SYSTEMIC EFFECT OF *SARAPUNKHA* ON CARDIO VASCULAR SYSTEM: AN EXPERIMENTAL STUDY

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ABSTRACT:

Objective: Many herbal drugs are shifted from edge to main stream to use herbal remedies for the treatment of the disease with lesser side effects as compare to synthetic chemicals,in this chain *Tephrosia purpurea (Sarapunkha)* is one of the important drugs in *Ayurvedic* system of medicine. The present study was undertaken to find out the action of *Tephrosia purpurea(Sarapunkha)* on cardiovascular function. Administration of the preparations of *Tephrosiapurpurea (Sarapunkha)*in the clinical practice is done through oral route so that the active principles of the drug could reach the target organ like liver, kidney, spleen and heart. During the passage of the active principle, it is probable, that *Tephrosia purpurea (Sarapunkha)*ingredients might act on highly dynamic cardiovascular system.

Method: Albino rats were used in this study ,Urethane (1.3 mg./gm. body weight) was selected for anaesthesia. The ECG recordings were taken, before and after-intra gastric administration of drug (0.5 mg./gm. body weight).

Result: The study on Albino Rats shows that after feeding root powder decoction of *Tephrosia purpurea (Sarapunkha),* RR interval increased and thus heart rate was observed to decrease. Even though a decrease in force of contraction of the cardiac muscle under influence of *Tephrosia purpurea(Sarapunkha)* cannot be excluded.

Conclusion: The *Tephrosia purpurea (Sarapunkha)* decoction preparation does influence the activity of the autonomic nervous system with consequent alterations in the functions of the cardio vascular system.

Key words: Albino rats, ECG**,** Sharapunkha**,***Tephrosia purpurea*, Urethane.

INTRODUCTION:

Ayurveda is the first systematically written record of medicine of the world and incorporating all aspect of human life. The main aim of *Ayurveda* is being to provide guidelines for maintenance and promotion of health as well as prevention and then treatment of diseases. The Science of *Ayurveda* primarily involves the use of the products of plant origin. This may include roots, shoots, leaves, flowers and seeds, either individually or in combination or from plants of different species and genera in different proportions. [1]

This study evaluates the potential of a herbal plant *Tephrosia purpurea*, using a rat model. In present study Albino rats (Charles Foster strain) were used. An attempt was made to observe the influence of drug on cardiovascular system in the Albino rats. Root powder decoction of *Tephrosia purpurea* was fed by intra gastric route in known doses (0.5 mg/gm. body weight) [2].

Concept of cardiovascular system in Ayurveda: The word *Hridaya* consists of three verbs i.e. *Hri* which means to bring back forcibly (venous return) *Da* to donate (pumping function of the heart) *Ya* means to move or to circulate[3] . *Hridaya* has been said as root of *Rasavaha* channels [4,5] and store house of all the activities of body and mind and it nourishes all the tissues of the body by supplying *Rasa*(may be plasma and other intra cellular fluid) to them[6] .The description of cardiovascular system as a closed circuit is the specific contribution of *Bhela* which was actually re-invented by William Harvey in 17th Century [7] .As per *Bhela Samhita, Rasa* gets ejected out of the heart and moves all over the body, after that returns to the heart through the blood vessels called *Siras* which originate at heart [8].

MATERIALS AND METHODS:

20 healthy Albino rats of Charles Foster strain (weighing 160 gm. – 200 gm.), included for the study of cardiovascular system. In this study, Urethane was selected for anaesthesia [9] .Urethane (1.3 gm./kg.body weight) was dissolved in distilled water and required quantity was injected intra-peritoneal to the animals. It was found that all the animals were deeply anesthetized within 10 minutes [10]. The ECG recordings were taken, keeping the animal in supine position on a surgical board. It was observed that in the control conditions, heart rate stabilized to a fairly constant pace within 10 to 20 minutes of induction of anaesthesia. Therefore, up to 20 minutes period following anaesthesia was taken as the stabilization period.

ECG recordings were taken initially, then after 30 minutes, 60 minutes, respectively. Then same procedure was followed for ECG recording, after-intra gastric administration of drug i.e. at initial, after 30, 60, 90, 120, 150,180 minutes respectively [11].Proper circulation of fresh air, adequate light adjustment and room temperature was maintained.

