Research Article

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Cardioprotective Potential of *Coriandrum Sativum*

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The aim of this study was to determine cardioprotective potential of fresh leaves of coriandrum sativum against salbutamol induced cardiac injury in rabbits. Salbutamol administered rabbits (50mg/kg) showed elevated levels of cardiac marker enzymes (CKMB, LDH, AST, ALT) and decreased level of antioxidant enzymes (SOD, CAT). Both pre- and post-treatment of plant extract (100mg/kg) for fifteen days showed a significant cardioprotective activity by lowering the levels of serum marker enzymes and peroxidase and elevated levels of antioxidant enzymes. These results showed cardioprotective ability of coriandrum sativum.

Key words: *Coriandrum sativum* (CS), Salbutamol, Antioxidants, Myocardial infaction

The medicinal plants are potential sources of drugs as they are rich in secondary metabolites and essential oils of therapeutic importance. Uses of medicinal plants in various ailments are due to being economical, effective, their ease availability and due to their safety. Because of these advantages the use of medicinal plants has been widely increased by the traditional medical practitioners in their day to day practice. (Prakash and Gupta, 2005)

Foods are used commonly to meet our nutritional needs. However, foods obtained by plants contain a wide range of non-nutrient phytochemicals that are synthesized by plants for their own defense and for other biological functions. When we ingest these plant foods to meet our nutritional needs, we also ingest a wide variety of these non-nutrient phytochemicals. These phytochemicals have the potential for preventing chronic diseases and also non-toxic. (Rao, 2003)

Cardiovascular disease is the number one cause of death globally and is projected to remain the leading cause of death.

As many as 1.4 million children are suffering from heart related diseases in Pakistan and some 8,000 need heart surgeries annually, but out of them only 1,200 are operated upon. (Sixth "Biennial International Conference," organized by the Pakistan Society of Cardiovascular and Thoracic Surgeries).

Free radicals play deleterious role to body established ischemia. Presence of various antioxidant compounds in fruits and vegetables, for example, vitamins C and E, b-carotene and polyphenolics have been associated with decreased risks of several chronic diseases, such as coronary heart disease and some cancers. (Nuutila *et al.,* 2003) Antioxidants scavenging the free radicals and protect the body. There is inverse relationship between intake of polyphenols and heart diseases.

Coriander: *Coriandrum sativum* is an annual herb in the family Apiaceae. Coriander has been used for the relief of anxiety and insomnia in Iranian folk medicine. Experiments in mice support its use as an anxiolytic. (Emamghoreishi, et *al*., 2005).

Coriander as a natural antioxidant increases the antioxidant contents in foods and thus inhibit unwanted oxidation processes (Wangensteen *et al*., 2004).

Being as source of natural antioxidant, it can play a major role to reduce heart diseases. The aim of this research work is to investigate the cardioprotective effect of fresh leaves of *coriander sativum* in rabbits against *salbutamol* induced cardiac injury.

MATERIALS AND METHODS

Plant material: *Coriandrum sativum*

Extract preparation: 150gm of growing parts of fresh leaves of *coriandrum sativum* was weighted. Then grinded leaves were

macerated in solvent Methanol. Filtered, after this solvent was evaporated. Then, this extract was used for treatment.

Materials and Chemicals
Salbutamol, Methanol, plant dose, syringes, cotton, centrifuge tubes, ephendroff tubes, kits of CK-MB, LDH, GOT and GPT.

Experimental Animals
Eighteen rabbits weighing about 1Kg will be used as experimental animals. Animals were divided into 6 groups. Animals were kept under standard condition of food, water and light.

G1: Control group
Normal diet provide to the control group.

G2: Salbutamol Damage group
In damage group Salbutamol 50mg/kg was given for two days. Then blood sample was collected for 4-5 days.

G3: Inderoll Group
After 48 hrs. of *Salbutamol* induction, *Inderoll* drug was given for 4-5 days to compare with plant cardioprotective effect.

G3: Coriander preventive group
In this group plant extract (100mg/kg) were given to the rabbits once a day at fixed time by oral gavages, for three weeks. At the end of experiment period rabbits were administrated with salbutamol (50mg/kg) to induce myocardial injury for two consecutive days. After 48 hours blood samples was taken to illustrate preventive effect of *coriandrum sativum.*

G4: Coriander curative group
Salbutamol was induced for two days. Then the plant extract (100mg/kg) was given for five days after 24 hours. Blood samples were taken daily to check curative effect. After experiment rabbits were sacrificed.

G6: Base line group
Plant material (100mg/kg) was given to rabbits for three weeks. At the end of experimental procedure blood samples were collected.

Collection of blood samples
Blood sample were collected from neck vein overnight fasted rabbits before starting experiments. The blood sample were collected in centrifuged glass tubes, centrifuge it and serum was separated and stored in deep freezer for further biochemical measurements.

