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MANNANS AND GLYCEMIC INDEX

Effects of Locust Bean Gum on Glucose Tolerance, Sugar Digestion, and Gastric Motility in Rats
ALAN C. TSAI AND BECKY PENG
Human Nutrition Program, School of Public Health, University of Michigan, Ann Arbor, MI 48109

ABSTRACT Effects of selected indigestible gel-forming complex carbohydrates, including locust bean gum, guar gum, and pectin, on glucose tolerance and food motility were studied in rats. Addition of 2.5% of guar gum or locust bean gum to an oral glucose tolerance test solution significantly altered the postprandial serum glucose response. Although all three complex carbohydrates tested did not reduce the initial rise in serum glucose, locust bean gum and guar gum significantly reduced its subsequent rebound hypoglycemia. Further tests with locust bean gum showed that these effects were dependent on the concentration of the gum added to the test solution or diet. Addition of locust bean gum to test diets reduced the rate of gastric emptying and thus slowed down the passage of food from the stomach into the upper small intestine. The study suggests that addition of locust bean gum to the diet can flatten the post prandial serum glucose curve by slowing the rate of food passage from the stomach into the small intestine. It is probable that locust

Hydrolyzed guar gum decreases postprandial blood glucose and glucose absorption in the rat small intestine.
Faculty of Human Life Science, Mimasaka University, Tsuyama, Okayama 708 8511, Japan. takahashitoru71@nifty.com

Abstract
We hypothesized that infusing partially hydrolyzed guar gum (PHGG) into the duodenum would reduce increases in postprandial plasma glucose by decreasing the rate of glucose diffusion from the small intestine luminal digesta of the rat. The postprandial plasma glucose and apparent glucose disappearance from the small intestine were measured after infusing artificial digesta containing 0 (control), 3.0, or 6.0 g/L PHGG into the duodenum via a cannula under anesthesia in experiments 1 and 2. The diffusion of glucose in the artificial digesta was estimated using dialysis tubing, filled with the same artificial digesta, soaked in a buffer in experiment 3. In experiment 1, the plasma glucose concentration was lower in the digesta containing 3.0 and 6.0 g/L PHGG than in the control digesta at 120 minutes (P < .05). The plasma insulin concentration was lower for the digesta containing 6.0 g/L PHGG than for the control digesta at 60 minutes (P < .05) and lower for the digesta containing 6.0 g/L PHGG than for that containing 3.0 g/L PHGG at 120 minutes (P < .05). The area under the curve of plasma glucose and insulin (experiment 1), apparent disappearance of glucose in the lumen of the small intestine (experiment
2), and net disappearance of glucose in the dialysis tube depended negatively on the viscosity of the artificial digesta ($P < .05, .05, .001, and .05$), which was increased by adding PHGG. Therefore, PHGG can decrease the postprandial blood glucose by lowering the rate of absorption from the small intestine in the rat by reducing the diffusion of glucose in the lumen.

PMID: 19628109 [PubMed - indexed for MEDLINE]

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**The biological activities of mannans and related complex carbohydrates.**

**Tizard IR, Carpenter RH, McAnalley BH, Kemp MC.**

Department of Veterinary Microbiology and Parasitology, College of Veterinary Medicine, Texas A&M University, College Station 77843.

**Abstract**

Complex polymers containing mannose (mannans) possess significant biological activity when administered to mammals. When given orally, they inhibit cholesterol absorption and induce hypocholesterolemia. If administered by other routes, they bind to mannose-binding proteins and induce macrophage activation and interleukin-1 release, inhibit viral replication, stimulate bone marrow activity, promote wound healing and inhibit tumor growth. This range of activities makes the mannans, potentially important biological-response modifiers and therapeutic agents.

PMID: 2692629 [PubMed - indexed for MEDLINE]
Effect of a modified guar gum preparation on glucose and lipid levels in diabetics and healthy volunteers.
Smith U, Holm G.

Six healthy volunteers and 17 diabetics (6 insulin-dependent and 11 diet- and tablet-treated) were treated with a special processed, palatable guar gum (10 g b.i.d. immediately before meals) for periods of one or three weeks or, in some cases, up to 13 weeks. A standardized test meal was given to study the effect of the fiber on postprandial glucose levels. Ten g guar was stirred in water and taken immediately before the test meal. The postprandial blood glucose levels were similar in the healthy volunteers but significantly lower in the diabetics following treatment with guar for one and three weeks, respectively. Furthermore, the fasting blood glucose levels were significantly lower in the diabetics after three, but not one, weeks of treatment. The lower postprandial glucose levels were coupled with attenuated and delayed insulin levels in accordance with an effect of guar gum on the rate of carbohydrate absorption. The cholesterol levels were on average reduced with 14% in the diabetics following three weeks' treatment with guar. The higher the initial cholesterol level, the greater the reduction in cholesterol; 26% reduction was achieved in four patients with initial levels above 7 mM. The alpha-lipoprotein cholesterol levels were not significantly changed, thus an increase in the alpha-lipoprotein cholesterol/total serum cholesterol ratio was obtained. Neither plasma triglycerides nor body weights altered during treatment. The reported side-effects
were as expected and were usually mild and transient (e.g. increased flatulence). The data show that guar gum also reduces postprandial glucose levels on a long-term basis and may improve the diabetic control. Additionally, treatment with this fiber leads to a concentration-dependent decrease in cholesterol levels.

