Original Research Paper

Volume - 10 | Issue - 7 | July - 2020 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Pharmacology

EFFECT OF AQUEOUS EXTRACT OF UNRIPE MUSA PARADISICA (BANANA) SKIN ON CARDIAC AND SKELETAL MUSCLE OF TOAD

Dr. Rajlaxmi Upadhyay* Asst. Professor, Department of Pharmacology, S. C. B. Medical College, Cuttack, Odisha, India *Corresponding Author

Dr. Sabita Mohapatra Professor, S. C. B. Medical College, Cuttack, Odisha, India

ABSTRACT

OBJECTIVE: Since time immemorial plant and plant products have been used by man to cure his ailments. Banana (*Musa Paradisica*) and its unripe skin have been in folklore and Ayurvedic medicine as laxative, poultice and anthelmintics. However there are no studies to confirm the pharmacological properties of this indigenous product. The present study was undertaken to evaluate the effect of aqueous extract of banana peel on some isolated muscle preparation of toad.

MATERIAL AND METHODS: Aqueous extract of banana skin was prepared and its effect on isolated rectus abdominis muscle and heart of toad was studied. The extract was used in increasing doses along with known agonist and antagonist. The study was done in two parts to see the effect on

- Cardiac muscle
- Skeletal muscle

RESULTS

Effect on cardiac muscle: In lower doses toad heart showed increase in heart rate and amplitude of contraction, and heart was inhibited by the extract in higher doses, which was partially antagonised by atropine. In presence of propranolol though there is significant decrease in heart rate by the extract, the decreased in the force of contraction was not statistically significant. Nifedipine produced significant decreased of heart rate and amplitude of contraction of the extract

Effect on skeletal muscle: The extract produced a graded stimulatory response with different doses on acetylcholine induced contraction. Neostigmine further increased the stimulatory effect. At lower concentration, the extract potentiated acetylcholine induced contractions which was partially blocked by standard antagonist pancuronium

CONCLUSION: Aqueous extract of raw banana skin has a stimulatory effect on cardiac muscle of toad like digitalis and also skeletal muscle potentiation action like neostigmine. Further studies are required to establish the usefulness of active principles involved in banana skin extract.

KEYWORDS : Banana (*Musa Paradisica*), cardiac, skeletal, effects, toad

INTRODUCTION

Since time immemorial man has been using plants as medicines. Hence research on herbal drugs is required to stalk chain on the patent rights on medicinal plants used in our traditional practices.

Musa paradisca commonly known as banana (family Musacea) is one such plant which has rich medicinal properties. Banana and its skin have been used in folklore and ayurvedic medicines as laxative, poultice and anthelmintic[1]. Different parts of the plant are used as common home remedies such as roots (anthelminthic), flowers (astringents, dysentry and menorrhagia), stem (otalgia, hemoptysis, epilepsy, hysteria), ripe fruit (anti scurbutic, mild demulsant, astringent, diet in dysentry), unripe fruit(diabetes), young leafs (cool dressing for blisters and burns), banana skin (laxative, poultice and anthelminthics)[2], but there are no studies to confirm the pharmacological properties of this indigenous plant. Our pilot studies conducted have shown the effect of raw banana skin on heart and rectus abdominis muscle of toad[3].

Cardiac glycosides and catecholamines have been used as the main therapeutic drug in the treatment of congestive cardiac failure however the dangers of cardiac glycosides and their side effects are well documented. Hence the search of new nature based drug which increases cardiac muscle contractility with a broad therapeutic index continues. Thus the current study was undertaken with the following objectives :

To study the effect of aqueous extract of Musa paradisica on

1. perfused toad's heart and on isolated rectus abdominis muscle of toad.
2. Elucidate the possible mechanism of action.