Biochemical Assay
The activity of cardiac enzymes like tropanin, CKMB, LDH, AST, ALT in serum were determined by kit methods by using Bioanalyzer.

Tissue homogenate preparation:
Hearts were mixed and homogenized in 0.05M ice cold phosphate buffer (pH. 7.4). Homogenate was mixed, centrifuged and supernant was collected and further used for performing of antioxidant enzyme (peroxidase, catalase and superoxide dismutase) assay.

Quantitative estimation of Peroxidase
Peroxidase (POD) was measured using the method of Paglia and Valentine, (1967).

Quantitative estimation of Catalase
Catalase level in the samples was estimated by the method as described by Aebi 1974.

Superoxide Dismutase (SOD) activity
SOD activity was assayed by using the photochemical NBT method as described by Kakkar *et al*., (1984).

Statistical analysis
All values are expressed as mean ±S.D. The analysis of variance (ANOVA) was applied to test for significance of biochemical data of the different groups.

RESULTS

This study was divided into two parts. One is post treatment of plant extract after salbutamol induced cardiac injury, which confirmed the curative effect of plant extract. Second includes pretreatment of plant extract to evaluate the preventive effect of plant.

Biochemical Assay

Coriander curative effect: After the induction of salbutamol for two consecutive days, plant extract was given for five days after twenty four hours. Blood samples were taken daily to perform biochemical assay.

CK-MB: CK-MB level was significantly ($p<0.05$) increased in salbutamol damage group (203±2.000) as compared to control group (123±4.339). A significant ($p<0.05$) fall in CK-MB level was observed in *coriander* curative group after 5 days plant

dosing (161.667±3.055) when compared to Salbutamol damage group (186±3.606). However, Inderoll (a synthetic drug used for curing myocardial infarction) showed maximum decreasing effect on CK-MB (132.667±3.055) as compared to plant effect (186±3.606). The base line group showed normal level of CK-MB (125.333±4.726). (Table.1)

LDH: Orally administrated rabbits with salbutamol (damage group) showed a significant ($p<0.05$) increase in LDH level (537±7.000) as compared to control group (304±7.810) which indicates myocardial infarction in rabbits. Coriander curative group when compared to Inderoll (312.667±9.292) and salbutamol damage group (498.333±1.528) showed LDH level (453.333±7.059) near to salbutamol damage group which indicated that *coriandrum sativum* has no powerful effect to reduce LDH level. The normal LDH level in base line group indicates that *coriandrum sativum* has no harmful effect in rabbits (table 2).

AST: A significant ($p<0.05$) elevation was observed in AST level of salbutamol damage group (45±2.000) when compared to control group (17±1.732). Oral supplementation of *coriandrum sativum* (for 4-5 days) showed a significant ($p<0.05$) decrease in the level of AST (25±1.000) when compared to *inderoll* (18±1.000) and salbutamol damage group (32±2.646). The base line group showed AST level in normal range (Table: 3).

ALT: Group 2 (salbutamol damage group) showed significant increase ($p<0.05$) in serum ALT level (44.667**±**4.163) as compared to control group (19**±**1.732). Group 4 (curative group) showed a significant ($p<0.05$) decrease in serum ALT level (28**±**1.000) when compared to *inderoll* group and salbutamol damage group (21**±** 1.000), (31**±**1.000) respectively. The base line group showed normal level of ALT (Table: 4)

Coriander preventive effect: After fifteen days of oral administration of plant dose, salbutamol was given for two consecutive days to induce myocardial infarction in rabbits. Then blood samples were taken and biochemical assay was performed to illustrate the cardioprotective preventive effect of *coriandrum sativum*.

Pretreatment of plant showed a significant decrease in CK-MB (157.33±3.51), AST (31±+-2.000) and ALT (26±3.61) when compared to *salbutamol* induced serum level of CK-MB (203±2.000), AST (45±2.000) and ALT (44.667±4.163) respectively. Pretreatment of plant, however, do not decreased the level of LDH (524±7.810) when compared to *salbutamol* damage group (537±7.000) (table: 5).

Antioxidant Enzyme Assay

Catalase: Group-2*:* Sabutamol induced rabbits showed a significant ($p<0.05$) decrease in catalase level (0.332 unit/mg of protein) as compared to control rabbits (0.428unit/mg of protein). Both pre- and post-treatment of *coriandrum sativum* showed a significant ($p<0.05$) decrease in catalase level (0.271 unit/mg protein) and (0.277unit/mg of protein) when compared to inderoll group (0.338unit/mg of protein) and damage group (0.332unit/mg protein). Group 6.rabbits (base line group) showed catalase level (0.450unit/mg of protein) near to control group (0.428unit/mg of protein) (table 6).

