CARDIOTONIC EFFECTS OF JUICE OF BULBS OF ALLIUM CEPA ON ISOLATED FROG'S HEART

Basudev Lenka¹, Manas Ranjan Pradhan², Manjushree Mohanty³, Subhradipta Bhattacharyya⁴

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ABSTRACT: The present study was undertaken to evaluate activity of juice of bulbs of Allium cepa on isolated frog's heart. Different parts of this species are used in India for a wide range of medicinal purposes. Effect of juice of bulbs of Allium cepa was studied by using isolated frog heart perfusion technique (IFHP). Cardiotonic activity was studied on both normal and hypodynamic hearts. The present preliminary studies confirm the better cardiotonic activity of juice of bulbs of Allium cepa as compared to digoxin. Further studies can confirm the reduced toxicity and this will be the advantage of juice of bulbs of Allium cepa over digitalis. Thus, in future it will be interesting to isolate the active chemical constituents which are responsible for the cardiotonic activity.

KEYWORDS: Cardiotonic, digoxin, Allium cepa, isolated frog's heart.

INTRODUCTION: Cardiovascular Diseases (CVD) are the common cause of deaths in many parts of the world. Although modern drugs are effective in preventing the disorders, their use is often limited because of their side effects and adverse reactions. A wide array of plants and its active principles, with minimal side effects, provide an alternate therapy for ischemic heart disease.¹ The cardiac glycosides (e.g. digoxin) used in CHF have narrow therapeutic index and cause many serious cardiac side effects. Despite of advanced knowledge regarding basic pharmacology of digitalis, still it produce serious cardiac effects.² Hence there is a need for a new drug research with wide therapeutic index and good cardiac activity.

The plant Allium cepa Linn(Liliaceae) has shown the antidiabetic,³ antioxidant,⁴ antihypertensive,⁵ antithrombotic,⁶ hypoglycemic,⁷ antihyperlipidemic effects.⁸ Bulb extract has shown to have ecobolic effect in rats.⁹

Onion bulbs contain a good number of phytochemicals, most of which are hydrocarbons and their derivatives. These include: Dipropyl disulphide (which is used as a flavor compound), Allicin (which has antidiabetic, antihypertensive, antibiotic and antithrombotic activities), diethyl sulphide (which is of insecticidal property), Dimethyl disulphide (which is used as a gas odorant and in chemical synthesis), Mercaptopropane or propylmercaptan (which is used as flavor compound).¹⁰

Due to above various activities shown by Allium cepa, the study was undertaken to access the cardiac activity of the juice of bulbs of Allium cepa.

MATERIALS AND METHOD:

Standard drug: Digoxin.

Test drug: Juice of bulbs of Allium cepa.

Physiological solutions: Ringer solution and Hypodynamic ringer solution.

Animal: Frog (*Rana tigrina*).

Instruments: Sherrington rotating drum, Sterling's heart lever.

ORIGINAL ARTICLE

Preparation of extract: Allium cepa bulbs were purchased from local market Bhubaneswar, Odisha, India. It was authenticated by botanist. The Allium cepa bulbs were peeled and outer layer of bulbs removed.

Then the bulbs were crushed by grinding to produce juice. The material was filtered through whatman filter paper no.40 and filtrate was collected. This undiluted filtrate was used throughout the experiment.

Preparation of Digoxin solution: The marketed digoxin ampoules (Sunpharma Ltd.) were obtained from local market. Dilutions was made with distilled water as 50 µg/ml. Above prepared samples were evaluated for their cardiotonic activity and treated as standard.

Preparation of Ringer solution and Hypodynamic Ringer solution: Ringer solution and Hypodynamic ringer solution was prepared by using standard method (Kulkarni S K, 1993).

Evaluation of Allium cepa juice after obtaining ethical clearance from the Institute Animal Ethics Committee, Kalinga Institute of Medical Sciences, KIIT University, Bhubaneswar – 24, the frog of species *Rana tigrina* was pithed and pinned to the frog board. A midline incision was given on the abdomen, the pectoral girdle was removed and the heart was exposed. The pericardium was carefully removed and few drops of frog ringer were poured over the heart.

The inferior vena cava was traced and a thread was put around it and a small cut was made to insert the venous cannula. The cannula was inserted in the vein and the thread was tied to assure that the cannula is in place which is in turn connected to a Marriott's bottle containing frog ringer solution. A small cut in one of the aorta was given for the ringer to come out. Heart was isolated and attached to the stand with moderate flow of ringer.

