ORIGINAL ARTICLE

EFFECT OF FEEDING GARLIC (*ALLIUM SATIVUM*) ON BODY WEIGHT AND SERUM CHOLESTEROL LEVELS IN RATS

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Background: Oral garlic supplementation may be effective in decreasing serum cholesterol levels as much as 15% to 20%. Garlic indirectly effect atherosclerosis by reduction of hyperlipidemia, hypertension and probably diabetes mellitus and prevents thrombus formation. This study was undertaken to test the hypothesis that garlic powder with a prolonged mode of action promises potent biological effects into hypocholesterolemia. **Methods**: Fifty albino rats were randomly divided into 5 equal groups (n=10). All rats were initially fed normal diet for at least 7 days. Then Group A was control and was fed a normal diet + 0.5% cholesterol, Group B was fed normal diet and 3 mg garlic per 10 g of feed and Group C was fed normal diet and 10 mg garlic per 10 g of feed. The experiment lasted for 12 weeks. Body weight and serum cholesterol were noted before and after giving garlic + cholesterol. **Results:** Effect of serum cholesterol level was significantly decreased after taking 3 and 10 mg of garlic. However it was observed that the body weight was increased after taking garlic. **Conclusion:** Garlic consumption although can decrease the level of serum cholesterol but it increases the body weight. Garlic consumption alone can decrease serum cholesterol level, but it cannot be used as the main therapeutic agent for hyperlipidaemia.
Keywords: cholesterol, garlic, body weight

INTRODUCTION

Hypercholesterolemia has been implicated as an important risk factor for the development of coronary artery disease, hypertension, Colon polyps and cancer etc. It is estimated that 55% of Americans have cholesterol levels greater than 5.17 mmol/L (200 mg/dl) of coronary heart disease. Cardiovascular and related illnesses are one of the most common diseases prevalent in many parts of the world, including Pakistan. An increased risk of coronary heart disease is primarily associated with high serum total cholesterol and their carrier proteins.[1]

Lipid management is well established as an effective preventive and management tool for cardiovascular disease. Health's claim regarding the cholesterol lowering benefits of garlic is wide spread.[2]

Reports from medical literature during the past 20 years suggest that oral garlic supplementation may be effective in decreasing serum cholesterol levels as much as 15% to 20%.[3] Garlic indirectly effect atherosclerosis by reduction of hyperlipidemia, hypertension and probably diabetes mellitus and prevents thrombus formation. Garlic's direct effect on atherosclerosis may be explained by its capacity to reduce lipid contents in arterial cells and prevent intracellular lipid accumulation. Positive result of these trials may open a new era in the use of garlic in prevention and treatment of many atherosclerosis related diseases.[4]

The metabolic and kinetic behaviour of different garlic constituents were investigated in the isolated perfused rat liver, using aqueous extracts of garlic powder.[5] Allicin is the main constituent of *Allium sativum*. It is very reactive in lowering serum cholesterol level. The transformation of allicin into the biological active allicin molecule upon crushing of a garlic clove is extremely rapid.[2,6] In addition to allicin, Diallyldisulfide (DADS), an active principle of garlic is known for its antihyperlipidemic properties. Experimental study on group of rats confirmed the hypolipidemic action of DADS analogs may be beneficial in preventing the vascular complications that are induced by hyperlipidemia and provide a new therapeutic approach for the treatment of cardiovascular and related diseases.[7]

Prevention of cardiovascular disease by modifying its major risk factors, including serum cholesterol levels, is an important strategy.[8] Meta analysis of the controlled trial of garlic to reduce hypercholesterolemia showed a significant reduction in the total serum cholesterol levels.[9] However, a study reported that garlic powder preparation did not significantly affect plasma lipids levels.[10]

Clinical investigations of the effects of garlic preparations in hypercholesterolemia have demonstrated somewhat controversial results. These discrepancies may be due to the differences of the composition of garlic preparations and the biological response they may induce.

This study was undertaken to test the hypothesis that garlic powder with a prolonged mode of action promises potent biological effects into hypocholesterolemia.

MATERIAL AND METHODS

Fifty albino rats were randomly divided into 5 groups, 10 rats in each group. Group A was control and was fed a normal diet. Group B was fed normal diet and 3 mg garlic per 10 g of feed. Group C was fed normal diet and 10 mg garlic per 10 g of feed. Group D was fed normal diet, 0.5% cholesterol and 3 mg garlic per 10 g of feed. Group E was fed normal diet, 0.5% cholesterol and 10 mg garlic per 10 g of feed. The experiment lasted for 12 weeks.

