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ORIGINAL ARTICLE

Effects of Onion on Serum values of Glucose Compared with Zn Sulfate in Rat

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ABSTRACT

Onion (Allium Cepa.) is an old ancient medical treatment to render risk of various diseases. The aim of this study was to survey effects of fresh Onion (Allium Cepa. Linn) juice on serum values of Glucose compared with Zn sulfate in rats. A hundred and sixty-two male Wister rats randomly allocated into 9 treatment groups (each include 3 groups and 6 replicate). In group 1, rats received basal diet. In group 2, basal diet + 1cc fresh onion juice were provided. In group 3, rats were offered basal diet + 2cc fresh onion juice. Group 4 fed basal diet + 15 mg/kg zinc sulfate complement. In group 5, basal diet + 30 mg/kg zinc sulfate complement delivered to rats. In group 6, animals nourished with basal diet + 1cc fresh onion juice + 15 mg/kg zinc sulfate complement. In group 7, basal diet + 1cc fresh onion juice + 30 mg/kg zinc sulfate complement provided to rats. Group 8 consumed basal diet + 2cc fresh onion juice + 15 mg/kg zinc sulfate complement. In group 9, animals fed basal diet + 2cc fresh onion juice + 30 mg/kg zinc sulfate complement. Animals were kept 1 week for adaptation to experimental condition, then after treated for next 4 weeks. At the end of the study, 12 hours fasting period blood samples were taken and analysed for serum glucose concentrations. According to the data, different levels of sole fresh onion juice (1 and 2 cc) or Zn sulfate supplementation (15 and 30 mg/kg) and combination administration had no significant effects on serum glucose levels (P≥0.05).

Key words: *Onion juice, Zinc sulfate, Glucose, Rat*

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INTRODUCTION

The edible *Allium* species Garlic (*A. sativum* L.) and onion (*A. cepa* L.) have long been used as food ingredients and medicine [1]. Their bulbs and corms are magnificently nutritious and include great therapeutic phenolic phytochemicals such as antidiebetic, anti-atherosclerotic, anti-thrombotic, anti-hypertensive, anti-hyperlipidemic, anti-inflammatory, antioxidant anti-cancer and etc. [2]. Diabetes mellitus is a common and very prevalent disease affecting the citizens of both developed and developing countries. It is estimated that 25% of the world population is affected by this disease. Diabetes mellitus is caused by the abnormality of carbohydrate metabolism which is linked to low blood insulin level or insensitivity of target organs to insulin [3]. Despite considerable progress in the treatment of diabetes by oral hypoglycemic agents, search for newer drugs continues because the existing synthetic drugs have several limitations. The herbal drugs with antidiabetic activity are yet to be commercially formulated as modern medicines, even though they have been acclaimed for their therapeutic properties in the traditional systems of medicine [4]. In our previous study, we found that garlic extract decreased the serum glucose in CrCl3-exposed rats [5].

Zinc has been known to be essential for animals and humans for many years. The causes of zinc deficiency include, in addition to genetic disorders, malnutrition, alcoholism, malabsorption, chronic renal disease, and certain diuretic and chelating agents [6]. It is the second most abundant transition metal after iron and it is the only metal which appears in all enzyme classes [7]. Zinc is a cofactor for several

metalloenzymes involved in DNA transcription and protein synthesis and also has anti-apoptotic and antioxidant properties [8]. Recent research has reported that phenolic phytochemicals from onion have blood glucose lowering effect and high antioxidant activity in alloxan-induced diabetic rat [9, 10]. Further it is rich in flavonoids such as quercetin and sulfur compounds, such as allyl propyl disulfide that have perceived benefits to human health. Epidemiological studies have also shown that the intake of certain types of flavonoids, including quercetin and myricetin is inversely associated with the risk of incident type II diabetes [11]. Quercetin, Isoquercitrin and rutin have shown inhibitory activities on α-glucosidase from the rat intestine. Based on previous studies, in the current study our hypothesis was to investigate possible effects of fresh onion juice and Zn sulfate on serum glucose levels in rat.

