

# Comparison of Cardiac Effects of Avicennia Marina & Digoxin on Isolated Rabbit's Heart

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## ABSTRACT

**Objective:** To compare the cardiac effects of aqueous extract of Avicennia marina and digoxin on the isolated rabbit's heart by Langendorff method.

**Study Design:** Experimental interventional study.

**Place & Duration:** Experimental work was completed in five months duration at BMSI, JPMC, Karachi.

**Material & Methods:** An aqueous extract obtained from the leaves of traditional medicinal plant Avicennia marina (Mangrove plant) tested on isolated heart of Rabbit and its effect were compared with digoxin, using the langendorff heart preparation. Administration of extract and digoxin into the retrograde perfusion solution induced cardio-activity in vitro and their effect compared in presence of Atenolol and Verapamil.

**Results:** Aqueous extract of Mangrove plant leaves possessed positive inotropic and negative chronotropic effect in langendorff method of heart preparation. Similar effect is also produced by digoxin as mentioned in standard medical text books. Pre-treatment with Atenolol and Verapamil separately failed to modify the cardiac effect produce by aqueous extract of Avicennia marina and digoxin. Our observations showed similarity in responses of extract and digoxin. The effect produced by aqueous extract and digoxin in presence of Atenolol and Verapamil respectively have similarity in cardiac effect.

**Conclusion:** Mangrove plant extract showed increased in force of contraction and decreases in rate of isolated mammalian heart, as a similar effect produced by digoxin, and which shows the similarity in their action even in presence of Atenolol and Verapamil respectively.

**Key words:** Mangrove, Cardio-activity, digoxin, Atenolol, Verapamil, Langendorff.

## INTRODUCTION:

Avicennia marina, mangrove plant species belong to the family of Avicenniaceae<sup>1</sup>. The word mangrove means tropical trees or shrubs growing in shore mud with many tangled roots above the ground<sup>2</sup>. In Pakistan most abundant species of mangrove plant is Avicennia marina. The plants are the assets of human being<sup>3</sup>. In the history of men, different species of the plant are being used for the treatment / cure of different diseases. Origins of present medicines are primarily based

From plants sources, which later on analysis's and active ingredients are synthesized. In Eastern, Ayurvedic and indigenous medicines, still natural sources of drugs are used, which are mostly plants in origin. In the same way different parts of the Mangrove plants are also used indifferent parts of world for different indications as an indigenous medicine. Medicinally mangrove plants are used as astringent<sup>4</sup>, as anti-diarrheal<sup>5</sup>, as anti-malarial<sup>6</sup>, as anti-hemorrhagic<sup>7</sup>, anti-diabetic<sup>8</sup> anti-ulcer<sup>9</sup>, antiviral & anti antioxidant<sup>10</sup>, & anti-bacterial<sup>11</sup>. The literature review does not cited any pharmacological study of Avicennia marina plant on heart, therefore we decided to do work / study on this aspect.

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## MATERIAL AND METHODS:

### Plant material:

Leaves of plants were collected from mangrove area near netti jetty bridge, Keamari, Karachi. The leaves were dried at room temperature under the shade for ten days, then grind in to fine particles

using the vegetative grinder. Grinded leaves particles soak in distilled water for 48 hours and filtered. From filtrate water was evaporated by simple heating, the remaining residue was treated as aqueous extract<sup>12</sup>. Stock solution were made by taking the 20-gram of aqueous extract and by adding 20 ml of distilled water, to make dilution of 01 g/ml solution. Stock solution was refrigerated and its serial dilutions were used in this experimental study<sup>13</sup>.

#### **Isolated perfuse rabbit's heart:**

Experiment performed on isolated heart of healthy adult rabbits weighing 750 -1500 grams, kept under observation for a period of about 15-20 days prior to sacrifice. Preparation of isolated mammalian heart was based on langendorff methods<sup>14,15</sup>. Ringer lock solution<sup>16</sup> was used as a nutrient solution for retrograde perfusion to the isolated Rabbit's heart preparation.

#### **Parameters:**

In our experimental research work two parameters<sup>16</sup> were selected.

- \* Rate of isolated heart contraction as a rate of contraction.
- \* Amplitude of isolated heart contraction as a force of contraction. Drugs used and nutrition Solution:

Digoxin, Atenolol, Verapamil, Ringer lock nutritional solution and Aqueous extract of *Avicennia marina*, a mangrove plant.

#### **Recording:**

All data were recorded on grass polygraph model 7B, by means of force displacing transducer 7B, by means of force displacing transducer FT03C. Force displacement transducer was attached to the heart by means of heart clip and thread.

#### **Data Analyses:**

Data was analyzed by simple mean and difference in mean, before and after drugs / aqueous extract administration in nutrient solution by retrograde perfusion. Difference / change in mean expressed in percentage (%).

