Diabetes & Metabolic Syndrome: Clinical Research & Reviews 10S (2016) S11–S15

Contents lists available at ScienceDirect

Diabetes & Metabolic Syndrome: Clinical Research & Reviews

journal homepage: www.elsevier.com/locate/dsx

Original article

Different consumed oils and metabolic parameters in type 2 diabetes patients in diabetes society of Natanz

Alireza Milajerdi [a,1], Zahra Maghsoudi [b,2], Reza Ghiasvand [b,*]

[a] Nutrition Sciences and Dietetics College, Tehran University of Medical Sciences, Iran
[b] Nutrition and Food Sciences College, Isfahan University of Medical Sciences, PO Box: 81745, Iran

ARTICLE INFO

Keywords:
Consumed oil
Hypertension
Type 2 diabetes

ABSTRACT

Aims: This study, for the first time, has investigated the effect of highly consumed oils in Iran on type 2 diabetic patient's blood pressure.
Materials and methods: After measuring height, weight and blood pressure and calculating Body Mass Index (BMI) of 200 patients (30–65 years old) with type 2 diabetes (26.7% men, 73.3% women) in diabetes center of Natanz, their consumed oil was obtained by questionnaire, and their blood lipid and glucose were also measured. Data analyzed by SPSS 16 software, one-way ANOVA, independent T test, and Means procedure statistic tests.
Results: In mean procedure test, the highest average of systolic and diastolic blood pressure was in patients consumed solid and semi-solid oils; and the lowest was in patients consumed vegetable liquid oils. However, women consumed solid vegetable oils have lower systolic and mean arterial pressures. In one-way ANOVA test, there was a significant relation between consumed oil and hemoglobin A1C ($p = 0.049$) and diastolic blood pressure ($p = 0.032$).
Conclusion: Consumption of solid and semi-solid oils, especially animal fat, cause increasing in blood pressure of diabetic type 2 patients; but consumption of olive oil, and to a lesser extent liquid vegetable oils, related to lesser increasing in their blood pressure.

1. Introduction

Hypertension is a chronic disease that its prevalence has increased in recent years in Iran and all over the world and continues to increase. This disease causes many complications, including heart attack and stroke, kidney and eye disorders [1–3]. In Iran, about 27% of 45–69 years peoples and about 42% of people over 70 years suffer from hypertension and 3.1% of daily deaths are due to hypertension [4,5]. It is predicted that more than 1.5 billion peoples in the world will suffer from hypertension in 2025. About 65 million peoples in America suffer from hypertension [6]. Researchers have attributed 95% of hypertension attacks to diet and lifestyle. They assumed factors such as obesity, hyperlipidemia, hyperglycemia, age, gender, family history, etc. as the main contributing factors [6,7]. Hypertension makes diabetic patients more prone to cardiovascular diseases. Therefore, cardiovascular disease risk factors, including hypertension, control should be considered along with blood glucose control in diabetic patients [8,9]. In previous years, hypertension treatment was mainly based on medications, but in the recent years more attention has been directed on the treatment with changes in diet and lifestyle [10,11]. One of the most important issues in the dietary therapy is proper selection of oils. Major oils in Iran markets are including liquid oil for cooking, liquid oil for frying (partially hydrogenated), solid vegetable oil (hydrogenated), and olive oil. Liquid oils for cooking are including sunflower, canola, soybeans and corn oils. The major fatty acids in these oils are unsaturated fatty acids with several double bonds (Poly Unsaturated Fatty Acids = PUFA) [12,13]. However, liquid oils for frying are mostly a combination of liquid oils and partially hydrogenated palm oil. In addition to abundant saturated fatty acids, liquid oil for frying contained trans-fatty acids. Because trans-fatty acids are made during hydrogenation of the oil, hydrogenated oils also contained trans and saturated fatty acids, Asgari et al. study has shown that 21% of fatty acid composition of Iranian oils for frying are 16 and 18-carbon saturated fatty acids, so that, one-third of their total fatty acids are trans fatty acids [13]. Solid animal oils,

