RESEARCH COMMUNICATIONS


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Cardioprotective effects of Cichorium intybus in ageing myocardium of albino rats

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The cardioprotective effects of the aqueous extracts of the leaves of Cichorium intybus (CE) have been examined in the ageing myocardium of albino rats. Shade-dried powdered leaves of C. intybus were fed to the ageing animals for 30 days. The effects of CE on malondialdehyde level (peroxidative damage-index) on taurine, glutathione and catalase activity of the heart have been studied. Ageing caused peroxidative damage, increase in taurine and glutathione levels in the heart. Catalase activity decreased in the ageing myocardium. CE was found to ameliorate the age-induced injury and offered protection to the heart from oxidative damage, suggestive of ageing.

A number of herbal drugs and plant extracts have been effective in various cardiac disorders and ageing. Allium sativum, Emblica officinalis, Ocimum sanctum and Arjuna terminalia have been examined earlier for their cardioprotective action.

However, experimental evidence on the beneficial role of Cichorium intybus (family Compositae) in age-related myocardial damage is lacking. Keeping this in view, we examined the cardioprotective effects of Cichorium leaves extract in ageing heart.

Twenty-four-month-old male albino rats of Wistar strain (300 ± 5 g) were selected. They were divided into two groups of seven each—Group 1 (Control): These animals were allowed free access to pellet diet and water ad libitum; Group 2: C. intybus leaves were shade-dried, powdered, suspended in water and administered (500 mg) twice daily orally to these ageing rats for 30 days along with rat feed and water ad libitum.

Albino rats (3 months and 6 months old) maintained under identical control conditions in the animal house were also used to study the effect of ageing on the biochemical parameters.

The rats were sacrificed by spinal dislocation after overnight starvation. The control, aged and Cichorium extract-treated animals were used simultaneously. They were dissected quickly and the heart was removed. Auricles and ventricles were excised using sterilized bent forceps and scalpel and kept in cavity glass in mammalian Ringer at 0°C. The tissue was weighed quickly in an electrical balance and used immediately. Catalase (E.C.1.11.1.6), Levels of malondialdehyde (MDA), taurine and glutathione were determined. Statistical analysis was done using the Student’s t test.

The ageing rats exhibited increased taurine, glutathione and MDA levels. The catalase activity of ageing heart was significantly low compared to 3 and 6-month-old rats (Tables 1 and 2). Administration of C. intybus extracts brought down the oxidative stress, substantially decreased taurine, glutathione and MDA levels in the ageing myocardium (Table 2). An activation of catalase activity was observed due to the protective action of the extract from Cichorium leaves. Figure 1 shows the remarkable increase of $V_{\text{max}}$ of enzyme catalase in the myocardium of auricles and ventricles on feeding the ageing rats (controls) with C. intybus leaves.

<table>
<thead>
<tr>
<th>Table 1. Taurine and glutathione levels (mg/g) in the myocardium</th>
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<tbody>
<tr>
<td>Controls</td>
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<tr>
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<tr>
<td>3 months</td>
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<td>6 months</td>
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<td>24 months</td>
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<tr>
<td>Experimental</td>
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<tr>
<td>CE-treated</td>
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<td>24 months</td>
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*P < 0.001 (between 24 months ageing controls and Cichorium intybus treated.)

1P < 0.01 between 6-month-old and 24-month-old rats.
Table 2. Malondialdehyde level and catalase activity in the myocardium

<table>
<thead>
<tr>
<th>Malondialdehyde (mM MDA/g)</th>
<th>Catalase activity (units/g/min)</th>
<th>Energy of activation (EaC) (kcal/deg/mol of substrate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Auricle</td>
<td>Ventricle</td>
</tr>
<tr>
<td>Controls 3 months</td>
<td>11.7 ± 0.3</td>
<td>11.0 ± 0.4</td>
</tr>
<tr>
<td>6 months</td>
<td>11.8 ± 0.5</td>
<td>11.0 ± 0.5</td>
</tr>
<tr>
<td>24 months</td>
<td>2.10 ± 0.5</td>
<td>21.0 ± 1.0</td>
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<tr>
<td>Chichorum leaf extract</td>
<td>11.0 ± 0.6</td>
<td>12.0 ± 0.3</td>
</tr>
<tr>
<td>treated 24-month-old rats</td>
<td></td>
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</tbody>
</table>

*P < 0.001, **P < 0.05, "Not significant (Values are mean of six observations ± SD).*

*P = Between 24 months ageing and chicory-treated.

Ageing has caused an increase in the levels of taurine in the myocardium (Table 1). Earlier studies have implicated taurine in a wide variety of cardiac phenomena. It has been shown to exert a positive inotropic effect in heart. Chubb and Huxtable have observed that the diseased/stressed condition of the myocardium is associated with the increased taurine concentration in the heart, which is due to increased influx of taurine in the myocardium during the stress. Taurine also increases the intracellular calcium level in the normal hearts. Thus, during ageing calcium homeostasis gets impaired by elevated levels of taurine and this causes cellular injury. The administration of aqueous extract of "Chichorum" leaves as seen in the present study has protected the ageing myocardium by decreasing the taurine level (16 and 31% in the myocardium of auricles and ventricles respectively, Table 1) and this may be due to decrease in the influx of taurine and may result in the decreased uptake of calcium by the myocardium, thereby preventing the myocardial cells to be overloaded with calcium.