Drug *(Tephrosia purpurea)*:

Tephrosia purpurea is a plant of Fabaceae family and Leguminoseae (Papilionateae) Sub-family, its Genus is *Tephrosia Pers* and Species is *Tephrosia purpurea (Linn) Pers.* [12] .It is commonly known in sanskrit as *'sharapunkha'* [13].The whole plant and various parts of the plant are useful *as Ayurvedic* medicines. Medicinal uses of drugs are tonic, laxative, diuretic and cures heart disease ,bronchitis, boils, pimples, splenic diseases, tumours, enlargement of liver and spleen[14].Two varieties are described in *Ayurvedic* texts *as rakta* (Red) *and sweta* (White)[15] . *Sharapukha* being the Linn. variant and second the Pers-variant. The white variety is botanically known as *Tephrosia villosa* and it is a rejuvenative. In India, dry plants collected as fuel. Seeds used as substitute for coffee. Used as insect repellent[16].Three new unusual flavonoids tephroglabrin, tepurindiol and O-methylpongamol isolated from roots along with seven known closely related flavonoids and structure of a new compounds determined[17].A new β-hydroxy chalcone-purpurnone is isolated from root and established its structure. Isolonchocarpin, pongamol, Lanceolatin A, Lanceolatin B, Karanjin, Kanjone and β-sitosterol isolated from roots [18] .

Method of Drug preparation and administration:

Tephrosia purpurea was collected in the months of August–October. Roots were separated from the rest of the plants and washed thoroughly and dried in shade for 7-10 days. After drying, fine grinding of root was done. For the preparation of decoction of drug, 6 gm. of root powder was taken and 100 ml. of water added to it in a beaker. The contents were heated on a slow flame. The procedure of heating and boiling the mixture was continued till solvent was reduced to ¼th of its original volume. The mixture was filtered through a sieve with pore size No.1/120. The total time taken in boiling the mixture was around 30-40 minutes [19] .

Dose schedule for Albino Rats:

Root powder decoction of *Tephrosia purpurea* was fed by intra-gastric route in known doses (0.5 mg. /gm. body weight), and concentration was made 50mg/ml.

Method of ECG recording in rats:

ECG recordings were taken before and after administration of *Tephrosia purpurea* root powder decoction on anesthetized rats. Electrodes were constructed by 24 gauge needle (Nickel, hypodermic needle) and inserted at appropriate limbs. The ECG recorded by the standard bi-polar leads and tracing speed adjusted on 50 mm./sec.

OBSERVATIONS AND RESULT:

ECG Recording in Rats:

PR Interval

PR interval increased after drug administration. Before drug administration, PR interval at different interval were 0.042±0.41, 0.045±0.006, 0.042±0.041, 0.045±0.006, 0.045±0.006 whereas after drug administration Mean±S.D. at initial 30, 60, 90, 120, 150, 180 minutes were 0.048±0.004, 0.048±0.004, 0.048±0.008, 0.050±0.006, 0.047±0.005, 0.047±0.005 respectively. On intergroup comparison of mean difference of PR interval at different intervals, it was not found statistically significant, but It was highly significant just after drug administration in duration between ($T_D - T_{30}$) ($t=3.35$, $p<0.05$),as shown in **Table No.01**

PR Segment

After the use of drug PR segment increased at different intervals but on intergroup comparison at different interval no significant change was observed.

QRS Duration

In QRS duration no variation was observed before and after drug administration.

QRS Amplitude

After intra-gastric administration of drug QRS Amplitude increased. On intra group comparison of mean of QRS difference from initial to different interval, it was found significant only at 150 minutes interval while in rest of comparison it was not significant, as shown in **Table No.02**

RR Interval

RR interval increased after drug administration. Before drug administration, Mean±S.D. of RR interval ranged between 0.14467±0.19 to 0.1567±0.0237 at different interval whereas after drug administration it was found at different intervals in range of 0.163±0.0477 to 0.180±0.0420. On intergroup comparison of mean of RR interval difference from before treatment initially to different interval it was found significant only, as shown in **Table No.03**

QT Interval

QT interval after the use of drug at different intervals was found increased and mean of QT interval ranged between 0.707±0.0052 to 0.0767±0.002 at different interval. On inter-group comparison, it was found highly significant only when compared with initial vs T_D (t=6.68,p<0.01), as shown in **Table No.04**

Heart Rate

After using drug overall decrease was observed in heart rate. Mean± S.D. of heart rate before drug administration ranged between 358±49.16 to 390.17±52.96 whereas after drug administration heart rate at different intervals was observed in between 330.16±58.28 to 353.83±76.93. On inter group comparison heart rate was found highly significant (Initial vs. T_D) (t=4.78, p<0.01) significant ($T_D$vs. T_{180}, t = 2.75 p<0.05), as shown in **Table No.05**

DISCUSSION :

