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Nut consumption is associated with lower incidence of type 2 diabetes: The Tehran Lipid and Glucose Study

G. Asghari [a], Z. Ghorbani [a,b], P. Mirmiran [a,*], F. Azizi [c]

[a] *Nutrition and Endocrine Research Centre, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences, Teheran, I.R., Iran*
[b] *School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences, Teheran, I.R., Iran*
[c] *Endocrine Research Centre, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences, Teheran, I.R., Iran*

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Abstract

Aim. – Nuts are rich in unsaturated fatty acids as well as other bioactive constituents. The present study investigated the association between nut consumption and the incidence of type 2 diabetes mellitus (T2DM) in a Middle Eastern population.

Methods. – The study was conducted within the framework of the Tehran Lipid and Glucose Study (TLGS), in which 1984 participants (920 men and 1064 women) free of DM, aged ≥ 20 years, were followed from phase III (2005–2008) to phase V (2011–2014). Dietary data were obtained from valid and reliable food-frequency questionnaires at baseline. Using multiple logistic regression, odds ratios (ORs) and 95% confidence intervals (CIs) were calculated, with adjustments for age, gender, BMI, serum cholesterol and triglycerides, smoking and energy intake.

Results. – Study participants' means ± SD of age and of BMI were 40.1 ± 13.1 years and 27.0 ± 4.8 kg/m^2, respectively. The median ± SE of their total daily consumption of nuts was 1.19 ± 0.11 servings. After 6.2 ± 0.7 years of follow-up, 150 cases of T2DM were confirmed. On comparing those who consumed ≥ 4 servings/week with those who consumed < 1 serving/week, the age-/energy-adjusted OR of incident T2DM for total nut consumption was 0.64 (95% CI: 0.36–1.12; *P* for trend = 0.03). In a fully adjusted model, nut consumption was associated with a lower risk of T2DM, and the ORs (95% CIs) of risk for those consuming 2–3.99 and ≥ 4 servings/week of nuts were 0.51 (0.26–0.97) and 0.47 (0.25–0.90), respectively, compared with those consuming < 1 serving/week (*P* < 0.001 for trend).

Conclusion. – Our findings suggest that consuming ≥ 4 servings/week of nuts reduced the risk of T2DM compared with < 1 serving/week.

Keywords: Incidence; Nuts; Type 2 diabetes

1. Introduction

The latest incidence figures for type 2 diabetes mellitus (T2DM) in Iran are 9.36 in men and 10.1 in women [1]. Data from the Surveillance of Risk Factors of Non-communicable Diseases, documented from 2005 to 2011 in Iran, show a 35% increase in the prevalence of DM during this time period, and call for urgent action and implementation of preventative programmes [2]. Microvascular (retinopathy, neuropathy, nephropathy) and macrovascular (hypertension, hyperlipidaemia, coronary artery disease, cerebral vascular disease, ischaemic heart disease [IHD], stroke, peripheral vascular disease) complications are the main results of T2DM [3–6].

In general, an unhealthy lifestyle – with a combination of sedentarity and poor dietary habits, including high intakes of energy (calories), total and saturated fatty acids, red and processed meats as well as sugary foods, and a low consumption of fibre, fruit and vegetables – is one of the best-known modifiable risk factors of T2DM [1,3,4,6,7].

Given that nuts are low in carbohydrate, a number of previous studies have shown that eating nuts, either alone or with other foods, can modify insulin resistance and reduce levels of postprandial glucose, thereby resulting in better glycaemic control

* Corresponding author. Nutrition and Endocrine Research Centre, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences, P.O. Box: 19395-4763, Tehran, Iran. Tel.: +98 21 22432503; fax: +98 21 22402463.
E-mail addresses: mirmiran@endocrine.ac.ir, parvin.mirmiran@gmail.com (P. Mirmiran).

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[8,9]. However, the results of previous prospective studies on the association of nut consumption with DM risk have been inconclusive [10–12]. Two prospective studies, the Nurses' Health Study (NHS) [10] and Shanghai Women's Health Study [11], have both suggested that increasing the frequency of nut intake can contribute to a decrease in the risk of DM [10,11]; a report from the Physicians' Health Study [12], however, found no association between nut consumption and risk of DM. In addition, evidence from two recent reviews of nut consumption and risk of T2DM, hypertension and IHD documented different findings [13,14]. Afshin et al. [13] reported an inverse association between incidence of DM and nut consumption whereas, in the meta-analysis conducted by Guo et al. [14], it was shown that the consumption of > 2 servings/week of nuts had no effect on the risk of DM.