All rats were initially fed normal diet for at least 7 days. Normal feed diet of rats mainly consisted of 19% crude protein, calcium, phosphorous, sodium, fibre, amino acid and metabolising energy. Composition of garlic is carbohydrate mostly, protein, vitamin B_6, energy and 0.5 gm fat. Food intake was monitored daily for all groups. The different doses of garlic were given every day. Blood samples were drawn after overnight starvation for estimation of serum cholesterol. Body weight and serum cholesterol were noted before and after garlic + cholesterol + feed.

Student's *t*-test was applied to compare the level of cholesterol of different groups. Data was analysed using SPSS-15.

RESULTS

All the rats stayed healthy throughout the experimental period and did not show any adverse effects of garlic. Changes of body weight were noted after 12 week. Group A was considered as controls. Their average body weight was 250 gm. In rats belonging to group B the body weight was more as compared to group A, but this showed no significant differences. On the other hand in group C the body weight was significantly ($p<0.05$, 0.001) greater than group A and B.

Changes in level of serum cholesterol were noted after 12 weeks. A diet containing 10 gm feed + 0.5% cholesterol was given to group A. Their serum cholesterol level was 230.91 mg/dl.

In rats belonging to group B serum cholesterol level was significantly increased ($p<0.01$) as compared to group A. On the other hand in group C level of serum cholesterol was significantly greater ($p<0.001$) than group A, but it was less than group B. Changes in body weight in group of rats after taking garlic are presented in Table-1.

Table-1: Change in body weight (gm) after 12 weeks experiment (Mean±SD)

Groups of Rats	Body Weight
Group A Control (normal feed)	250.85±20.29
Group B (3 mg garlic/10 g of feed)	260.00±21.60
Group C (10 mg garlic/10 g of feed)	340.00±20.60**

**$p<0.001$ (Highly significant)

Table-2: Change in serum cholesterol (mg/dl) after 12 weeks experiment (Mean±SD)

Groups of Rats	Cholesterol
Group A (Control) (normal feed+0.5% cholesterol)	230.91±0.81
Group B (3 mg garlic+0.5% chol/10 g of feed)	198.91±12.54*
Group C (10 mg garlic+0.5% chol/10 g of feed)	175.43±28.36**

*$p<0.01$= Significant, **$p<0.001$=Highly significant

DISCUSSION

Herbs and spices have a traditional history of use, with strong roles in cultural heritage, and in the appreciation of food and its links to health. Demonstrating the benefits of foods by scientific means remains a challenge, particularly when compared with standards applied for assessing pharmaceutical agents.[11]

This study observed that the normal body weight of rats was 250 gm. Body weight was increased after giving 3 mg and 10 mg of garlic/10 gm of feed. Our study was in accordance to a recent study who observed the significant effect of dietary garlic supplementation on body weight gain, in 35 crossbred dairy calves.[12] A group of workers[13] also reported that animals consuming feed added with the garlic showed insignificant increase in body weight of lambs.

We observed that 10 mg garlic + 0.5% cholesterol/10 gm of feed was more effectively reduced the level of cholesterol as compared to 3 mg garlic + 0.5% cholesterol /10 gm feed. Our study is in accord with the study of a group of workers who exposed primary rat hepatocytes and human hepG2 cells to Allicin. They observed concentration-dependent inhibition of cholesterol biosynthesis at different steps of this metabolic pathway. They found that at low concentration Allicin was almost uneffective. This inhibition was exerted at the level of HMG-CO A-reductase. At somewhat higher concentrations inhibition of cholesterol biosynthesis by Allicin was also observed at late steps resulting in the accumulation of the precursor amounts of dihydrolanosterol.[14] Our study was in contrast to a study who observed there was no indication of graded effect by garlic dose over the range of 0.500 and 1,000 mg/day.[10] Another study also not demonstrate any beneficial effects of garlic on serum cholesterol.[8]

Our study was in accord to many studies. According to a study taking garlic supplement for 8−12 weeks can lower cholesterol by 17 mg of cholesterol/dl of blood, and reduction is statistically significant but it is unlikely that it will lessen risk of heart attack.[15] A group of workers reported that there was no effect of garlic tablets on the total lipids their

carrier and blood pressure but there was a significant difference in the total cholesterol alone.[16] The best available evidence suggested that garlic, in an amount approximately one half to one clove per day decreased total serum cholesterol levels by about 9% in groups of patients studied.[9,17,18]

CONCLUSION

Garlic consumption although can decrease the level of serum cholesterol but it increases the body weight. Garlic consumption alone can decrease serum cholesterol level, but it cannot be used as the main therapeutic agent for hyperlipidemia. Further research is needed to reach on better conclusion.

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