* Corresponding author. Tel.: +98 3117922742; fax: +98 31137922742.
E-mail addresses: amkhv@yahoo.com (A. Milajerdi), nutritionist2020@yahoo.com (Z. Maghsoudi), ghisvand@hlth.mui.ac.ir (R. Ghiasvand).
[1] Tel.: +98 9138619202.
[2] Tel.: +98 9131037334.

http://dx.doi.org/10.1016/j.dsx.2016.01.010
1871-4021/

contain large amounts of saturated fatty acids, using are also traditionally prevalent in Iran [12,13]. According to the studies, oils containing trans and saturated fatty acids may increase insulin resistance and blood pressure [14,15]. However, PUFAs, such as omega-3 and omega-6 fatty acids, consumption may prevent and treat insulin resistance and hypertension [16–18]. There is controversy about the effect of monounsaturated fatty acids (Mono Unsaturated Fatty Acids = MUFA) and olive oil, as the best source of MUFAs, on blood pressure [19–21]. It seems that the combination of increased blood glucose and oils containing trans and saturated fatty acids consumption can cause serious risk of hypertension in type 2 diabetic (T2D) patients. Therefore, appropriate oil selection is very important in T2D patients. Based on our search, there is no study about the effects of available oils in Iran on blood pressure in T2D patients. So, due to the importance of hypertension in patients with type 2 diabetes, this study aimed to determine the effect of available oils in Iran markets on blood pressure of T2D patients.