MATERIAL AND METHODS

Preparation of Banana skin extract (BSE) Aqueous extract was made from raw bananas. The bananas were approximately 25cms long. The peel of these unripe bananas were removed, dried under shade and powdered in a mechanical grinder. Sixty grams of pulverized banana skin was extracted with distilled water using Soxhlet's apparatus. The yield was 13.5%. The extract was administered in doses of 0.5mg/ ml, 1.0mg/ ml, 1.5mg/ ml and 2mg/ ml

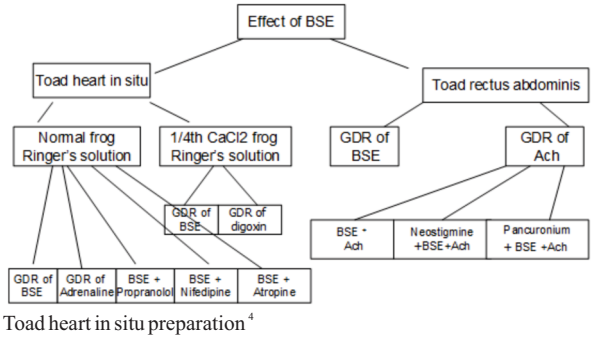
Animals

Common Indian toad weighing between 100 to 150 grams housed and maintained in cages of the animal house were used.

Drugs

Acetylcholine, atropine, neostigmine, pancuronium, adrenaline, propranolol, nifedipine, digoxin.

Plan of the study



Toad heart in situ preparation [4]

Toads were pithed and the heart exposed. The inferior vena cava was cannulated for perfusing the heart. The basal cardiac contractions were recorded after administration of distilled water. The average basal heart rate and amplitude of contraction were 70beats/min and 18mm respectively. The effects obtained with the drugs and extracts were calculated as % change over control value.

Graded dose response was recorded for extract in dose of 0.5mg/ml,1.0mg/ml &1.5mg/ml and 2.0mg/ml.

The toad heart was perfused with propranlol, a β-adrenergic blocker at 3×10^{-5}M concentration in frog ringer solution for 60 seconds followed by the administration of the extracts and recordings were noted.

Nifedipine a calcium channel blocker at 2.88 $\times 10^{-5}$M concentration in the frog ringer's solution was administered for 60 seconds followed by the extract and the recordings were noted.

In CCF cardiac musculature fails to contract adequately. This is said to be a hypodynamic heart. Experimentally hypodynamic heart can be produced by perfusing the heart with ringer containing 1/4th CaCl2, other constituents remaining the same. The perfusion fluid was replaced with modified ringer containing1/4th CaCl2. Graded dose response was again recorded with same dose of extracts with this modified ringers solution and the recordings were noted.

Isolated rectus abdominis muscle[5]

A portion of toad's rectus abdominis muscle was mounted in frog ringer's solution in 5 ml capacity organ bath and aerated with air. Each preparation was allowed to equilibrate for 45min under a resting tension of 1gm to obtain stable basal condition.

Initially a concentration of acetylcholine was identified which produced submaximal contraction (2.00cm) of the muscle. The effect of graded doses of extract was noted by adding banana skin extract to the bath and allowing to remain in contact with the muscle for 3min, followed by adding of the submaximal dose of acetylcholine. To know the effect of Neostigmine and pancuroniumon the cholinergic effect of banana skin extract, the respective agent was first administered to the bath 10min before administration of banana skin extract. Three minutes after administration of the test drug, the preparation was then challenged with the submaximal dose of acetylcholine and contractions were recorded.

RESULTS

The graded dose response of banana skin extract was studied in normal frog ringer solution and in presence of propranolol and nifedipine.

Table-1 Effect of BSE on toad heart in situ

Drugs	Frog ringer HR(beats/min) F.C(mm) (% of control value)		Frog ringer + Propranolol HR(beats/min) F.C (mm) (% of control value)		Frog ringer + Nifedipine HR (beats/min) F.C (mm) (% of control value)	
Control	70±1.25	18±0.06	-	-	-	-
Adrenaline	111±5.*** ↑58.57	46.4± 8.1** ↑158	81.2 ±3.4*** ↑16	34.3 ± 5.8 ↑90.55		
Extract 0.5mg/ml	85.5±3.6*** ↑22.14	44.4± 8.3** ↑147	61.2± 3.2*** ↓12.57	32.2 ± 2.01 ↑78.88	30.6±2 .5*** ↓56.28	25 ± 6.25* ↑38.8
Extract 1.0mg/ml	87.6±2.6*** ↑25.14	46.4± 8.9** ↑158	66.3 ± 2*** ↓5.28	34.86 ± 3.09 ↑93.66	32.2±2.5*** ↓53.98	26.0 ±5.1* ↑44.4
Extract 1.5mg/ml	87.9±2.5*** ↑25.57	46.9± 8.2** ↑ 161	66.32 ± 2*** ↓5.25	35.21 ± 3.07 ↑95.61	32.3±3.6*** ↓53.82	25 ± 4.09* ↑38.8
Extract 2.0mg/ml	inhibited	inhibited				