MATERIALS AND METHODS

To survey possible effects of fresh Onion (*Allium Cepa. Linn*) juice on serum Lipase and Amylase level compared with Zn sulfate supplementation, a hundred and sixty-two male Wister rats (230–250 g) were purchased from Pasteur Institute in Iran and randomly allocated into 9 treatment groups (each include 3 groups and 6 replicate). The rats were housed individually in stainless steel wire-bottomed cages and resided under standard laboratory conditions according to European community suggestions for laboratory animals at temperature 23.1-25.8°C and the humidity was 55-60%, 12 h lighting period. All animals offered *ad libitum* access to chow pellets (Azarbayjan Co. Iran) and fresh water.

Plant material

Fresh onion (*Allium Cepa. Linn*) was obtained from Ilkhchi-Tabriz, East Azarbayjan province, Iran. The *Allium Cepa. Linn* identified at division of Pharmacognosy, Faculty of Pharmacy, Tehran University of Medical Sciences, Iran. All Onion juice was obtained through a fruit juicer before the experiments [12, 13].

Analysis of onion juice

The flavonoid components of onion juice were determined by Shinoda test at Tehran University of Medical Sciences. The chief flavonoid component in onion is Quercetin and determined using qualitative thin-layer chromatography (TLC). 10 mL of fresh onion juice dried in a vacuum then the resulting residue dissolved in 1 mL of methanol. Methanolic solution (20 mL) was spotted on a silica gel plate (10×20 cm, silica gel 60 GF254, Merck, Darmstadt, Germany) by EtOAc/MeOH (80:20) solvent system. Quercetin as vehicle purchased from Sigma chemical Co. (St. Louis, MO, USA). Then after developing and drying, 2 % $AlCl_3$ solution in methanol is used to spray TLC plate. To recognize quercetin in the onion samples yellow spot caused by quercetin was the identification factor at RF=0.6. Quercetin was separated via preparative TLC on silica gel and LIAISON analyzer used to determine quantity of quercetin in sample. Quercetin compared to a pure quercetin standard curve in 370 nm. The quercetin in experimental fresh onion samples was 11.1 mg per100 g.

Experimental procedure

Onion juice (1 or 2 cc) was provided to rats on a daily basis as gavages (gastro–oral). Zinc sulfate purchased from Merk (© Merck KGaA, Darmstadt, Germany) and 15 and 30 mg/kg was dissolved in water and orally offered to animals. Doses were calculated based on our previous and pilot studies [12-16]. At first week of experiment, all groups received basal diet for 1 week in order to adapt to experimental condition then treated for 4 weeks. Groups were divided as follows:

Groups 1: basal diet (as the vehicle control),
Groups 2: basal diet + 1cc fresh onion juice,
Groups 3: basal diet + 2cc fresh onion juice,
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 juice + 15 mg/kg zinc sulfate complement,
Groups 7: basal diet + 1cc fresh onion juice + 30 mg/kg zinc sulfate complement,
Groups 8: basal diet + 2cc fresh onion juice + 15 mg/kg zinc sulfate complement,
Groups 9: basal diet + 2cc fresh onion juice + 30 mg/kg zinc sulfate complement.
All groups were given treatments orally.

Biochemical assays

At the end of the study, 12 hours fasting period given to rats (FD 12), 6 rats randomly selected from each group and blood samples were taken from the tail tip [17]. Blood samples (2 ml) centrifuged at 250× g for 10 minute and serum was separated and stored at -20 ºc until used. Serum Lipase and Amylase concentrations determined by calorimetric method using auto analyzer (Mindray- BS-200, Germany). Animal handling and experimental procedures were performed according to the Guide for the Care and Use of Laboratory animals by the National Institutes of Health (USA) and the current laws of the Iranian government. All protocols for animal experiment were approved by the institutional animal ethical committee.