The results thus explain the cardioprotective effects of "Chichorum" leaf extract have on the myocardium. Oral administration of the extract has prevented the activation of lipid peroxidation system (~47 and ~42% in the auricles and ventricles) and stimulated the catalase activity (Table 2). Feeding with "Chichorum" also decreased significantly the activation energy (EaC) and K_in (Figure 1), indicating the enhanced potential of catalase in chicory-fed aged rats. The catalase activity showed an increase of 77 and 124% respectively in the myocardium of auricles and ventricles on feeding with "Chichorum".

The results thus show that administration of "Chichorum" leaf extract has brought about protective changes in the ageing myocardium (Table 2). Ageing is known to result in the activation of lipid peroxidation and decreased activity of enzyme catalase which is a constituent enzyme of the antioxidant system of the body. Table 2 shows that catalase activity has decreased remarkably in the myocardium of ageing rats. From the kinetic parameters of the peroxidative enzyme catalase, it is clear that ageing has brought about an inefficiency of this antioxidant enzyme in the myocardium, which is indicated by the
remarkable increase shown in the energy of activation
due to ageing (Table 2).

These alterations found in the kinetic parameters (Figure 1) therefore point out to enhanced catalytic potential
of enzyme catalase of the myocardium on feeding with
Cichorium. Cichorium leaves when fed for 30 days have
rendered the catalase enzyme of the heart biologically
more efficient to suppress peroxidative damage.

To sum up, administration of C. intybus leaves has
caused an activation of enzyme catalase and lowering of
lipid peroxidation. It caused a substantial decrease in
taurine and glutathione levels. The activation of myocar
dial catalase as indicated by decreased energy of activa
tion and $K_m$ by the extract of the leaves of Cichorium is
suggestive of increased activation of antioxidant system

offering protection to the heart from oxidative damage,
suggestive of ageing.

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Pramod Sadasheo Moharir (1943–2003)

Prof. Pramod Sadasheo Moharir, a widely respected researcher, teacher and philoso
pher, breathed his last on 14 January 2003 after brain haemorrhage. Born in
Nagpur on 21 April 1943, Moharir had his early education in Nagpur. He obtained
M Tech from IIT Bombay (now Mumbai) in 1966 and Ph D from IIT Kanpur in
1971. He worked as a lecturer at BITS, Pilani during 1971–72 and then moved to
Roorkee for a short duration in 1972. Subsequently, he was a lecturer at IISc,
Bangalore during 1972–76, Assistant Professor at IIT, Bombay during 1976–77,
and then Reader and Professor at University of Roorkee (now IIT Roorkee) during
1977–89. He joined National Geophysical Research Institute, Hyderabad in 1989
as a visiting scientist and, since May 1992, served the institute as a senior scientist.

Moharir made significant contributions in seismological signal processing, model
ling of earthquake sequences, mathematical analysis and modelling of various
geophysical problems. His initial work was on the problem of redundancy reduc
tion and bandwidth compression of sampled pictures. He developed many new
techniques to obtain linear orthonormal transforms useful for signal processing,
secrecy coding and pattern recognition. His extensive work on signal processing
was applied in geophysical signal processing. He covered a range of transforms,
developed recursive relationships for linear systems and extended these notions
to define efficient nonlinear transforms.

Moharir’s immense interest in pulse
compression sequences for system iden
tification resulted in the development of
Barker sequences of lengths above 13
and ternary sequences with Barker spe
cifications. Besides, he extended the
notion of correlative processing for pulse
compression to monogenic signatures.
He modified the predictive deconvolution

technique to develop a superior recursive
deconvolution technique and generalized
the notion of minimum entropy decono
volution to Occam deconvolution strate
gies. His contributions to the field of
pattern recognition and its application to
seismic discrimination are invaluable.

His contributions in the field of earth
quake mechanics, geophysical inversion
and numerical techniques are numerous.
He developed new statistical models for
earthquake sequences and proposed modi
fied finite difference techniques based on
approximation–theoretic and operator–
algebraic notions. His critical analysis of
the non-uniqueness in geophysical inver
sion provides insight into various types of
non-uniquenesses in geophysical interpre
tation. For his significant contributions, he
was awarded S.S. Bhatnagar prize in 1987.

Moharir was a voracious reader and a
great orator. He could speak on any topic
with authority and philosophical touch.
He never shied away from expressing his
bold views on scientific pursuits as well
as on any general theme. On the personal
front, he was a very affectionate, encour
aging, and caring person to his friends.
Among many instances of his affection
ate gestures, I would like to mention here
his letter of 12 July 2001, where he appreci
ated my efforts in setting a new trad
tion and treading a new path of giving
equal financial weightage to contributors
of my edited volume on fractals and
counted me as one among his friends.
In his death the country has lost a great
philosopher, teacher, and researcher whose
innovative ideas and critical appraisals
always infused enthusiasm in colleagues
and students. His sad, untimely demise is
an irreparable loss to all those people for
whom he was a great source of inspiration.

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PERSONAL NEWS