Values are Mean ± SEM, ** p<0.05 *** p < 0.01 N = 6 in each group, ** p < 0.01

The extract in doses of 0.5, 1.0 and 1.5 mg/ml produced significant increase in heart rate and amplitude of contraction similar to that seen with adrenaline where extract at 2.0mg/ml produced cardiac arrest which was partially antagonised by Atropine. In presence of propranolol though there is significant decrease in heart rate by the extract, the decreased in the force of contraction was not statistically significant. Nifedipine produced significant decreased of heart rate and amplitude of contraction of the extract (table-1).

Table-2 Effect of BSE on Hypodynamic toad heart

Drugs/ extract	HR (beats/ min)	FC (Height in mm)
control	60±1.27	5±1.04
digitalis	53.5±2.47 ↓25.06%	12.08 ± 2.12* ↑140
BSE(0.5mg/ ml)	72.01 ± 0.27*** ↑20.01%	16± 1.02*** ↑220%
BSE(1.0 mg/ ml)	79.07± 0.28*** ↑31.78%	21±3.04*** ↑320%
BSE(1.5mg/ ml)	79.04± 0.32*** ↑31.73%	16± 3.1*** ↑220%

N=6 * p< 0.05 *** p< 0.001

The extract in doses of 0.5, 1.0, and 1.5 mg/ ml produced a significant increase in heart rate and force of contraction in hypodynamic heart. The increase in the force of contraction was comparable to that of digitalis (Table-2)

Table-3 Effect of BSE on isolated rectus abdominis

Drugs/extract	Mean Ht. of contraction(in cm) ±SEM No contraction		% Change
BSE alone 0.5,1.0,1.5 mg/ml			
Ach induced contraction	Before Ach	After Ach	
BSE 0.5mg/ml	2.02±0.27	3.06±0.04**	51.48%
BSE 1.0 mg/ml	2.02±0.28	3.09±0.06**	54.5%
BSE 1.5mg/ml	2.02±0.10	3.09±0.20**	54.5%
Neostigmine 1µg/ml	2.04±0.25	4.05±0.20**	↑100%
BSE+Neostigmine (1mg/ml + 1µg/ml)	2.06±0.26	4.00±0.12**	↑ 96.5%
BSE+ Pancuronium (1mg/ml + 10µg/ml)	20.0±0.26	0	↓100%

The extract alone had no effect on the rectus abdominis but potentiated Ach induced contraction by 50% approx. Neostigmine further enhanced stimulatory effect by 94%. This effect was comparable with the stimulatory effect of neostigmine on Ach induced contraction. Pancuronium inhibited the Contraction induced by the extract and acetycholine(table-3).

Statistical analysis

Student's t-test was used to evaluate the difference. A p value less than 0.05 was considered significant.

DISCUSSION

On toad heart

Banana skin extract produced significant stimulatory activity significantly blocked by nifedipine (suggesting calcium mediated action) and partially blocked by propranol (suggesting some β adrenergic action). Cardiac inhibition at high doses of extract was partially antagonized by atropine (suggesting cholinergic activity of the extract at higher doses)

On rectus abdominis muscle

The aqueous extract potentiates the acetylcholine induced contraction in a concentration dependent manner, addition of neostigmine further increased the potentiating effect of BSE by 96.5%, pre treatment with pancuronium inhibited the potentiating effect of BSE

Cardiac glycosides and catecholamines have been used as the main therapeutic drug in the treatment of congestive cardiac failure [6], however they have limited use due to their adverse effects.

The aqueous extract of banana skin elicited a powerful stimulatory effect. This effect was significantly blocked by nifedipine and partially by propranolol. Nifedipine is a voltage gated l-type calcium channel antagonist[7]. Since nifedipine blocks the stimulatory effect of BSE significantly, the extract might have produced its action by opening the voltage sensitive slow calcium channels.

Studies on isolated skeletal muscle preparation of toad reveals that the aqueous extract potentiates the acetylcholine induced contraction of the preparation which was futher potentiated by addition of neostigmine.

CONCLUSION

Aqueous extract of raw banana peel possesses a stimulatory property

like digitalis with less adverse effect and a skeletal muscle potentiation action like neostigmine. However further studies are required to establish the active principles involved therein and to see its effects on other animals.

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