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Hypolipidemic effects of aqueous extract of onion (Allium cepa. Linn) on serum levels of cholesterol, triglycerides, LDL and HDL compared with Zn sulfate supplementation in the rats

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ABSTRACT

People who take onion (Allium sativum) supplements hope to improve their well-being and to reduce the risk of various diseases. Numerous myths about its medicinal properties have existed for centuries in various cultures. According to some investigators the lower incidence of widespread disease in southern countries may partly be due to consumption of large quantities of onion. The objective of this study was to determination of onion (Allium cepa. linn) extract on the serum concentration of cholesterol, triglycerides, LDL and HDL. In this experiment, 162 mature male rats (250 gm on the average) were acquired from Razi Serum–producing Institute of Karaj and transferred to keeping place and then divided into the 9 identical groups. In the present study, lipids of serum were significantly decreased consequent consumption of onion extract. In conclusion can be state that onion and zinc sulfate have the most important hypolipidemic effects that combined use of these elements showed best effect than alone use.

Keywords: aqueous extract, onion (*Allium cepa. Linn*), cholesterol, triglycerides, LDL, HDL, Rat.

INTRODUCTION

Onions are rich in phenolic compounds. Moreover, they are a major source of quercetin, a flavonol used as a nutritional supplement for its anti-inflammatory and antioxidant properties [14,15,16,20].

Onion and onion extract shows antioxidants properties and may be beneficial against some cancers. Indeed, onion extract inhibited cell proliferation of colon, kidney and liver cancer and could inhibited mutation processes that triggers cancer. Onions also have hypoglycemic properties and the capacity to decrease platelet aggregation. Other in vitro studies have shown that onion juice or extract have anti-parasitic, anti-fungal and anti-bacterial properties [3,4,10,13],

In studies with animals, consumption of onion extracts led to the reduction of blood lipids in rats and rabbits. Several studies have also shown an anti-diabetic property: the reduction of blood sugar by eating onion in diabetic

rabbits and the decreased hypoglycemia in diabetic rats. In addition, an amino acid from onion, s-methyl cysteine sulfoxide contributes to anti-diabetic effects of onion in rats by controlling blood glucose in addition to other effects that are comparable to the insulin. Consumption of onions has also been anti-thrombotic in rats, an inhibitory effect of platelet aggregation in rabbits and decreased cell proliferation of colon cancer in rats. Finally, the dried onion consumption decreased hypertension in rats. Protection against asthma has also been obtained by consuming an extract of onion with guinea pigs [11,21].

In studies with human, onion consumption reduces the risk of colon, larynx, ovarian and stomach cancer, reduces the risk of developing cancer of the esophagus, oral cavity, pharynx, and decreases rates of glucose in the blood of diabetics. The protective effects of onion against breast cancer have also been studied in a case study in France. Consumption of onions has also been beneficial in bone density in women aged 50 and older before and after menopause. Onions have also shown many benefits in terms of cardiovascular disease [7,17].

The onion nutritional value is showed in the table 1.

Table 1: Onion nutrition facts

Compound	Concentration
Protein (g/100g)	1.3
Fat (g/100g)	0.2
Carbohydrate (g/100g)	7.1
Fibre (g/100g)	2.1
Vitamin	
Vitamin C (mg/100g)	7.0
Vitamin E (mg/100g)	0.14
Mineral	
Potassium (mg/100g)	170
Calcium (mg/100g)	25
Magnesium (mg/100g)	10
Phosphorus (mg/100g)	33
Sulfur	50
Iron (mg/100g)	0.3

Recently oral ingestion of pharmacological doses of zinc was reported to lower HDL, cholesterol in man [5], Also, increased levels of serum cholesterol were observed in rats fed high-zinc diets [8,9] and high levels of serum cholesterol are one of the three major risk factors for coronary heart disease. These observations are of concern because of the recent popularity and availability of zinc supplement. The objective of this study was to determination of onion (Allium cepa. linn) extract on the serum concentration of cholesterol, triglycerides, LDL and HDL.

MATERIALS AND METHODS

In this experiment, 162 mature male rats (250 gm on the average) were acquired from Razi Serum–producing Institute of Karaj and transferred to keeping place. This design is performed as a factorial experiment 3*3 (3 level of onion extract and 3 level of zinc sulfate complement) in the form of totally random design with 9 groups per 3 replications each containing 6 rats. All of keeping cages were disinfected before performing the experiment.