Peroxidase: Induction of salbutamol for two days significantly ($p<0.05$) increased the POD level (0.080 unit/mg of protein) as compared to control group (0.0041 units /mg protein). Both pre- and post-treatment of *coriandrum sativum* showed a significantly ($p<0.05$) decrease in the pereoxidase level (0.0650unit/mg protein), (0.0523 unit/mg of protein) when compared to group 2. rabbits (0.080unit/mg of protein). Group 6.(base line group) showed POD level (0.0047unit/mg of protein) close to control group (0.0040unit/mg protein) (table : 7).

Superoxide Dismutase (SOD): Group - 2 sabutamol induced rabbits showed significantly ($p<0.05$) lower % inhibition (after fifteen min.) (19%) as compared to control group (50%). Pretreatment of plant showed significantly ($p<0.05$) higher (42%) when compared to inderoll group (53%) and damage group (19%). Post-treatment of plant showed 14% inhibition close to group 2. rabbits (19%). Group 6. rabbits showed significantly ($p<0.05$) higher inhibition (27%) as compared to group 2. rabbits (19%) (Table: 8)

Gross pathology: Pathological examination of myocardial infarction under the microscope, presents as a circumscribed

Table 1: Curative cardioprotective effect of *coriandrum sativum* on CKMB (IU/L) level of different groups

Days	Control Group	Salbutamol Group	Inderoll Group	Curtive Group	Base line Group
1	123±4.339	203±2.000	207.333-±6.658	211±2.000	125.333±4.726
2	122.667±2.082	200.333±1.528	199±9.539	204.667±3.786	127±3.606
3	122.667±2.309	193.667±5.508	185.667±4.163	194.333±3.055	129±1.000
4	123±2.646	189.667±4.401	167±4.000	179±1.000	130±3.606
5	122.667±3.706	186±3.606	132.667±3.055	161.667±3.055	130±2.646

Table 2: Curative cardioprotective effect of *coriandrum sativum* on LDH (IU/L) level of different experimental groups

Days	Control Group	Salbutamol Group	Inderoll Group	Curtive Group	Base line Group
1	304±7.810	537±7.000	524±7.810	540±9.539	304±12.490
2	302.667±3.055	534±11.000	498.333±8.505	533±9.539	306±6.000
3	303.333±8.622	520±9.849	431±1.000	503.667±1.528	307.667±8.622
4	301±11.000	514±17.059	377.667±1.520	476.667±4.933	304±1.000
5	301.667±6.506	498.333+-1.528	312.667+-9.292	453.333+-7.059	304+-7.810

Table 3: Curative cardioprotective effect of *coriandrum sativum* on AST(IU/L) level of different experimental groups

Days	Control Group	Salbutamol Group	Inderoll Group	Curtive Group	Base line Group
1	17±1.732	45±2.000	45±4.583	48±1.000	19±1.732
2	17.333±1.155	43.667±3.512	41±1.000	45±3.000	20±1.732
3	16.333±1.528	41±1.000	36.667±3.512	40±2.000	21±1.000
4	17±1.000	37±1.000	26±2.000	31.333±1.528	20.333±1.528
5	17±1.000	32±2.646	18±1.000	25±1.000	19.333±1.528

Table 4: Curative cardioprotective effect of *coriandrum sativum* on ALT(IU/L) level of different experimental groups

Days	Control Group	Salbutamol Group	Inderoll Group	Curtive Group	Base line Group
1	19±1.732	44.667±4.163	45±4.583	46.333±1.528	19±1.000
2	18±2.000	42+-±3.606	39.667±3.512	44.333±3.786	20±1.000
3	19.667±1.528	38.667+-±2.517	35.333±4.726	41.667±2.517	20.333±0.577
4	19±1.000	35+_2.000	28±1.000	31.333±1.528	20±1.732
5	19±1.000	31+_±1.000	21±1.000	28+-±1.000	20±1.000

Table 5: Preventive cardioprotective effect of *coriandrum sativum* on different experimental groups

Enzymes (IU/L)	Control group	Salbutamol group	Inderoll group	Preventive group	Base line group
CKMB	123±4.339	203±2.000	207.333±6.658	157.33±3.51	125.333±4.726
LDH	304±7.810	537±7.000	524±7.810	502.67±3.79	304±12.490
AST	17±1.732	45±2.000	45±4.583	31±2.000	19±1.732
ALT	19±1.732	44.667±4.163	45±4.583	26±3.61	19±1.000

Table 6: Catalase level (units/mg of protein) of different experimental groups

Time/ min	Control group	Salbutamol damage group	Inderoll group	Curative group	Preventive group	Base line group
3	0.428	0.332	0.338	0.271	0.277	0.450

Table 7: Peroxidase level (units/mg of protein) of different groups

Time/ min	Control group	Salbutamol damage group	Inderoll group	Curative group	Preventive group	Base line group
3	0.0041	0.080	0.0730	0.0650	0.0523	0.0047

Table 8: % inhibition of NBT caused by superoxide dismutase

Control group	Salbutamol damage group	Inderoll group	Curative group	Preventive group	Base line group
50%	19%	53%	14%	42%	27%

Table 9: Gross pathology of different experimental groups.

