Brief Communication

# Effects of Yogurt and Yogurt Plus Shallot Consumption on Lipid Profiles in Type 2 Diabetic Women

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## Abstract

**Background:** Identification of food with lowering cholesterol level properties plays a vital role to control impaired lipid profile among type 2 diabetic patients. the current study aimed to evaluate the effects of yogurt and yogurt plus shallot intake on lipid profiles in type 2 diabetic women. **Methods:** Forty-eight participants with type 2 diabetes were enrolled in this study. Participants in the first group ($n$ = 22) received 150 ml of low-fat yogurt (1.5% fat) and those in the second group ($n$ = 26) received 150 ml of low-fat yogurt (1.5% fat) plus shallot for 10 weeks. Serum triglyceride (TG), low-density lipoprotein cholesterol (LDL-C), total cholesterol (TC) concentrations, and fasting blood sugar (FBS) were measured before and after each intervention. **Results:** comparison of parameters between two groups after intervention showed that TG and TC concentrations decreased more in participants who consumed yogurt plus shallot than who consumed yogurt ($P$ = 0.003 and $P$ = 0.04, respectively), also LDL-C level of participants who were in yogurt plus shallot group was lower than that of participants in yogurt group, but this difference was marginally significant ($P$ = 0.06). However, FBS level was not statistically different between two groups. **Conclusions:** This study found that yogurt plus shallot intake significantly decreased LDL-C, TG, and TC levels in diabetic women compared with yogurt intake.

**Keywords:** *Shallot, type II diabetes, yogurt*

## Introduction

A chronic disease of type 2 diabetes mellitus (T2DM) is related to multiple complications.[1] Postprandial lipid metabolism of type 2 diabetic patients was impaired which can lead to increased low-density lipoprotein cholesterol (LDL-C) and triglyceride (TG) levels; it also reduced the concentration of high-density lipoprotein cholesterol (HDL-C).[2] Investigations suggest that dysfunction of lipoprotein lipase may have a major role in elevating serum TGs level in diabetic patients.[3]

The prevalence of type 2 diabetes is growing as a result of urbanization, increasing the prevalence of obesity and sedentary lifestyle.[4] According to several worldwide studies, the outbreak of T2DM was 2.8% in 2000, and it is estimated to increase to 4.4% by 2030.[5] According to a meta-analysis study, type 2 diabetes had an outbreak of 24% among ≥40 years old Iranian population and this amount increases by 0.4% every year.[6] T2DM is correlated with the increasing risk of cardiovascular diseases, and it is one of the important causes of blindness and renal transplantation.[7] Studies report that women with type 2 diabetes are in the higher risk of complications due to high level of blood glucose than that of men, and risk of progressing coronary artery diseases is greater among them. Risk of hypertension and dyslipidemia was also higher in diabetic women compared to men.[8] Due to the side effects of antidiabetic drugs, patients intend to consume natural food sources with antidiabetic effects.[9] Studies reported that healthy dietary patterns had a significant effect on preventing type 2 diabetes and its complications. Low-fat dairy and its products is one of the food groups that can incorporate as healthy food items in healthy eating patterns for diabetic patients and it can improve insulin resistance.[10-13] Studies showed that intake of dairy was related with improving lipid profile in patients with type 2 diabetes and might have a beneficial effect on the management of T2DM.[2,14,15] The impact of dairy consumption on protecting diabetes



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mellitus can be explained by insulinotropic effects and improving insulin sensitivity effects of medium-chain fatty acids in whey and casein; moreover, its calcium and Vitamin D contents of dairy products have a significant role in reducing risk of type 2 diabetes, through reducing appetite, regulating fat metabolism, and managing body weight.[12] Studies reported that various types of vegetables and herbs have antidiabetic properties through their antioxidant content.[16] Iranian shallot, an edible onion, contains several antioxidants. Animal studies showed that the extract of Iranian shallot reduces plasma LDL-C and TG, glucose, and hemoglobin A1c (HbA1c) concentrations; however, it increases HDL-C and insulin levels.[16] Effects of yogurt and yogurt plus shallot consumption on lipid profiles in women with T2DM as a population with greater incidence of diabetes complications were examined in this study.