Purushottam Kaushik *et al*. 1999 reported its internal use as a purifier of blood[20,21].*Tephrosia purpurea* induced significant increase in haemoglobin % and total RBC count. After irradiation there was no fall in RBC count and Hb% unlike in control group. This indicate that *Tephrosia purpurea* has a selective effect on erythroid compartment[22].The study on Albino Rats shows that feeding of *Tephrosia purpurea* does not produce any change in heart rate for the first 60 minutes following intake of decoction, however after about 70 minutes the heart rate was observed to decrease Even though a decrease in force of contraction of the heart muscle under influence of *Tephrosia purpurea* cannot be excluded. The effect of *Tephrosia purpurea* on cardio-vascular system seems to be localized to the cardiac activity while blood vessels may not be influenced significantly. *Tephrosia purpurea* induced significant increase in haemoglobin percent and total RBCs count.

The present study does not provide any clue and cannot differentiate the effect of the drug on sympathetic and parasympathetic components of the autonomic nervous system, however the present observations clearly suggest that *Tephrosia purpurea* decoction preparation does influence the activity of the autonomic nervous system with consequent alterations in the functions of the cardio vascular system. *Tephrosia purpurea* decoction influences cardiac activity, so as to cause reduction in heart rate. Further longitudinal and more extensive studies are needed with large sample size to explore exact mechanism of action.

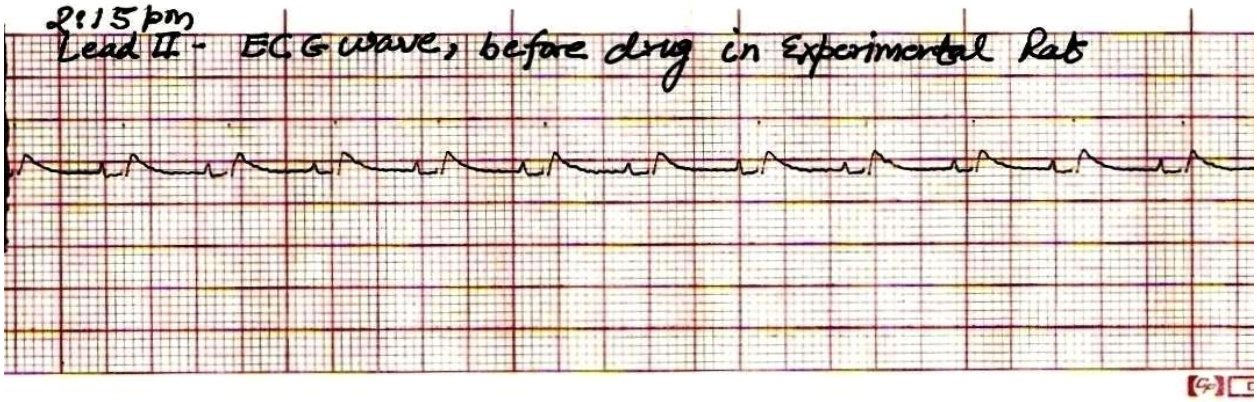

Fig. No.1:ECG Tracing before intra gastric drug administration of *Tephrosiapurpurea* root decoction in Albino Rat.

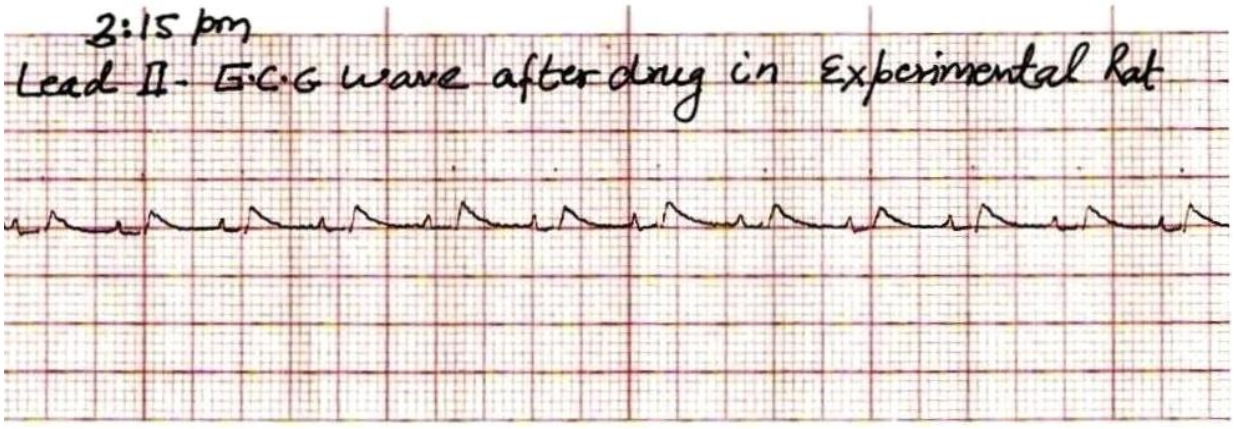

Fig. No.2:ECG Tracing after intra gastric drug administration of *Tephrosiapurpurea* root decoction in Albino Rat.

