Clinical Nutrition ESPEN xxx (2018) e1–e5

Contents lists available at ScienceDirect

Clinical Nutrition ESPEN

journal homepage: http://www.clinicalnutritionespen.com

Randomized Controlled Trial

The effect of honey consumption compared with sucrose on lipid profile in young healthy subjects (randomized clinical trial)

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ARTICLE INFO

Article history:
Received 2 April 2018
Accepted 24 April 2018

Keywords:
Honey
Sucrose
Total cholesterol
Triacylglycerol (TG)
High density lipoprotein (HDL)
Low density lipoprotein (LDL)

SUMMARY

Background and aims: Several studies have demonstrated that honey consumption has beneficial effects on cardiovascular disease indicators. The current study aimed to investigate the effect of honey consumption compared with sucrose on lipid profile among young healthy subjects.

Methods: Sixty healthy subjects, aged 18–30 years, were randomly recruited into this double blind randomized trial and assigned into two groups: honey (received 70 g honey per day) and sucrose (received 70 g sucrose per day) groups. Total cholesterol, TG, LDL and HDL were measured in the control and intervention groups at the beginning and end of study.

Results: In this trial, the baseline FBS, SBP and DBP were not different between honey and sucrose groups ($P > 0.3$). We found evidence indicating consumption of honey can decrease total cholesterol, TG and LDL and increase HDL in healthy young subjects, but intake of sucrose increase total cholesterol, TG and LDL and decreased HDL. In all of these analyses, confounding variable including age, physical activity and some nutrient intake were adjusted.

Conclusions: Honey consumption can improve the lipid profile such as; total cholesterol, TG and LDL and increase HDL, but consumption of sucrose increases total cholesterol, TG and LDL and decreases HDL. Further clinical trial studies are required to confirm our findings.

1. Introduction

Cardiovascular diseases (CVDs) are a group of heart and blood vessels disorders that are a leading cause of morbidity and mortality in the world [1–3]. An estimated 17.3 million people died from CVDs in 2008, representing 30% of all global deaths a number that is expected to grow to >23.6 million by 2030 [2,4,5]. According to WHO, CVD is responsible for more than 45% of deaths in Iran [6]. The untreated cardiovascular disease may lead to ischemic heart disease which is the most common cause of death worldwide. Another fatal endpoint of cardiovascular disease is myocardial infarction which results in heart attack. Overall, untreated cardiovascular diseases can have high social and individual burden [7].

Apart from smoking, the main risk factors for CVD are elevated blood cholesterol, elevated blood pressure, obesity and diabetes [8]. All related factors can affect poor eating habits [9]. Among these risk factors is elevated blood cholesterol that can be changed by modified diet [10]. One of the dietary factors which are claimed that can affect lipid profile is displacing sucrose by honey [11]. In the past decades, honey has been considered as a complementary medicine, and the use of natural honey dates back to 2000 BC [12,13]. In previous studies, the antioxidant, anti-bacterial and healing effects of honey have been shown, while data about anti-hyperlipidemic, antihypertensive and blood glucose lowering effects of natural honey is limited and results remain inconclusive especially in RCTs [13,14]. Earlier studies that have investigated

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https://doi.org/10.1016/j.clnesp.2018.04.016

different effects of natural honey and sucrose consumption on blood lipid profile have reached conflicting results [15,16]. In relation to studies on total cholesterol (TC), there are several studies which have shown the reduction in its levels [15,16] and another study found no significant difference between intervention and control groups [17]. In regard to low-density lipoprotein 3 (LDL3) studies showed the reduction in its level [10–12] in Intervention group and another study [17] found no significant difference between two groups as well. In one study, the use of natural honey in combination with Nigella sativa (Kalonji) improved lipid profile in smokers with hyperlipidemia [18]. In another study, 10 g of natural honey per day for 70 days improved lipid profile in patients with type 2 diabetes, but these changes were not statistically significant [19]. In an animal study, Intravenous and intrapulmonary administration of honey solution improved lipid profile in healthy sheep [20]. In another study, honey consumption of 3 g per kilogram of body weight reduced the levels of low-density lipoprotein and cholesterol levels but did not show significant effects on levels of triglycerides and high-density lipoprotein in rats [13]. Overall, it seems that no definite conclusion is available about the influence of honey consumption on lipid profile.

Besides the controversy in earlier findings, it must be kept in mind that a lot of previous studies were on the animal patient subjects and limited data are available about the effect of honey and sucrose consumption on lipid profile in healthy subjects. If the positive effects of honey consumption on lipid profile are confirmed then we can hope to reduce one of the cardiovascular risk factors and thereby reduce the heavy burden of the disease. Given the limited information, we aimed to investigate the effect of honey consumption compared with sucrose on lipid profile among a young healthy group of Iranians.