## Methods

Participants were recruited from the Endocrinology Research Center, Isfahan University of Medical Sciences. Inclusion criteria were female gender, age between 45 and 70 years, and not being on insulin treatment. Participants were excluded from the study if pregnancy happened or they had to use insulin therapy. This study is registered by registration ID "IRCT201508185062N10" with the Iranian Registry of Clinical Trials. Protocol of the study was explained to all the participants before they completed informed consent forms. Finally, 48 T2DM patients were included in this study. Patients were randomly divided into two groups. The first group ($n$ = 22) patients received 150 ml of low-fat yogurt (1.5% fat, calories: 86 kcal, fat: 2.2 g, carbohydrate: 9.6 g, protein: 7.2 g) and second group ($n$ = 26) patients received 150 ml of low-fat yogurt (1.5% fat) plus shallot (3 g) for 10 weeks. Two grams of grinded shallot per 100 g of yogurt was used for intervention. Yogurt and yogurt plus shallot were purchased from Caleh Company (Caleh, Isfahan, Iran). Anthropometric indices were measured before and after the intervention period. Weight was measured by digital scale with minimal wear (Seca scale, Tehran, Iran), and height was measured with a wall-mounted stadiometer and with 0.5 cm precision. Fasting blood samples of each participant were collected at baseline and after 10 weeks. Serum TG, LDL-C, and total cholesterol (TC) concentrations were measured by clinical assay using Biosystem kits. Participants had to visit every week to receive their intervention yogurt and inform us if there was any inconvenience regarding the intervention. All the participants had been asked not to change their dietary intake, physical activity, and their medication, and if they had to change, they should inform us. No side effect was reported by participants throughout the study, and all the participants completed the study. SPSS software, version 20(IBM SPSS, Tokyo, Japan) was used for statistical analysis. Paired sample $t$-test was used to analyze the changes in lipid profiles and anthropometric indices in each group before and after the intervention. To examine the difference between two groups, the independent sample $t$-test was used.

## Results

Anthropometric characteristics of the participants are shown in Table 1. There was no significant difference between age, weight, and body mass index between two groups at baseline. The results of this study also showed that there was no significant difference in lipid profile, including TC, LDL-C, and TG levels as well as fasting blood sugar (FBS) level of participants at baseline and after the intervention period among those who consume 150 ml of yogurt [Table 2]. When the FBS levels assessed after the intervention, we could not find any significant change between baseline and after the intervention levels in yogurt group; however, the values were marginally significant in yogurt plus shallot group ($P$ = 0. 11 and $P$ = 0.08, respectively). The similar results were reported for TC ($P$ = 0.14 and $P$ = 0.09, respectively) and TG levels ($P$ = 0.18 and $P$ = 0.07, respectively). Analyses of blood sample failed to find any significant difference in LDL-C levels before and after the intervention period, in participants of yogurt and yogurt plus shallot groups ($P$ = 0.6 and $P$ = 0.2, respectively). Comparison between the two intervention groups showed that participants who consumed yogurt plus shallot had significantly lower TG concentration than that of participants who consumed yogurt only ($P$ = 0. 003). There was the same condition about TC levels of two groups ($P$ = 0. 04). Participants who consumed yogurt plus shallot had lower LDL-C level than that of participants who consumed yogurt only, but this difference was marginally significant ($P$ = 0.06). FBS level was not statistically different between two groups.

## Discussion

In this study, we compared the effects of yogurt plus shallot with yogurt on lipid profile of diabetic women. The results of our study indicated that FBS, TC, and TG levels in participants who consumed yogurt plus shallot marginally decreased after 10-week intervention. Participants who consumed yogurt plus shallot, after the intervention, had significantly lower TG and TC

**Table 1: Age and anthropometric characteristics of patients[a]**

| Variable | Yogurt group | Yogurt + shallot group | *P* | Range |
|---|---|---|---|---|
| Age (years) | 58.5±12.2 | 61.5±8.53 | 0.33 | 59.5±9.9 |
| Weight (kg) | 71.4±7.5 | 68.5±12.2 | 0.11 | 69±9.6 |
| BMI (kg/m$^2$) | 28.5±3.2 | 27.5±4.12 | 0.24 | 27.8±3.4 |

[a]Values are means±SD. $P$<0.05 was considered statistically significant. BMI=Body mass index, SD=Standard deviation

