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Original Research

Effect of Royal Jelly Intake on Serum Glucose, Apolipoprotein A-I (ApoA-I), Apolipoprotein B (ApoB) and ApoB/ApoA-I Ratios in Patients with Type 2 Diabetes: A Randomized, Double-Blind Clinical Trial Study

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ABSTRACT

Objectives: Type 2 diabetes is the most common metabolic disorder worldwide. Evidence supports a role for royal jelly (RJ) in reduction of serum glucose and lipids in animals and healthy subjects. The purpose of this study was to determine the effect of RJ intake on serum glucose, apolipoprotein A-I (ApoA-I), apolipoprotein B (ApoB) and ApoB/ApoA-I ratios in patients with type 2 diabetes.
Methods: Fifty patients with type 2 diabetes participated in a double-blind, placebo-controlled study. The participants were randomly divided into RJ and placebo groups and were given doses of 1000 mg royal jelly or placebo 3 times a day for 8 weeks, respectively. Weight, height, fasting blood glucose, ApoA-I and ApoB were measured at baseline and endpoint.
Results: There were no significant differences in baseline characteristics and dietary intakes between groups. The mean difference in glucose concentrations decreased in the RJ group (–9.4 mg/dL vs. 4 mg/dL; p=0.011). The mean difference in ApoA-I concentrations increased in the RJ group (34.4 mg/dL vs. –1.08 mg/dL; p=0.013). There was a significant decrease in mean difference of ApoB/ApoA-I in the RJ group compared with the placebo group (0.008 vs. 0.13; p<0.044), respectively.
Conclusions: These data suggest that RJ intake may have desirable effects on serum glucose, Apo-A-I concentrations and ApoB/ApoA-I ratios in people with type 2 diabetes.

Mots clés :
ApoA–I
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RÉSUMÉ

Objectifs : Le diabète de type 2 est la maladie métabolique la plus fréquente dans le monde. Les données probantes établissent un lien entre la gelée royale (GR) et la réduction du glucose sérique et des lipides chez les animaux et les sujets sains. L'objectif de la présente étude était de déterminer l'effet de l'apport en GR sur le glucose sérique, l'apolipoprotéine A –I (ApoA–I), l'apolipoprotéine B (ApoB) et les ratios ApoB/ApoA –I des patients souffrant du diabète de type 2.
Méthodes : Cinquante patients souffrant du diabète de type 2 ont participé à l'étude comparative contre placebo, à double insu. Nous avons réparti de manière aléatoire les participants en un groupe GR et un groupe placebo, soit des doses respectives de 1000 mg de GR ou du placebo 3 fois par jour durant 8 semaines. Nous avons mesuré le poids, la taille, la glycémie à jeun, l'ApoA–I et l'ApoB au début et à la fin.
Résultats : Nous n'avons observé aucune différence significative dans les caractéristiques initiales et les apports alimentaires entre les groupes. La différence moyenne dans les concentrations de glucose a diminué dans le groupe GR (–9,4 mg/dl *vs* 4 mg/dl; p=0,011). La différence moyenne dans les concentrations d'ApoA –I a diminué dans le groupe GR (34,4 mg/dl *vs* –1,08 mg/dl; p=0,013). Nous avons observé une diminution significative dans la différence moyenne du ratio ApoB/ApoA –I dans le groupe GR par rapport au groupe placebo (0,008 *vs* 0,13; p<0,044), respectivement.

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Conclusions : Ces données suggèrent que l'apport en GR peut avoir des effets bénéfiques sur le glucose sérique, les concentrations d'ApoA –I et les ratios ApoB/ApoA –I chez les personnes souffrant du diabète de type 2.

Introduction

The prevalence of type 2 diabetes is increasing, rising from 171 million in 2000 to an expected level of 366 million in 2030 (1), and up to 90% of diabetes cases are type 2 diabetes (2). Also, this prevalence is reported to be more than 14% in Tehran, Iran, with an estimated incidence of new cases in about 1% of population per year (3).

Type 2 diabetes is one of the major metabolic disorders and is associated with great morbidity and economic cost. Apart from hyperglycemia, type 2 diabetes is also characterized by oxidative stress, inflammation and insulin resistance (4). Dietary intervention has been successfully proven to improve serum lipid levels and glycemic profiles in adults with type 2 diabetes (5).

Royal jelly (RJ) is a traditional product commonly used as a supplement in medical treatments of various diseases. It is secreted from the hypopharyngeal and mandibular glands of young worker bees to feed larvae and the adult queen bee (6). RJ is a unique substance containing a combination of free amino acids, proteins (12% to 15%), sugars (10% to 12%), fatty acids, lipids (3% to 7%), bioactive substances such as 10-hydroxy-trans-2-decenoic acid, vitamins and minerals (7–9).