Given these conflicting results, the effect of eating nuts on the incidence of T2DM is still not clear. In addition, to our knowledge, there has been no prospective cohort study from the Middle East and North Africa (MENA) region on the association of nut consumption and risk of T2DM. This raises a concern as to whether the findings of previous studies can be generalized to populations living in these countries, as they have rather different social, economic and cultural backgrounds. Thus, to address this question, the present study aimed to investigate the association between nut consumption and the incidence of T2DM in a population-based study carried out in the MENA region.

2. Materials and methods

2.1. Subjects

The present study was conducted within the framework of the Tehran Lipid and Glucose Study (TLGS), details of which have been reported previously [15]. The principal aim of the TLGS was to prevent non-communicable diseases (NCD) by designing and implementing programmes to promote healthy lifestyles and reduce NCD risk factors. In brief, this cohort study was first launched in 1999 and enrolled > 15,000 subjects with a minimum age of 3 years, selected using multistage random cluster sampling methods. All of the included subjects were residents under the coverage of three medical health centres in District no. 13 of Tehran, the capital city of Iran, and all were re-evaluated every 3 years. Phase I, which had a cross-sectional design, took place between 1999 and 2001, while phases II, III, IV and V were performed during 2002–2005, 2005–2008, 2008–2011 and 2011–2014, respectively, using a prospective cohort design.

Of the 12,523 subjects enrolled in phase III of the study, 3462 participants were randomly selected for information on their dietary intakes. For the present investigation, only participants who had complete dietary data, medical histories, laboratory and anthropometric measurements from phase III (2005–2008) were selected, and followed until phase V (2011–2014).

After exclusion of subjects who were aged < 20 years ($n = 199$), pregnant ($n = 19$), had a history of cancer, stroke or cardiovascular disease, or diabetes at baseline ($n = 176$), and over- and under-reporters ($n = 22$) during phase III, plus those who were missing data for any of the covariates in phase V ($n = 70$), a total of 1984 subjects were finally eligible for inclusion.

The study protocol was approved by the institutional ethics committee of the Research Institute for Endocrine Sciences, affiliated with the Shahid Beheshti University of Medical Sciences in Tehran. All participants signed an informed written consent form to participate.

2.2. Dietary intakes

Each subject was interviewed by a trained nutritionist, who had at least 5 years of experience in the TLGS survey, to complete a valid and reliable 168-item semi-quantitative food-frequency questionnaire (FFQ) [16]. To evaluate the reproducibility of the FFQ, 132 subjects (61 men and 71 women), aged ≥ 20 years, completed this FFQ twice, with a 14-month interval between FFQ1 and FFQ2. Over a 1-year period, 12 dietary recalls (DRs) were collected (1 per month) to assess the validity of the FFQ. The age-/energy-adjusted and deattenuated Spearman correlation coefficients to assess validity of the FFQ for total food groups was 0.44 (nuts: 0.54) in men and 0.37 in women (nuts: 0.39). The median age-/energy-adjusted intraclass correlation coefficient, which reflects the reproducibility of food groups in the FFQ, was 0.51 in men (nuts: 0.34) and 0.59 in women (nuts: 0.52). During face-to face interviews, participants were asked to provide details about their usual consumption frequency of various food items (such as nuts, seeds, peanuts, almonds, pistachios and walnuts) during the previous year on a daily, weekly or monthly basis. To calculate the mean daily intake of each food item, the frequency of consumption was multiplied by the amount consumed according to the recorded portion sizes, which were reported in household measures and then converted to grammes (g) based on raw or cooked coefficients. Energy (calorie) and nutrient contents were calculated, using US Department of Agriculture (USDA) food composition tables (FCTs), with Iranian FCTs used for local food items not found in the USDA FCTs.

Nuts included all kinds of tree nuts and seeds, including peanuts, almonds, walnuts, pistachios, hazelnuts, sunflower seeds, watermelon seeds and pumpkin seeds, and the compounds derived from them. Total nut consumption was calculated by summation of the items listed.

2.3. Measurement of covariates

At the time of entry to the study, all subjects were interviewed by trained interviewers using pretested questionnaires, and asked to provide details of their demographic data (age and education level), medical history of diagnosed diseases (cancer, stroke, cardiovascular disease, DM) and use of medications as well as smoking habits. Weight was measured with subjects minimally clothed and without shoes, using seca 707 digital scales (seca GmbH & Co., Hamburg, Germany) with 100 g accuracy (range: 0.1–150 kg). Height was measured using a tape measure with 0.5 cm accuracy, with subjects in a standing position and no shoes, and shoulders in normal alignment. Waist circumference was recorded to the nearest 0.1 cm at the level of the umbilicus