**Table 2: Comparisons of parameters in two groups before and after the supplementation[a]**

| Parameters (mg/dl) | Yogurt group* | | | | Yogurt + shallot group* | | | | *P* (between two groups)* |
|---|---|---|---|---|---|---|---|---|---|
| | Baseline values | After intervention | Change | *P* | Baseline values | After intervention | Change | *P* | |
| FBS | 245.3±85.6 | 202.3±73.4 | 52.3±28.6 | 0.11 | 225.6±52.3 | 169.5±47.0 | 56.0±36.9 | 0.08 | 0.11 |
| TC | 365.4±62.6 | 342.6±44.5 | 22.7±15.7 | 0.14 | 387.9±86.0 | 343.1±88.3 | 44.7±26.7 | 0.09 | 0.04 |
| LDL | 192.6±26.4 | 174.4±28.3 | 18.3±16.8 | 0.6 | 176.8±48.3 | 150.8±46.5 | 26.1±22.0 | 0.2 | 0.06 |
| TG | 412.7±62.3 | 376.4±59.0 | 36.4±22.0 | 0.18 | 482.6±94.3 | 377.5±93.3 | 105.9±45.3 | 0.07 | 0.003 |

[a]Values are means±SD. $P<0.05$ was considered statistically significant. *Independent sample *t*-test and paired *t*-test were used to assess the between and within groups comparison for FBS and lipid profile. FBS=Fasting blood sugar, LDL-C=Low-density lipoprotein cholesterol, TG=Triglyceride, SD=Standard deviation, TC=Total cholesterol

concentrations than that of participants who consumed yogurt only. Previous studies that investigated the effect of Persian shallot (Mooseer) on lipid profile in diabetic rats showed that shallot intake decreases plasma LDL-C, TG, glucose, and HbA1c concentrations, and it increases HDL-C, TC, and insulin levels.[16] Another study assessed the effect of garlic, Persian shallot, and leaves of sage on lipid profile and activity of antioxidant enzyme in diabetic rats. It revealed that intake of Persian shallot led to an increase in enzymes with antioxidant activity such as catalase, glutathione peroxidase, and superoxide dismutase, and it plays beneficial effects on reduction of LDL-C, TC, and very LDL-C levels.[17] Effects of Persian shallot on lipid profile might depend on its activation of SH group which found in sulfur compounds and can inhibit lipid synthesis through the oxidation of lipid-synthesizing enzymes. It can also activate an enzyme (7-alpha hydroxylase) to convert cholesterol to bile acids and decrease the cholesterol levels.[18] Studies showed that Persian shallots have the inhibitory effect on hormone-sensitive lipase, similar to insulin effect, which can decrease lipolysis.[16] Another proposed mechanism for lipid-lowering properties of shallot is that its sulfur compounds can oxidize NADPH and produce NADP. Subsequently, it can inhibit lipid synthesis because the lipid synthesis pathway depended on NADPH source.[18] The results of this study showed that intake of low-fat yogurt had no significant effect on lowering the participants' lipid profiles. In agreement with this result, Nestel *et al*. also showed that intake of low-fat dairy in short time did not lead to significant lowering effect on lipid profiles compared to high-fat dairy product.[19] In addition, Maki *et al*. studied the effect of low-fat dairy consumption and nondairy low-fat product on lipid profile and concluded that there were no significant differences between them.[20] Bel-Serrat *et al*. revealed that overall dairy intake leads to decrease of lipid profile in cardiovascular disease.[21] Huo Yung Kai *et al*. assessed the effect of high- and low-fat dairy intake on lipid profile. They concluded that participants who consume a higher amount of low-fat dairy had a better LDL-C level but had not significant effect on HDL-C and TG levels.[22] Effects of dairy intake on the reducing level of lipid profile may be associated with calcium content of them. A study showed that intake of calcium had a significant effect on lowering the level of LDL-C, TC, and total HDL-C.[23]

Our study had some limitations which should be considered. In our study, factors and component of diet which may influence the results were not controlled; thus, our results may be affected by these confounders. Moreover, we could not follow patients for adherence to the intervention. The strength of this study was that it assessed the effects of shallot intake on human population for the first time. Moreover, it assessed the effect of yogurt and yogurt plus shallot on lipid profiles of diabetic patients, which was not performed previously. Furthermore, this study was performed among women because of the higher incidence of diabetic complications compared to men.[8]

## Conclusions

This study found that shallot intake significantly decreased LDL-C, TG, and TC levels in diabetic women. Having different dosages of shallot in future studies may find a better supplement for diabetic patients.

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### Conflicts of interest

There are no conflicts of interest.

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