Organelles	Control group	Damage group	Inderoll group	Curative group	Preventive group	Base line group
Heart	Normal	Hard (damage)	Normal	Normal	Normal	Normal
Liver	Normal	Normal	Pale yellow	Pale yellow	Normal but discolored	Normal but discolored
Stomach	Damage	Damage	Damage	Damage	Damage	Damage
Lungs	Pale red	Normal but pale yellow	Normal	Normal	Congested	Normal
Kidney	Normal	Normal	Normal	Normal	Normal	Normal

area of ischemic, coagulative necrosis (cell death). Gross pathology was studied by a veterinary doctor immediately after sacrificing the animals.

Orally administrated rabbits with salbutamol showed damaged (hard) heart when compared to control group. Inderoll, *coriander* curative and preventive groups all showed normal (soft) heart. The base line group also showed normal heart. Stomach in all groups has been damaged. Other organelles showed normal condition. (Table 9)

DISCUSSION

The above results indicated that increased levels of CKMB, LDH, AST and ALT in salbutamol damage group showed myocardial infarction in rabbits. This is correlated with the study of Prabhu *et al.,* that isoproterenol (ISPH) induced myocardial infarction was confirmed by disturbances in serum and heart tissue marker enzymes such as lactate dehydrogenase (LDH), creatine phospho kinase (CPK), aspartate transaminase (AST) and alanine transaminase (ALT). Myocardial infarction again confirmed by the studies of Nandave *et al*., that LDH and CK-MB are cystolic enzymes and are sensitive markers of ischemia myocyte injury. Depletion in myocardial LDH and CK-MB isoenzymes levels during myocardial necrosis indicates altered membrane permeability and leakage of these enzymes into blood stream. The oral supplementation of plant (for fifteen days) with both pre- and post-treatment caused significant ($p<0.05$) decrease in the cardiac marker enzymes (CK-MB, AST, ALT) except LDH which showed its cardioprotection ability and this is in line with the previous studies of Panda and Naik (2008) that Ginkgo biloba Phytosomes (GBP) elicited a significant cardioprotective activity by lowering the levels of serum marker enzymes (AST, LDH and CPK).

A significant decrease in endogenous antioxidant enzymes (Catalase, Superoxide dismutase) and increase in Peroxidase level were observed after oral administration of *salbutamol* for consecutively two days which again showed myocardial infarction in rabbits. Reduction in the activities of these antiperoxidative enzymes during myocardial injury may be due to the increased generation of reactive oxygen radicals, such as superoxide and hydrogen peroxide, which in turn leads to the inhibition of activities of these enzymes (Karthikeyan *et al*., 2007). Cs significantly ($p<0.05$) increased the endogenous antioxidants by increasing SOD level (only with pre-treatment) and decreased the peroxidase level (with pre- and to a lesser extent with post-treatment).

So these results indicated that *coriandrum sativum* has a potential to reduce risk of heart diseases by lowering the elevated level of cardiac marker enzymes and by increasing the endogenous antioxidants like superoxide dismutase. However, depletion in catalase level and still elevated level of LDH after oral gavages of *coriandrum sativum* was not clearly understood. The cardioprotective ability of cs again confirmed by gross pathological studies. The damaged heart condition in *salbutamol* damage group indicates that induction of salbutamol caused myocardial infarction in rabbits. The normal heart condition in all other groups (inderoll, curative, preventive) indicates that these treatments reduce MI in rabbits. The normal base line changes indicate that *coriandrum sativum* has no harmful effect in rabbits. Stomach in all treatment groups has been damaged which might be due to the induction of *salbutamol* but not confirmed. All other organelles approximately showed normal condition.

The cardioprotective ability might be attributed due to the presence of antioxidant compounds present in *coriandrum sativum*. Previous studies also revealed that

augmentation of endogenous antioxidant compounds by therapeutic substances has recently gained a great deal of scientific interest because any such property of a therapeutic agent can be expected to cause significant improvement in the endogenous defense against oxidative stress. *Coriandrum sativum* contain β-carotene component (represented 61.14% of the carotenoids) a principal component in coriander antioxidant action (Guerra *et al*., 2005) which may be responsible for its cardioprotective activity. Since, it was concluded that *Coriandrum sativum* leaves extract after purification and suitable extraction method can become an agent for reducing heart diseases.

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