2. Materials and methods

2.1. Study participants

This trial was done on the male student of Isfahan University of Medical Sciences with age range of 18–30 years. Subjects were asked to participate in the study by advertising at faculties of Isfahan University of Medical Sciences, Isfahan, Iran. 72 subjects enrolled in this trial which after examination by general practitioner 60 individuals of them have inclusion criteria and were selected to participate in this study. We conducted a randomized control trial including sixty healthy subjects, aged between 18 and 30 years, participating in this study that was selected randomly from students of Isfahan University of Medical Sciences by the use of systematic clustering sampling method. Participants were included in the study if they were aged 18–30 years old, healthy, male, non-athletic and non-smoker. Students were randomly allocated to the experimental (n = 30) or control group (n = 30) using permuted block allocation method. We calculated sample size by the following formula as:

$$n = \frac{2(Z1 + Z2)\sigma^2}{d^2},\ \alpha = 0.05,\ 1 - \beta = 0.8 \text{ and } d = 0.8$$

Participants were asked not to change their physical activity or diet during the period of study. Exclusion criteria were included: subjects that consumed a substantial amount of honey daily or took any sort of medication or changed their diet and lifestyles. We administered 70 g of natural honey solved in 250 mL tap water in the experimental group and 70 g of sucrose solved in 250-mL tap water in control group per day for 6 weeks. We assessed dietary intake with using 3-day diet record at the beginning and end of the study Physical activity level was determined by using International Physical Activity Questionnaire (IPAQ), which its reliability and validity in Iran is accomplished [21]. This questionnaire assesses walking time, moderate and vigorous intensity physical activities, and time spent sitting across a common week. Informed written consent was obtained from each subject that was approved by the Isfahan University of Medical Science Ethics Committee and this trial registered in Iranian registry of clinical trials (IRCT) with code IRCT2014111519966N1.

2.2. Biochemical analysis

A 5 ml blood sample was collected from each subject in the morning after a 12-h fasting. Fasting lipid profile including total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein (LDL-C) and triacylglycerol (TG) was determined for each subject at baseline. We used enzymatic kits for the measurements (Pars Azmoon, Iran). We took blood samples from the left ventricle of the heart and collected into the test tubes to obtain serum. Samples were subsequently centrifuged for 10 min (4000 × g). Serum was separated and used for the assessment of lipid profile. The within and between assay precisions were less than one percent for all biochemical assays. The laboratory tests were repeated one month after commencement of intervention.

2.3. Statistical analysis

Data are expressed as mean ± SD. We used the Kolmogorov–Smirnov test to examine the normal distribution of variables. We used Student's t-test and Chi-square test to assess differences between means of quantitative and qualitative variants respectively in honey and sucrose groups. For statistical analysis Paired t-test was used to compare means before and after intervention in the same group and unpaired t-test to compare between case and control group. We used analysis of Covariance to examine variations after adjusting for confounding factors, such as physical activity and age. Statistical analyses were performed using SPSS software (version 21; SPSS, Chicago, Ill). Results were considered significant when $P < 0.05$.

3. Result

Demographic information of the study participants in honey and sucrose group are provided in Table 1. All participants completed study (Fig. 1). We found that individuals in sucrose group were older than participants in the honey group. Physical activity, BMI, FBS, SBP, and DBP were not significantly different between the two groups ($P > 0.1$). The nutrient intakes of subjects in honey and sucrose groups are shown in Table 2. Participants in the honey group had a

Table 1
General characteristics of participants in honey and sucrose groups.

Variables	Honey group[a]	Sucrose group[b]	P-value[c]
Age (year)	21.53 ± 1.63	24.23 ± 1.88	<0.001
Weight (kg)	73.63 ± 14.23	68.33 ± 12.71	0.13
BMI (kg/m^2)	23.37 ± 4.04	22.55 ± 3.92	0.43
FBS (mg/dl)	82.80 ± 7.51	82.76 ± 6.88	0.98
SBP (mmHg)	126.43 ± 6.48	128.16 ± 6.88	0.32
DBP (mmHg)	82.16 ± 5.43	83 ± 7.38	0.62
PAL (Met-hour/week)	1899.5 ± 450.2	1923.5 ± 494.9	0.84

Data is presented as mean and standard.
Abbreviation: Body mass index, fasting blood sugar, systolic blood pressure, diastolic blood pressure, physical activity level, Daily Metabolic Equivalent.
[a] Received 70 g honey per day.
[b] Received 70 g sucrose per day.
[c] Obtained from independent sample t test.

Please cite this article in press as: Rasad H, et al., The effect of honey consumption compared with sucrose on lipid profile in young healthy subjects (randomized clinical trial), Clinical Nutrition ESPEN (2018), https://doi.org/10.1016/j.clnesp.2018.04.016