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The effect of ginger powder supplementation on insulin resistance and glycemic indices in patients with type 2 diabetes: A randomized, double-blind, placebo-controlled trial

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KEYWORDS
Ginger;
Diabetes mellitus;
Insulin resistance

Summary
Objective: To identify the effect of some herbal products on insulin resistance. Regarding the scientific evidences existing about ginger, this research was therefore carried out to identify the effect of ginger supplementation on insulin resistance and glycemic indices in diabetes mellitus.
Methods: This is a randomized, double-blind, placebo-controlled trial in which 88 participants affected by diabetes were randomly assigned into ginger (GG) and placebo (PG) groups. The GG received 3 one-gram capsules containing ginger powder whereas the PG received 3 one-gram microcrystalline-containing capsules daily for 8 weeks. HbA1c, fructosamine, fasting blood sugar (FBS), fasting insulin, homeostasis model assessment insulin resistance index (HOMA-IR), β-cell function (*β*%), insulin sensitivity (*S*%) and the quantitative insulin sensitivity check index (QUICKI) were assessed before and after the intervention.
Results: FBS mean showed a decrease of 10.5% ($p = 0.003$) in the GG whereas the mean had an increase of 21% in the PG ($p = 0.01$). Variation in HbA1c mean was in line with that of FBS. Statistical difference was found in the two groups before and after the intervention in terms of median of fasting insulin level, *S*% and HOMA-IR ($P < 0.005$). Moreover QUICKI mean increased significantly in the two groups, the mean difference, however, was significantly higher in the GG.

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Conclusions: The study demonstrated that daily consumption of 3 one-gram capsules of ginger powder for 8 weeks is useful for patients with type 2 diabetes due to FBS and HbA1c reduction and improvement of insulin resistance indices such as QUICKI index.

Introduction

Diabetes mellitus (DM) is a disease which is diagnosed by increase in blood sugar concentration. This can be due to deficiency of insulin secretion or of insulin function or both. Patients with diabetes are estimated to amount to more than 366 million in 2030 being more than twice of the rate in 2000.[1] Most of the new cases will be from the developing countries and seemingly Middle East will suffer most from diabetic prevalence till 2020.[1,2] The prevalence of type 2 diabetes is high in the Middle East; the rate of 7.7% has been reported for Iran.[3] In another study in Iran, the rate has been estimated 8.7% in 15—64 years old population.[4] This type of diabetes has been estimated to be 14.2% from +30 y which is the highest in Yazd, Iran.[5]

Insulin resistance has an important role in causing type 2 diabetes and the resultant cardiovascular disease and is an independent risk factor for cardiovascular diseases even in nondiabetic patients.[6] Insulin resistance which exists in all patients with type 2 diabetes is defined as cells inefficiency in uptake of glucose from blood in the presence of insulin. This first causes increase in insulin secretion and later insufficiency of pancreas in overcoming insulin resistance which finally leads to diabetes symptoms.[7] In other words, insulin resistance is a metabolic condition in which tissues response to physiologic rate of insulin is lower than normal.[8]

The prevalence of DM in the developing countries of the Middle East gives credence to the urgency of finding new treatment strategies. Virtually about 3/4 of the people of the world have trust in traditional treatments especially herbal treatments; until the mid-19th century at least 8% of the medicines were herbal derivatives.[9]

Ginger plant, with the scientific name of *Zingiber Officinale* is a highly-utilized spice in the world and has been in use for more than 2500 years in China traditional medicine for treating problems such as rhinitis, rheumatism, nervous system diseases, gingivitis, toothache, asthma, constipation, diabetes,[10] maldigestion, diarrhea, nausea and vomiting, cardiopathy, hypertension and palpitation.[9]

Ginger is a herb, the herbal properties of which are similar to non-steroid anti-inflammatory drugs (NSAIDs), therefore, it can regulate biochemical pathways which are activated with chronic inflammation such as diabetes.[11] Laboratory studies have shown that ginger bears anti-inflammatory effect which can prevent arachidonic acid metabolism with inhibition of cyclooxygenase and lipooxygenase pathways.[12,13] As a result, there is the possibility of ginger having this effect due to inhibition of prostaglandins and leukotrienes production.[14]

Gingerols are one of the ginger active components which inhibit production of inflammation-causing prostaglandins.[15] One of the possible effects of ginger is inhibition of hepatic phosphorylase to reduce hepatic glycogenolysis and to increase activity of the enzymes which cause progression of glycogenesis. Another possible effect of ginger can be inhibition of the activity of hepatic glucose-6-phosphatase enzyme thereby causing reduction of blood glucose.[16]

In a study conducted by Shirdel et al. in Iran (2009), the antidiabetic and antilipidemic effects of ginger on diabetic mice were affected by aloxanmonohydrate and their comparison with glibenclamide was investigated the results of which represented a significant decrease of serum glucose by ginger in the diabetic mice.[17] In another study accomplished by Singh et al. (2009) in India, the blood glucose lowering, lipid lowering, and antioxidant effect of [6]-gingerol in type 2 diabetic db/db mice was investigated.[18] Also Goyal et al. (2006) in India produced significant reduction in body weight, glucose, insulin and lipid concentration as compared to controlled obese mice.[19]

Despite different scientific evidences there is no agreement regarding various ginger effects and few studies to date have been conducted on ginger and its relation with insulin resistance in patients with diabetes. This study was, therefore, carried out to determine the effect of ginger powder supplementation on insulin resistance and glycemic indices in patients with type 2 diabetes.

Material and methods

Type of study, participants and sample size

This is a randomized, double-blind, placebo-controlled trial with the participation of 88 patients with type 2 diabetes conducted in Yazd Diabetes Research Center between January to July 2012. Considering $\alpha = 0.05$, power of the test equal to 80%, and achieving two units of significant differences between groups in mean insulin resistance, sample size was estimated to be 40. Assuming a10% attrition, 44 patients in each group were included.

Inclusion criteria were: Having type 2 diabetes for at least 10 years, FBS <180 and 2 h-blood-sugar <250 mg/dl, no pregnancy or lactation, no autoimmune disorder, no cardiac ischemic or renal diseases, no thyroid and chronic inflammatory diseases, peptic ulcer and infection, no regular consumption of ginger or other herbal drugs, no sensitivity to ginger, body mass index (BMI) <40 kg/m^2, no consumption of triglyceride or cholesterol-, estrogen-, progesterone-lowering drugs, and no consumption of any supplements such as vitamin C, E, and omega 3 during 2 months before starting the research.

Exclusion criteria were: No observation of research protocol (no consumption of more than 20% of the capsules), any sensitivity due to ginger consumption reported by the patient or noticed after the outset of the study, consumption of vitamin, mineral or other nutritional supplements, consumption of alcohol or narcotic drugs, and any variation in patients' routine treatment according to physicians' resolution (i.e., variation in type and dose of the drugs to be consumed, and treatment with insulin).

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