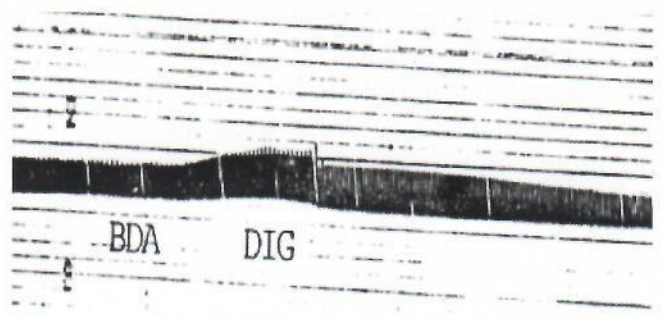
**Table:** Rate (per 10 seconds) & Amplitude (in mm) of Contraction of Isolated Rabbit's Heart. (N=80)

S.No.	Drug */ Extract *	Rate of contraction of Rabbit heart per 10 seconds				Amplitude of contraction in millimeters (mm)			
		B.D MEAN	A.D MEAN	Change in MEAN	% Change	B.D MEAN	A.D MEAN	Change in MEAN	% Change
01	Extract	15.16	14.25	- 0.91	6.002 Decrease	4.83	5.75	+ 0.92	19.047 Increase
02	Digoxin	12.91	12.08	- 0.83	6.429 Decrease	5.41	6.25	+0.84	15.526 Increase
03	Atenolol	16.50	15.60	- 0.90	5.454 Decrease	27.60	26.80	- 0.80	2.898 Decrease
04	Verapamil	14.00	13.20	- 0.80	5.714 Decrease	21.60	20.60	- 1.00	4.629 Decrease
05	Extract + Atenolol	16.10	13.70	- 2.40	14.906 Decrease	27.80	34.50	+ 6.70	24.100 Increase
06	Digoxin + Atenolol	19.18	17.88	- 1.30	6.777 Decrease	33.90	37.60	+3.70	10.914 Increase
07	Extract + Verapamil	14.10	13.50	- 0.60	4.255 Decrease	18.50	21.90	+ 3.40	18.378 Increase
08	Digoxin + Verapamil	16.90	15.70	- 1.20	7.100 Decrease	38.50	42.60	+4.10	10.649 Increase

B.D = Before drug A.D-After drug N-Number of observations , \*=Strength of 10<sup>9</sup> g/ml



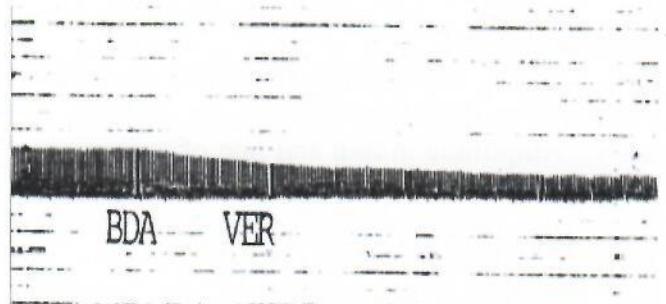
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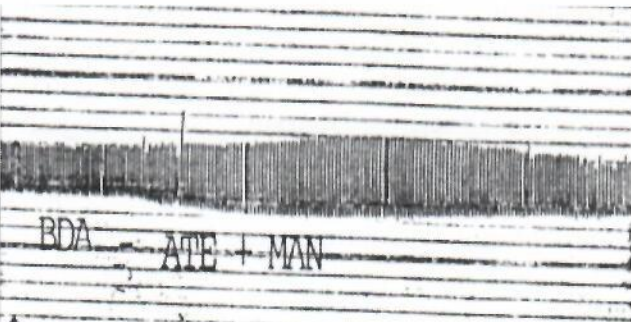
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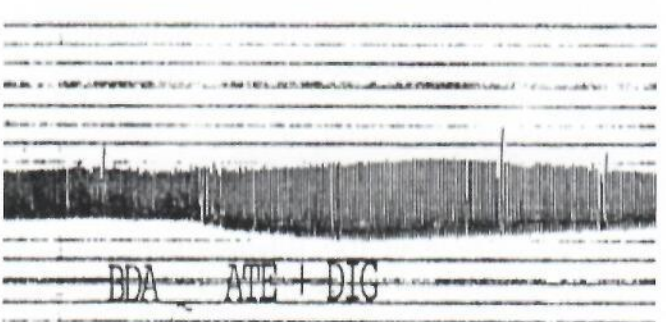
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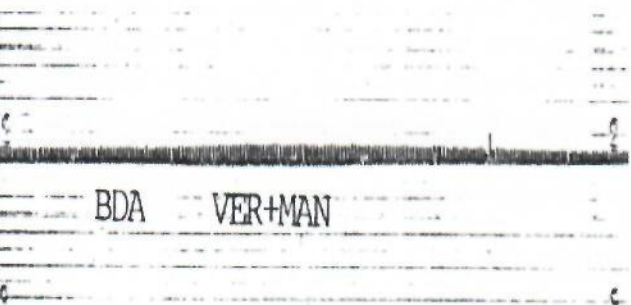
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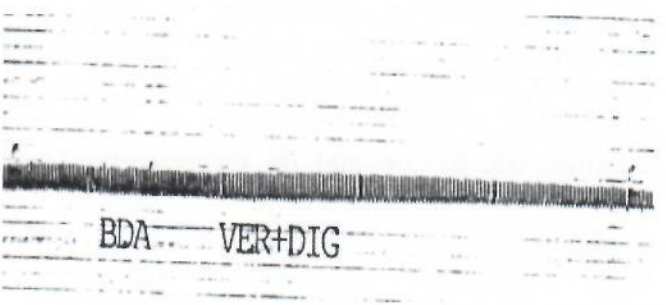
Tracing: 05



