BACOPA MONNIERA IMPROVES THE PROTEINS OF LYSOSOMAL AND NON-LYSOSOMAL FRACTIONS OF PROSTATE GLAND REDUCED IN AGED MICE

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Abstract: Aging is an unavoidable process in every living organism in which slow and gradual deterioration of tissues takes place. Free radicals are the major causative agents of aging. Prostate gland is the most affected organ during the process of aging. Various proteins produced by prostate are the markers and can be used to diagnose the prostatic disorders. They are reduced during aging and in pathological disorders of prostate. Disturbance in oxidant-antioxidant balance may be one of the causes of reduction in protein level. Many plants contain antioxidants which can be used to compensate the reduced level of antioxidants in aging. Bacopa monniera is antioxidant rich, antiaging herb. Hence present work is undertaken to investigate whether Bacopa leaf extract can maintain normal level of proteins in prostate and protect it from pathological abnormality. In the present work biochemical study of proteins was carried out in prostate of aging mice and in Bacopa treated mice. It was found that Bacopa can maintain proteins at almost normal level.

Key words: Bacopa monniera, Prostate gland

INTRODUCTION

Proteins not only form structural components of prostate but also contribute in the functional role by forming major part of prostatic secretion. Chen et al. [1] isolated the prostate α-protein which is the major glycoprotein with molecular weight 50,000 D in the cytosol fraction of rat ventral prostate. Lobe specificity of proteins was found in rat prostate [2]. Ponsette et al. [3] showed that estramustine binding protein is found to be increased during puberty and it is an androgen-sensitive protein, as it decreases after castration and increases by androgen administration. Many workers reported Keratin in metaplastic squamous epithelium of prostate [4], in microcarcinoma and a typical hyperplasia [5], in normal and benign prostatic tissue [6] and in histological section of normal, hyperplastic and neoplastic prostates [7].

Prostate specific antigen (PSA) is a serine protease produced by prostate epithelium, it is found in high concentration in semen where it liquifies the seminal fluid after ejaculation by cleaving seminogelin [8]. The presence of large amount of PSA in blood could contribute to the common finding of inflammatory infiltration in the prostate.

Prostatic acid phosphatase is a glycoprotein synthesized in prostate epithelial cells [9-11] and major part of it is secreted into prostatic fluid while left behind part remains intracellular [12,13].

Review of pertinent literature gives a large body of work indicating pivotal role of proteins in aging prostate and in prostate pathology. Shain et al. [14] showed that proteins separated on PAGE indicated presence of abundant amounts in the prostate cytoplasm. This study established age-related...
decrease in ventral prostate content of moderately abundant, androgen responsive proteins and the content of at least one protein is age and androgen-independent.

MATERIAL AND METHODS

Ethanol leaf-extract of *Bacopa monniera* was prepared by the method given by Tripathi et al. [15]. Experimental animals used were mice (*Mus musculus*). Mice of 5 months age, weighing about 40 gm were selected. Thirty healthy animals were divided into five groups and different doses were injected subcutaneously as follows.

1. **Control group**: 0.5 ml of sterile water was injected to the mice.
2. **D-galactose treated group**: 5% D-galactose, 0.5 ml was injected to the mice of this group for 20 days to induce aging as also reported by Song [16].
3. **Bacopa co-treated group**: 5% D-galactose along with Bacopa leaf-extract (40 mg/Kg body Wt) was given for 20 days.
4. **Natural recovery group**: The mice received 5% D-galactose as in group II for 20 days and then no any dose was given for next 20 days to study whether natural recovery occurs.
5. **Bacopa recovery group**: After induction of aging with D-galactose for 20 days like second group the mice were injected with 0.5 ml of Bacopa-leaf extract (40 mg/kg body wt) for next 20 days.

RESULTS

Results of quantitative estimation of proteins of lysosomal and non-lysosomal fractions of prostate gland were recorded in Table 1 and figure 1.

**Proteins in non-lysosomal fraction**: The protein contents in the prostate gland of D-galactose stressed mice was decreased by about 30% than that in control, the decrease was statistically significant (P< 0.05). In simultaneous treatment of *Bacopa* and D-galactose the prostate showed significant increase (P< 0.05) in protein content than in the prostate of mice treated with only D-galactose. In natural recovery group highly significant reduction in protein content, about 43%, than in aging induced prostate, was noted. Whereas in the *Bacopa* recovery group about 40% increase in protein content is detected than in the natural recovery group.

**Proteins of lysosomal fraction**: The protein contents in lysosomal fractions of prostate of aging accelerated group were found decreased by 20% as compared to the control group. Significant increase (P< 0.05) in the protein contents was observed in the prostate gland of *Bacopa* co-treatment as compared to aging group. But in natural recovery group further loss in protein content was detected than the aging induced group, whereas protein contents in *Bacopa* recovery group was 14% higher than that in the natural recovery group.