RJ has been demonstrated to possess several pharmacologic activities in experimental animals and in some human studies, including vasodilator and hypotensive activities (10,11) antioxidative activity (12), antitumour activity (13,14), antihypercholesterolemic activity (15,16) and anti-inflammatory activity (17). To date, most studies have been designed to be used in rats or have been achieved in vitro, and a few of them have been designed for healthy humans.

Therefore, the purpose of the current study was to determine the effects of RJ consumption on serum glucose, ApoA-I, ApoB and ApoB/ApoA-I ratios in people with type 2 diabetes compared with a group receiving placebo.

Methods

This parallel design, randomized double-blind placebo-controlled study was financially supported by Iran University of Medical Sciences (p/1006), Tehran, Iran.

Subjects

All subjects were adult volunteers with type 2 diabetes according to the definition by the American Diabetes Association, which includes serum fasting glucose ≥126 mg/dL, 2-hour plasma glucose levels ≥200 mg/dL and glycated hemoglobin (A1C) levels of 6% to 8%, after 2 tests and confirmation by an endocrinologist. They were recruited mainly among the patients who were referred to the Endocrinology and Metabolism Research Center of Iran University of Medical Sciences, Tehran, Iran. The purpose and expectations of the study were explained to each volunteer. The participants freely volunteered to participate in the present study and could withdraw from the study whenever they wished. Eligible patients were included after we received written informed consent.

Study criteria included patients who had had type 2 diabetes for 5 to 10 years, were between 20 and 65 years of age, had body mass indexes between 20 and 30, had taken glucose-lowering medications for type 2 diabetes (antidiabetic drugs such as metformin, glibenclamide or both) without insulin injection, had no histories of alcohol abuse or smoking, were taking no supplements (including vitamins and minerals and also lipid-lowering drugs) during the 3 months before and during the study, had no hepatic or renal disease, and had no history of cancer or myocardial infarction.

Exclusion criteria were total serum cholesterol and triglyceride levels above 240 and 400 mg/dL, respectively; any sign of sensitivity to RJ at any time during the study; pregnancy or lactation; taking oral contraceptives during the study and starting insulin injection.

The study was approved by the Ethics Committee of Iran University of Medical Sciences, Tehran, Iran (registration #90-01-122-12592) and was registered on the Iranian Registry of Clinical Trials website (IRCT138905102709N8).

Experiment design

Among the 50 volunteers with type 2 diabetes, 46 patients were randomly divided into 2 groups—the RJ group (13 females and 10 males, 51.8±9.7 years) and the placebo group (11 females and 12 males, 53.1±7.5 years). The RJ group was given 3000 mg RJ capsules per day (Natural Life, Frengrove, Australia), and the placebo group received 3 capsules that looked exactly the same but contained glycerin, which could not be distinguished by color, odor or taste (Pars Minoo, Tehran, Iran) for 8 weeks.

The participants were specifically asked to maintain their usual diets, physical activities and medications during the study period. Medical and drug histories were obtained via face-to-face interviews. The dietary intakes of patients were assessed using a 24-hour-recall food questionnaire for 3 days (2 weekdays and 1 weekend day) at the beginning, at week 4 and at the end of 8 weeks. All of the 24-hour-recall questionnaires were analyzed by the Nutritionist IV software program (v. 4.1), and mean intakes of energy, macronutrients and some of the micronutrients were calculated. Physical activity was measured by an International Physical Activity Questionnaire (18) at baseline and at the end of the study. Compliance with the supplementation protocol was supervised by a research technician who contacted the subjects once a week. Each subject was required to return the original bottle of their respective supplement for capsule counts, and compliance was monitored by counting the unconsumed capsules each week.

All subjects were stable because medications had not been modified over the past month, and there was homogeneity regarding their treatments (metformin, glibenclamide or both).

Blood samples (10 mL) were collected from each patient after 12 to 14 hours of fasting, between 8 AM and 10 AM. Fasting blood sugar levels were measured by an autoanalyzer using an enzymatic method (Pars Azmon kit, Tehran, Iran). ApoA-I and ApoB were measured by immunoturbidimetry (Pars Azmon) with a Cobas MIRA analyzer (Roche Diagnostic, Basel, Switzerland).

Statistical analyses

In designing the study, we considered power of 90% with a 2-sided test, with alpha=0.05 (type I error) to detect a 5% difference in serum glucose between the 2 groups. On the basis of standard deviations (SDs) reported in a similar study (16), the number of subjects needed to treat to detect this difference was 20 per group. Given an anticipated dropout rate of 25%, we set the enrollment target at 25 subjects.