Tracing: 06



Tracing: 07



Tracing: 08

BDA=Before drug administration, MAN=Mangrove extract, DIG=Digoxin,  
ATE=Atenolol, VER=Verapamil

- \* Rate of isolated heart contraction as a rate of contraction.
- \* Amplitude of isolated heart contraction as a force of contraction. Drugs used and nutrition Solution:

Digoxin, Atenolol, Verapamil, Ringer lock nutritional solution and Aqueous extract of *Avicennia marina*, a mangrove plant.

#### **Recording:**

All data were recorded on grass polygraph model 7B, by means of force displacing transducer

#### **RESULT:**

Eight individual observations were recorded for drugs and extract as shown in table. Amplitude in mm and rate of contraction per 10 seconds were recorded. In dose Strength of 10-9 g/ml, aqueous extract of *Avicennia marina*, mangrove plant possessed negative chronotropic and positive inotropic effect on isolated langendorff rabbit's heart preparation, as shown in table No: 01 (tracing: 01). Whereas isolated perfuse rabbit heart showed a standard behavior against the standard known drugs like Digoxin, a cardiac glycoside, induced positive inotropic and negative chronotropic effect as shown in table No: 02 (tracing:02) Atenolol, a Beta blocker, a sympatholytic drug induced a negative inotropic and negative chronotropic effect as shown in table No: 03 (tracing: 03). Whereas Verapamil, a prototype calcium blocker drug, showed a negative inotropic and negative chronotropic effect as shown in table No: 04 (tracing: 04). When Mangrove extract plus Atenolol, Mangrove extract plus Verapamil, Digoxin plus Atenolol, and Digoxin plus Verapamil administered to isolated rabbit's heart preparation, it produces the effect as shown in tracings: 05, 07, 06 and 08 respectively. The effect of *Avicennia marina* was observed as positive inotropic and negative chronotropic even in presence of Atenolol and Verapamil (tracing: 05 and 07 respectively) as shown in table No: 05 and 07 respectively and also the effect of digoxin was observed as positive inotropic and negative chronotropic even in presence of Atenolol and Verapamil (tracing: 06

and 08 respectively) as shown in table No: 06 and 08 respectively. Furthermore it is observed from our data, that neither Atenolol nor Verapamil modify or alter the effect produced by aqueous extract of *Avicennia marina* and digoxin.

#### **DISCUSSION:**

As no any published data is available, on the effect of *Avicennia marina*, a mangrove plant on heart, so our observed data's comparison is not possible. In our work extract showed biphasic response, in inotropic action, that is in initial phase we observed increase in inotropic effect and in later phase it showed decrease in inotropic effect, which is common occurrences in langendorff heart preparation<sup>15</sup>. The cardiac effect on isolated rabbit heart was observed in our basic research worked. Mangrove extract showed positive inotropic and negative chronotropic effect. Digoxin, Atenolol<sup>17</sup> and Verapamil<sup>18</sup> showed standard effect. We observed that Atenolol and Verapamil did not modify cardiac effect produced by Mangrove extract and Digoxin, these results suggested that extract of plant does not act through the beta adrenoceptors or through the calcium channels. Digoxin has negative chronotropic and positive inotropic effect<sup>19,20</sup> and it does not act through the beta adrenoceptors or through the calcium channels but it acts on NaK ATPase pump. In our observations, mangrove extract showed the similar cardiac effects as digoxin have. The resemblance of effect of Mangrove extract and effect produced by Digoxin, indicates the presence of Cardio-active compound in Mangrove plant, which may be prove beneficial in the treatment of cardiac diseases such as congestive cardiac failure. Hence it can be hypothesize that mangrove extract contains the cardio-tonic compound.

#### **CONCLUSION:**

Aqueous extract of Mangrove leaves have positive inotropic & negative chronotropic effect on isolated rabbit's heart preparation & this effect is similar as Digoxin have effect on isolated rabbit's heart preparation by langeondroff method.

**SUGGESTION:**

Further isolation of active compound from mangrove plant and its pharmacological evaluation, can be beneficial in treating the cardiac problems especially congestive heart failure.

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