DISCUSSION

Proteins are the major components of prostatic secretion and they play an important role in motility and fertility of sperms [18].

In the present investigation an attempt is made to study variation in protein contents from the lysosomal and non-lysosomal tissue fractions of *Bacopa monniera* on non-lysosomal and lysosomal Proteins (mg) in the Prostate gland of aging induced mice. Values are mean± SD from 5 animals in each group.

**Table 1**: Effect of *Bacopa monniera* on non-lysosomal and lysosomal tissue fractions of prostate gland of aging induced mice.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Non-lysosomal Proteins (mg)</th>
<th>Lysosomal Proteins (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Control</td>
<td>470 ± 1.58</td>
<td>117 ± 1.12</td>
</tr>
<tr>
<td>II D-galactose treated</td>
<td>224 ± 0.7</td>
<td>94 ± 0.7</td>
</tr>
<tr>
<td>III Bacopa co-treated</td>
<td>376 ± 0.7</td>
<td>100 ± 1.12</td>
</tr>
<tr>
<td>IV Natural recovery</td>
<td>197 ± 0.87</td>
<td>84 ± 0.87</td>
</tr>
<tr>
<td>V Bacopa recovery</td>
<td>276 ± 0.7</td>
<td>96 ± 0.85</td>
</tr>
</tbody>
</table>
prostate gland, in aging induced mice and the recovery in protein secretion due to administration of ethanol leaf-extract of *Bacopa*. The results displayed number of variations in proteins in different study groups. Biochemical estimation of proteins in aging induced mice shows 30% decrease in non-lysosomal proteins and 20% decrease in lysosomal proteins. Age related variations in proteins is also detected by Ponsette et al. [9]. According to them estramustine binding protein decreases in aging.

Aging process is marked by degenerative changes in structure and function of the organs. The major factor responsible for variations in aging is imbalance in oxidants and antioxidants. The natural defense system of body is the antioxidant enzymes like catalase, superoxide dismutase, glutathione peroxidase, they trap or neutralise the free radicals generated during metabolism. During aging the level of antioxidant enzymes get reduced [19] which results in elevation of free radicals and oxidative stress in the cells. The oxidative stress bring about cellular damage affecting all the cellular components like DNA, proteins, carbohydrates and enzymes [20].

The oxidative stress causes oxidation of proteins leading to hazardous and destructive alteration in number of vital substances including proteins. Protein oxidation can result in cleavage of polypeptide chain, modification of amino acids side chains and conversion of the proteins to the derivatives that are highly sensitive to proteolytic degradation. In addition oxidation of proteins results in several types of damages including oxidation of sulfhydryl groups, reduction of disulfides, oxidative adduction of amino acid residues, protein-protein cross-linking and peptide fragmentation [21]. The amino acids containing sulfhydryl groups e.g. cystine and methionine, more easily undergo oxidation- resulting in disulfides that cause protein aggregation and lipofuscin- formation. Oxidised proteins are mere vulnerable to cross linking by the aldehydes produced due to lipid peroxidation.

To compensate the reduction in antioxidant enzymes in the body dietary intake of antioxidants is advised to prevent old age disorders. Vegetables, fruits, flavonoids, vitamins trace elements are the rich sources of free radical scavengers. Vitamin E along with TAP protein modulate prostate cancer cell growth, and control rapid cell proliferation [22].

*Bacopa monniera*, commonly known as Bramhi has antioxidant, antiaging property [15]. It has the ability to raise the level of antioxidant enzymes [23]. It also prevents DNA damage [24]. In present investigation ethanol leaf-extract of *Bacopa* was co-administered along with D-galactose to study the efficacy of *Bacopa* as protective agent of proteins in prostate. Our results of biochemical estimation clearly indicated the promising results and *Bacopa* was found efficient in maintaining protein level towards normalcy. Elevation of protein levels was found especially in non-lysosomal fraction, which is rich in secretory proteins. The free radicals and advanced glycation end products produced due to D-galactose treatment were neutralized by *Bacopa*. 

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Fig. 1: Protein contents (mg) of non-lysosomal and lysosomal fractions of prostate in study groups.
protecting the prostate gland and preventing the cellular damage so that the protein synthesizing machinery has been protected and the protein level was retained closer to normal level.

In conclusion proteins in the prostate are well balanced and retained toward normal level in both lysosomal and non-lysosomal fractions by Bacopa especially in Bacopa co-treatment. Bacopa post-treatment was not very effective in protecting normal level of proteins in prostate though it showed slight improvement in protein production than in the natural recovery study.

REFERENCES