh alone. These findings suggested that high and low dose of *Musa paradisiaca* extract and atropine may inhibit muscarinic receptors and decrease intestinal contractions. It is reported that inhibition of muscarinic receptors in GIT can lead to relaxation of intestinal smooth muscles.

The findings support that *Musa paradisiaca* may serve as the potential treatment for gastrointestinal disorders such as diarrhea as well as IBS. Further studies can be carried out to establish the fact clinically.

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