All of groups were kept in 12-hour light and 12-hour darkness conditions with 25-30 temperature and free access to water and food in metal cages placed in animal husbandry of veterinary faculty of Islamic Azad University, Tabriz Branch.

Fresh onions were used in this experiment, and onion extract was obtained through soxhlet apparatus in combination with deionized distilled water within 6 hours in two successive days at 30˚C (to prevent elements and materials of onion from decomposition).

Then, the extract was placed in incubator in order to be concentrated. Certain concentrations of onion extract were dissolved in pure water and became reachable by rats on a daily basis. Zinc sulfate complement was acquired (from Germany Merk) and after measuring certain rat by digital scale was given to mice on a daily basis.

It must be mention that onion extract was give as gavages (gastro–oral) and zinc sulfate complement was dissolved in water in certain amount and it was added to food after steeping and powdering of pellets, then the food was mixed, ground and dried, and obtained pellets was given to animal.

Moreover, during the first week of experiment, all groups consumed basal diet in order to adapt with breeding environment conditions then groups were divided as follows:

Groups 1: basal diet,
Groups 2: basal diet + 1cc fresh onion extract,
Groups 3: basal diet + 2cc fresh onion extract,
Groups 4: basal diet + 15 mg/ kg zinc sulfate complement,
Groups 5: basal diet + 30 mg/ kg zinc sulfate complement,
Groups 6: basal diet + 1cc fresh onion extract + 15 mg/ kg zinc sulfate complement,
Groups 7: basal diet + 1cc fresh onion extract + 30 mg/ kg zinc sulfate complement,
Groups 8: basal diet + 2cc fresh onion extract + 15 mg/ kg zinc sulfate complement
Groups 9: basal diet + 2cc fresh onion extract + 30 mg/ kg zinc sulfate complement.

The above mentioned groups were treated for 4 weeks. At the end of fourth week, after 12 hours starvation, 6 rats were selected randomly from every treatment and their blood sampling was done through decapitation, then serum concentrations of the cholesterol, triglycerides, LDL and HDL were measured.

Statistical Analysis:
Data were subjected to a one-way analysis of variance using the General Linear Models (GLM), and the statistical analysis system (SAS) User's guide. The result of the Analysis of variance according to the model is,

$$Yijk = \mu + \alpha i + \beta j + (a\ \beta)\ i\ j + eijk$$

Where,
Yijk = All dependent variable
μ = Overall mean
αi = The fixed effect of onion levels (i = 1, 2, 3)
βj = The fixed effect of zinc sulfate levels (j = 1, 2, 3)
eijk = The effect of experimental error

When significant difference among the means was found, means were separated using Duncan's multiple range tests.

RESULTS

Variance analysis of cholesterol, triglycerides and lipoproteins is presented in the table 2. Effect of alone onion extract on cholesterol levels and LDL, HDL were significant at the 5% level, while there was no effect on triglyceride concentrations.

The effects of alone zinc supplementation resulted in significancy only HDL concentration at 5% level. The effect of combined use of zinc supplementation and the aqueous extract of onion on serum cholesterol and LDL, HDL were significant at the 5% level.

Based on table 2, treatment group 9 had the greatest effect on serum lipid parameters. Also, revealed that despite of the significance of triglyceride concentration in treatments those received aqueous extract of onion, the concentration of this biochemical factor was decreased linearly.

Table 2: Comparison of cholesterol, triglycerides, LDL and HDL levels of serum (per ml dl)