2. Materials and methods

This is a cross-sectional study conducted on 200 patients with type 2 diabetes (26.7% male, 73.3% women) in Diabetes society of Natanz, Isfahan, from October 2012 to July 2014. The study population was selected according to inclusion criteria. Inclusion criteria were: type 2 diabetes, 30 and 65 years old, new cases of diabetes, no drug users except dietary supplements without any effects on blood pressure, without comorbidities such as nephropathy, retinopathy, neuropathy and hyperlipidemia and without memory disorders. The selected patients signed a written consent after explaining the process and the objectives of the study. Then, a general Questionnaire containing demographic information, physical activity level, medical history or specific physiological conditions, age and gender were taken from the patients. Physical activity Levels were assessed by four selections including: without exercise (low activity), exercise three times or less per week (moderate activity) and regular exercise at least four times a week (High activity). The patients' size was measured by dividing height to wrist circumference (both in cm). The Patients' size was recorded as small size (more than 10.4 and 11 in men and women, respectively), moderate (9.6–10.4 in men and 10.1–11 in women) and large (less than 9.6 and 10.1 in men and women, respectively). A dietary questionnaire was also recorded. This questionnaire contained usual consumed oil at the past year, including olive oil, vegetable oil for cooking, vegetable oil for frying, solid animal oil, or solid vegetable oil selections. The questionnaire was semi-quantitative. Consumed oil was asked at three levels including oil used for cooking, oil used for frying and oil used for salad and food decoration. There was three scales in front of each of the three selections include: less than a teaspoonful, a teaspoonful to less than a tablespoon, and a tablespoon or more. The selections graded as 1, 2 and 3, respectively. So, calculated scores were between 3 and 9. If a specific oil scores were 6 or more, considered as usual consumed oil. The patients' height and weight were also measured and recorded. Weight measured without shoes and in light clothing, using digital calibrated scale to the nearest of 100 g (Seca707, Hamburg, Germany) and height measured standing and without shoes using standard stadiometer (Seca, Hamburg, Germany) to the nearest of 0.1 cm. Body Mass Index (BMI) was calculated using weight/(height)^2 formula in kg/(m)^2 and compared with international standards of World Health Organization (WHO). BMI between 25 and 29.9 kg/(m)^2 assumed as overweight, and BMI equal to or greater than 30 kg/(m)^2 as obesity. Lipid profiles (Total Cholesterol = TC, High Density Lipoprotein = HDL, Triglyceride = TG) and glucose profiles (Fasting Blood Sugar = FBS, 2-h Plasma Glucose = 2hPG, Hemoglobin A1C = HbA1C) were measured after 12 h of fasting in T2D new cases. All experiments have conducted in the central laboratory of Natanz, Isfahan. The patients consumed 82.5 g solute glucose monohydrate (equivalent to 75 g anhydrous glucose) and blood samples were taken after 2 h. Blood samples were centrifuged at 7000 rpm for 5 min, 20 min after sampling. FBS was measured at the same day by Selectra-2 auto-analyzer (Vital Scientific, Pankeren, Netherlands) using glucose kit (Pars Azmoon Co., Iran). The results of oral glucose tolerance test were classified according to WHO criteria, including normal glucose (2hPG $<$ 140 mg/dl), glucose intolerance (140 $<$ 2hPG $\leq$ 200 mg/dl), and diabetes (2hPG $\geq$ 200 mg/dl). For HbA1c measurement, total hemoglobin was primarily measured. For this purpose, Drabkin reagent was used. Hemoglobin converted to ciano-mett hemoglobin in the presence of the reagent, then the absorbance was read at 540 nm, and total hemoglobin concentration was calculated from the standard curve. HbA1c hydrolyzed by acetic acid and the obtained protein was reacted with the precipitator. Then, the top part reacts with the reagent and the absorption read at 430 nm. At the end stage, total hemoglobin percentage was calculated. Serum TC and TG were enzymatically measured using Pars Azmoon kit (Pars Azmoon Co., Iran). HDL-C concentration measured after deposition of lipoproteins containing apolipoprotein B (Apo B) with phosphotungstic acid. Blood pressure measured twice, each takes 30 s, one before and one after nutritional education, with a standard barometer calibrated by the Institute of Standards and Industrial Research of Iran. The mean of the two measurements was recorded as the patients' blood pressure. At any measuring, the subjects rested for 15 min, and then, a physician measured blood pressure. The patients were sitting and the cuff was closed on the right arm at heart level. Systolic Blood Pressure (SBP) was considered when the first sound of Chortkoff heard and diastolic Blood Pressure (DBP) when the Chortkoff sounds were disappeared. Emptying rate of the machine was 3–2 mm Hg per second. Mean arterial pressure (MAP) was calculated with the formula (sum of doubled DBP plus SBP divided by three). Finally, patients with BMI over 40 kg/(m)^2 and who were unwilling to continue the study were excluded. Moreover, patients in acute conditions like blood pressure more than 160/110 mm Hg, blood sugar over 500 mg/d, critical hyperlipidemia (HDL less than 30 mg/dl, TG more than 500 mg/dl, or TC more than 500 mg/dl) or patients with liver or kidney diseases were also excluded. Finally, 190 patients with T2D (130 women, 60 men) terminated the study. Data analyzed by SPSS version 16 (Inc. Co., USA) software. To compare mean systolic and diastolic blood pressures in men and women consumed various oils, means procedure test was used. The effects of consumed oil on blood pressure (SBP, DBP, and MAP) and blood glucose (FBS, 2hPG and HbA1c) markers were assessed by one-way analysis of variance. To determine differences between each paired oils, LSD post hoc test was used. In order to control the effects of consumed oil by age, sex, body size, BMI, physical activity and education level, ANCOVA test was used. To compare the number of patients with systolic and diastolic blood pressures less than the reference values (cutoff points) for diabetic patients, independent-t test was used.

3. Results

The patients mean BMI was at overweight range (women = 29.40 $\pm$ 4.30, men = 27.04 $\pm$ 4.12). Data analysis showed that liquid oils are the most common (47.5%) consumed oils. The results indicated that the educational level of 81.5% of the patients was less than diploma. Physical activity was moderate or severe only in 6.8% of the patients, and the rest had low physical activity (Table 1). The study also showed that the highest mean SBP was in men and women consumed solid vegetable and animal oils, respectively. In contrast, the lowest mean SBP was in men and women consumed