Statistical analysis

This study is performed as a factorial 3×3 experiment (3 level of fresh onion juice and 3 level of zinc sulfate complement). Data were expressed as mean values ± SEM and a one-way analysis of variance using the general linear models (GLM). All statistical analyses were performed using SAS [18]. When significant difference among the means was found, means were separated using Duncan's multiple range tests. P≤0.05 considered significant difference between groups. 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

RESULTS

The effect of fresh onion juice on serum values of glucose compared with Zn sulfate supplementation is presented in table 1. According to the result, 4 weeks fresh onion juice administration (1 and 2 cc) had no significant effects on serum glucose concentrations in rats compared to control group (P≥0.05). Furthermore, of Zn sulfate (15 and 30 mg/kg) had no significant effects on serum glucose compared to control group after 4 weeks in rat (P≥0.05). Additionally, co-administration of fresh onion juice (1 and 2 cc) plus Zn sulfate (15 and 30 mg/kg) had no significant effects on serum glucose compared to control group after 4 weeks in rat (P≥0.05).

Table 1. Effects of different levels of fresh Onion (*Allium Cepa. Linn*) juice on serum values of Glucose compared with Zn sulfate supplementation in the rats.

		Glucose
Onion (cc)		
0 (control)		170.64
1		150.09
2		146.22
P-value		0.14
SEM		8.71
Zn sulfate supplementation (mg /kg)		
0 (control)		164.09
15		144.90
30		159.00
P-value		0.29
SEM		8.71
Combination administration		
Onion (cc)	**Zn sulfate supplementation (mg /kg)**	
0	0	178.20
	15	149.67
	30	179.00
1	0	157.33
	15	148.25
	30	146.50
2	0	147.33
	15	135.67
	30	155.67
	P-value	0.80
	SEM	13.96

Zn: Zinc, UMg: Magnesium. SEM: standard error mean

DISCUSSION

In this study, different levels of sole fresh onion juice (1 and 2 cc) or Zn sulfate supplementation (15 and 30 mg/kg) and their combination administration had no significant effects on serum glucose levels.

Diabetes is a chronic metabolic disorder that continues to present a major worldwide health problem. It is characterized by absolute or relative deficiencies in insulin secretion and/or insulin action associated with chronic hyperglycemia and disturbances of carbohydrate, lipid, and protein metabolism. As a consequence of the metabolic derangements in diabetes, various complications develop including both macro and micro-vascular dysfunctions [19]. In a previous study, injecting 7% onion for 5 weeks into diabetic rats significantly increased the kidney GPx, glutathione reductase and GST activities [20]. The biological action of Allium products is ascribed to organosulfur and phenolic compounds. It has been found that administration of onion products to diabetic rats significantly reduced hyperglycaemia [21]. In our study onion was not able to attenuated glucose levels in rat. It seems, onion dosages in our study were not in sufficient levels to cause significant effects on serum glucose levels. In addition this dosage can be used as a base dosage for further studies. Former studies reported that allicin, a sulfur containing amino acid in garlic has a potential to reduce diabetic condition in rat almost to the same extent as did glibenclamide and insulin [22]. Although many of the previous trials in animal models showed significant effects of garlic on glycemic control, hypoglycemic effect of garlic in human is not well studied. All human studies [23, 24] apart from two [25, 26], has showed the effect of garlic on blood glucose level in normal healthy individuals but not in diabetic patients.

Zinc biology is a rapidly developing field, and recent research reveals Zn's strategic role in most organ systems. Physiologically, Zn is vital for growth and development and for healthy functioning of many body systems, encompassing insulin storage and release, cognition, cell membrane integrity, sexual maturation and reproduction, dark vision adaptation, olfactory and gustatory activity, thyroid function, blood clotting, taste acuity and for a variety of host immune defenses, among others [27]. There has been little research on the relationship of zinc intake and blood glucose concentrations. Zinc acexamate may be a good tool in therapy of osteoporosis. Bone loss has been shown to induce with diabetes [28]. Streptozotocin (STZ)-diabetic rats induce an impairment of insulin secretion. A single subcutaneous administration of STZ (60 mg/kg body weight) to rats caused a significant decrease in body weight and serum zinc concentration, the increase in serum glucose [29]. The result of current showed that Zn sulfate was not able to affect serum glucose levels. It seems, this dosage can be used as a base dosage for further researches. We recommend further researches need to clarify effective dosage of co-administration of onion juice and Zn sulfate. Additionally, merit studies are needed to distinguish their potential for clinical use in clinical trials.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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