		Cholesterol	Triglycerides	LDL	HDL
Onion					
Group 1		88.15[a]	68.23	33.44[b]	31.72[a]
Group 2		76.71[b]	65.57	20.00[a]	42.50[b]
Group 3		67.72[ab]	60.18	19.25[a]	40.37[b]
P-value		*	NS	*	*
SEM		1.06	2.33	0.98	1.36
Zinc sulfate supplementation					
Group 1		79.84	84.82	24.63	30.33[a]
Group 4		77.30	55.69	20.00	42.40[b]
Group 5		75.16	66.33	29.00	46.78[c]
P-value		NS	NS	NS	*
SEM		3.1	5.2	2.16	2.1
Combination administration					
Onion	**Zinc sulfate supplementation**				
0 cc	0 (control)	88.40[a]	68.20	23.60[c]	30.80[a]
	15 mg /kg	87.50[a]	69.75	26.50[cd]	41.67[d]
	30 mg /kg	80.75[b]	54.75	20.00[ab]	46.00[e]
1 cc	0 (control)	82.00[ab]	60.25	24.00[c]	31.00[a]
	15 mg /kg	76.60[bc]	59.00	19.66[ab]	36.50[bc]
	30 mg /kg	72.60[c]	54.00	18.33[a]	40.00[d]
2 cc	0 (control)	80.75[b]	65.25	26.00[cd]	33.33[ab]
	15 mg /kg	68.00[d]	53.00	19.50[ab]	37.67[bc]
	30 mg /kg	65.33[d]	62.33	17.00[a]	45.50[e]
P-value		*	NS	*	*
SEM		1.98	2.02	1.3	3.3

DISCUSSION AND CONCLUSION

In the present study, lipids of serum were significantly decreased consequent consumption of onion extract. The recent report by Hooper et al., 1980 that pharmacological doses of zinc (160 mg) lowered HDL-cholesterol in normal men and that the mineral might be an atherogenic agent prompted this report of our observations of the effect of zinc supplementation on plasma lipids in rats [5]. Also, the results of Shah et al., 1988 showed the potential value of zinc sulfate in the treatment of hyperlipidemia and ischemic heart disease [19].

Lee et al., 2011 reported that quercetin-rich supplementation significantly reduced serum concentrations of total cholesterol ($P < 0.05$) and LDL-cholesterol ($P < 0.01$), whereas these effects were not shown in the placebo group. Furthermore, significant increases were observed in serum concentrations of HDL-cholesterol both in the placebo ($P < 0.005$) and quercetin-rich supplementation group ($P < 0.001$); however, changes in HDL-cholesterol were significantly greater in subjects receiving quercetin-rich supplementation than the placebo. Both systolic ($P < 0.05$) and diastolic blood pressure ($P < 0.01$) decreased significantly in the quercetin-rich supplementation group. Glucose concentrations decreased significantly after 10 weeks of quercetin-rich supplementation ($P < 0.05$). In contrast, no effects of quercetin-rich supplementation were observed for the inflammatory markers-IL-6 and sVCAM-1. Daily quercetin-rich supplementation from onion peel extract improved blood lipid profiles, glucose, and blood pressure, suggesting a beneficial role for quercetin as a preventive measure against cardiovascular risk [12].

Islam et al., 2008 suggested that the HF onion diet may increase insulin secretion and consequently insulin resistance in a dose-dependent manner, resulting in a worsened hyperglycemic and hyperlipidemic diabetic state. We conclude that higher dietary fat may impair the antidiabetic effects of dietary onion intake as has been previously reported [6].

Augusti et al., 2001 stated that better hypolipidemic effects and correction of elevated levels of certain enzymes shown by garlic and amla may be due to the facts that they contain comparatively better active principles than that found in onions [2].

In one other study revealed that administration of onion extract significantly reduced serum, liver and aorta triglycerides and serum and liver proteins. On the other hand liver free amino acids have been significantly increased in the onion treated group as compared to the sucrose fed control. The effects of onion have been ascribed

to its sulfur containing principles which oxidize thiol compounds either present free or combined in a protein and NADPH which are necessary for lipid synthesis [18].

In the research of Kumari et al., 1995 was determined that Oral administration of S-methyl cysteine sulphoxide (SMCS) from onion daily at a dose of 200 mg/kg body weight for a period of 45 days to alloxan diabetic rats controlled significantly their blood glucose and lipids in serum and tissues and altered the activities of liver hexokinase, glucose 6-phosphatase and HMG CoA reductase towards normal [10]. The above effects of SMCS were comparable to those of glibenclamide and insulin.

In one study indicated that it is safer to take whole onion rather than onion residue or extract, because whole onion could lower the blood cholesterol level even in normal condition and has a less pronounced effect on the micro-environment of the cells [1].

By comparison of above mentioned literatures it has been revealed that onion and zinc sulfate have the most important hypolipidemic effects that combined use of these elements showed best effect than alone use.

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