Table No.01: Effect of *Tephrosia purpurea* on PR Interval (Sec.) at different intervals in Albino Rats

Intervals	Initial - T_D	$T_D - T_{30}$	$T_D - T_{60}$	$T_D - T_{90}$	$T_D - T_{120}$	$T_D - T_{150}$	$T_D - T_{180}$
Intra group comparison	0.0067 ±0.0052	0.0 ±0.0	0.0 ±0.0	0.003 ±0.005	0.0017 ±0.004	0.0 ±0.0	0.0 ±0.0
Mean± S.D. of difference Paired t-test	t=3.35 p<0.05 S	t=0 NS	t=0 NS	t = 1.47 p>0.05 NS	t = 1.04 p>0.05 NS	t=0 NS	t=0 NS

Table No.02: Effect of *T. purpurea* on QRS Amplitude (mV.) at different intervals in Albino Rats

Intervals	Initial - T_D	$T_D - T_{30}$	$T_D - T_{60}$	$T_D - T_{90}$	$T_D - T_{120}$	$T_D - T_{150}$	$T_D - T_{180}$
Intra group comparison	0.0 ±0.0	0.008 ±0.002	0.025 ±0.042	0.033 ±0.041	0.033 ±0.041	0.058 ±0.050	0.05 ±0.055
Mean ± S.D. of difference Paired t-test	t = 0 NS	t = 0.98 p>0.05 NS	t = 1.46 p>0.05 NS	t = 1.97 p>0.05 NS	t = 1.97 p>0.05 NS	t = 2.84 p<0.05 S	t = 2.23 p>0.05 NS

Table No.03: Effect of *T. purpurea* on RR interval (sec.) at different intervals in Albino Rats

Intervals	Initial - T_D	$T_D - T_{30}$	$T_D - T_{60}$	$T_D - T_{90}$	$T_D - T_{120}$	$T_D - T_{150}$	$T_D - T_{180}$
Intra group comparison	0.027 ±0.022	0.003 ±0.0082	0.008 ±0.016	0.005 ±0.016	0.008 ±0.017	0.0017 ±0.017	0.0017 ±0.0013
Mean ± S.D. of difference Paired t-test	t = 3.01 p<0.05 S	t = 1.22 p>0.05 NS	t = 1.22 p>0.05 NS	t = 0.76 p>0.05 NS	t = 1.15 p>0.05 NS	t = 0.24 p>0.05 NS	t = 0.32 p>0.05 NS

Table No.04: Effect of *T. purpurea* on QT Interval (sec.) at different intervals in Albino Rats

Intervals	Initial - T_D	$T_D - T_{30}$	$T_D - T_{60}$	$T_D - T_{90}$	$T_D - T_{120}$	$T_D - T_{150}$	$T_D - T_{180}$
Intra group comparison	0.015 ±0.0055	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.003 ±0.0052	0.0 ±0.0	0.0017 ±0.0041
Mean ± S.D. of difference Paired t-test	t = 6.68 p<0.01 HS	t =0 NS	t =0 NS	t =0 NS	t = 1.41 p>0.05 NS	t =0 NS	t = 1.01 p>0.0 NS

Table No.05: Effect of *T. purpurea* on Heart rate (Per min.) at different intervals in Albino Rats

Intervals	Initial - T_D	$T_D - T_{30}$	$T_D - T_{60}$	$T_D - T_{90}$	$T_D - T_{120}$	$T_D - T_{150}$	$T_D - T_{180}$
Intra group comparison	46.17 ±23.67	3.83 ±28.17	11.83 ±37.60	23.67 ±29.17	23.33 ±24.50	19.17 ±26.22	23.33 ±20.74
Mean ± S.D. of difference **Paired t-test**	t = 4.78 p<0.01 HS	t = 0.33 p>0.05 NS	t = 0.77 p>0.05 NS	t = 1.99 p>0.05 NS	t = 2.33 p>0.05 NS	t = 1.79 p>0.05 NS	t = 2.75 p<0.05 S

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Conflict of interest: None Declared

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