A thin pin hook was passed through the tip of the ventricle and with the help of a fine thread attached to the hook; it was tied to the free limb of the Sterling's heart lever which was fixed to a stand. A proper tension was adjusted by altering the height of the lever (Kulkarni SK, 1993, Kale SR, 2003). The experimental animals served as a self-control i.e. same heart used for both control as well as test. First the normal heart contraction was noted without exposing Allium cepa juice.

Thereafter the Allium cepa juice was administered through traube's tube attached to Marriott's bottle in a dose dependant manner i.e. 1drop to 16 drops. The rate and force of heart contraction were noted as given in the following figures and tables. The effect of Allium cepa juice was compared with that of digoxin solution containing 50µg/ml.

RESULT AND DISCUSSION: A pilot study was conducted on normal ringer solution perfused toads heart with graded doses of freshly prepared juice of bulbs of Allium cepa showed a cardio stimulant effect preceded by a brief period of cardiac arrest, which mimicked the action of digitalis. So the effect of juice of bulbs of Allium cepa was compared with digoxin solution in hypodynamic heart for comparison.

The juice of bulbs of Allium cepa may have a mechanism of action like digoxin and a brief cardiac arrest at a high dose which may be due to vagomimetic effect like digoxin. The force of cardiac contraction by the juice of bulbs of Allium cepa was more prominent than digoxin in our study.

ORIGINAL ARTICLE

Figure 1: Effect of juice of bulbs of Allium cepa on ringer solution perfused heart

Sl. No.	Drug	Dose (drops)	Change in rate	Change in force
1	Control	0	Normal	Normal
2	Allium cepa juice	2	Transient decrease	Mild increased
3	Allium cepa juice	4	Transient decrease	Mild increased
4	Allium cepa juice	6	Transient decrease	Mild increased
5	Allium cepa juice	8	Significantly decrease	Mild increased
6	Allium cepa juice	10	Significantly decrease	Moderate increased
7	Allium cepa juice	12	Brief arrest	Significantly increased
8	Allium cepa juice	14	Brief arrest	Significantly increased
9	Allium cepa juice	16	Cardiac arrest	Significantly increased

Table 1: Effect of juice of bulbs of Allium cepa on ringer solution perfused heart

Figure 2: Effect of juice of bulbs of Allium cepa on hypodynamic perfused heart

Sl. No.	Drug	Dose (drops)	Change in rate	Change in force
1	Control	0	Normal	Normal
2	Allium cepa juice	2	No effect	Mild increased
3	Allium cepa juice	4	No effect	Mild increased
4	Allium cepa juice	6	No effect	Mild increased
5	Allium cepa juice	8	No effect	Moderate increased
6	Allium cepa juice	10	No effect	Moderate increased
7	Allium cepa juice	12	Transient Cardiac arrest	Significantly increased
8	Allium cepa juice	14	Transient Cardiac arrest	Significantly increased

Table 2: Effect of juice of bulbs of Allium cepa on hypodynamic perfused heart

ORIGINAL ARTICLE

Figure 3: Effect of Digoxin on hypodynamic perfused heart

Sl. No.	Drug	Dose (drops)	Change in rate	Change in force
1	Control	0	Normal	Normal
2	Digoxin	1	No effect	No effect
3	Digoxin	2	No effect	No effect
4	Digoxin	4	Mild decrease	No effect
5	Digoxin	8	Mild decrease	No effect
6	Digoxin	.12	Mild decrease	Moderate increased
7	Digoxin	16	Mild decrease	Significantly increased

Table 3: Effect of Digoxin on hypodynamic perfused heart

CONCLUSION: The pilot study revealed cardiac stimulant effect of juice of bulbs of *Allium cepa* in normal frog ringer solution. The juice of bulbs of *Allium cepa* also seems to possess cardiac stimulant effect on hypodynamic frog heart. In high doses it produced transient cardiac arrest followed by cardiac stimulation which may be due to vagomimetic action like digitalis, when the action was compared with digoxin. Further study in this regard will establish the role of juice of bulbs of *Allium cepa*.

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AUTHORS:

1. Basudev Lenka
2. Manas Ranjan Pradhan
3. Manjushree Mohanty
4. Subhradipta Bhattacharyya

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Pharmacology, KIMS, Odisha.
2. Lecturer, Department of Pharmacology, KIMS, Odisha.
3. Professor, Department of Pharmacology, KIMS. Odisha.
4. Tutor, Department of Pharmacology, KIMS, Odisha.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Basudev Lenka,
Assistant Professor,
Department of Pharmacology,
Kalinga Institute of Medical Sciences,
BBSR-24, Odisha.
Email: blenka2012@yahoo.com

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