PMID: 6297515 [PubMed - indexed for MEDLINE]

Comparison of guar gum, wheat bran and placebo on carbohydrate and lipid metabolism in type II diabetics
1990 Mar 24;120(12):402-8
Departement Innere Medizin, Abteilung Endokrinologie und Stoffwechsel, Kantonsspital Basel.

10 non-insulin-dependent (NIDDM) diabetic patients of the University Hospital Basle completed a placebo-controlled open crossover study of three 3-month periods in which the response to 30 g wheat bran and 15 g guar gum daily, respectively, was compared with placebo response. No significant difference occurred in blood glucose or HbA1c. Only postprandial plasma insulin levels were significantly lower in the afternoon at the end of both treatments (p less than 0.05). Serum total cholesterol levels decreased under guar gum by 10% (p less than 0.01), as did LDL cholesterol and the ratio of total to HDL cholesterol (p less than 0.05). Triglycerides were significantly lower (p less than 0.05) after 8 weeks. We conclude that neither guar gum nor wheat bran improves the metabolic control of NIDDM, but guar gum may be useful in patients with high serum total cholesterol levels.
Publication Types:
• English Abstract
• Review
PMID: 2157279 [PubMed - indexed for MEDLINE]
Effects of a partially hydrolyzed guar gum on intestinal absorption of carbohydrate, protein and fat: a double-blind controlled study in volunteers.
Gastroenterology Unit, University Hospital, Liestal, Switzerland.

Some dietary fibers have been shown to affect the rate of absorption of dietary carbohydrate, protein and fat as well as exocrine pancreatic function. The aim of the study was to examine the effect of partially hydrolysed guar gum (BENEFIBER), on normal absorption of glucose, amino acid (arginine) and fat. In addition hepatic, pancreatic, renal and hematological side effects were evaluated. METHODS: A double blind, randomized and cross-over design was used. Each subject served as its own control. Ten healthy male volunteers participated in the study. Each subject was randomly assigned to two different dietary regimes for a period of 7 days each. The study was repeated with the other diet for another 7-day period after an interval of at least 1 week. In one study period the subjects took liquid formula diet without fiber and during the other study period they took the same diet with fiber. RESULTS: The results of the study demonstrated that BENEFIBER did apparently not interfere with the normal absorption of glucose, amino acid and fat. In keeping with these
observations, insulin release and exocrine pancreatic function were not affected. Hematological, renal and hepatic toxicity were not observed in association with BENEFIBER consumption.

CONCLUSION: We conclude that BENEFIBER is a safe source of soluble fiber.

Publication Types:
• Clinical Trial
• Randomized Controlled Trial
• Research Support, Non-U.S. Gov't

PMID: 10205329 [PubMed - indexed for MEDLINE]

Dietary fibres, fibre analogues, and glucose tolerance: importance of viscosity.

To define the type of dietary fiber of fiber analogue with the greatest potential use in diabetic treatment, groups of four to six volunteers underwent 50-g glucose tolerance tests (GTT) with and without the addition of either guar, pectin, gum tragacanth, methylcellulose, wheat bran, or cholestyramine equivalent to 12 g fiber. The addition of each substance significantly reduced blood glucose concentration at one or more points during the GTT and generally reduced serum insulin concentrations. The greatest flattening of the glucose response was seen with guar, but this effect was abolished when hydrolysed non-viscous guar was used. The reduction in the mean peak rise in blood glucose concentration for each substance correlated positively with its viscosity (r = 0.926; P less than 0.01), as did delay in mouth-to-caecum transit time (r = 0.885; P less than 0.02). Viscous types of dietary fiber are therefore most likely to be therapeutically useful in modifying postprandial hyperglycaemia.

Publication Types:
• Clinical Trial
• Randomized Controlled Trial

PMID: 647304 [PubMed - indexed for MEDLINE]
Effect of Trigonella foenum-graecum (fenugreek) seeds on glycaemic control and insulin resistance in type 2 diabetes mellitus: a double blind placebo controlled study.


OBJECTIVES: To evaluate the effects of Trigonella foenum-graecum (fenugreek) seeds on glycemic control and insulin resistance, determined by HOMA model, in mild to moderate type 2 diabetes mellitus we performed a double blind placebo controlled study. METHODS: Twenty five newly diagnosed patients with type 2 diabetes (fasting glucose < 200 mg/dl) were randomly divided into two groups. Group I (n=12) received 1 gm/day hydroalcoholic extract of fenugreek seeds and Group II (n=13) received usual care (dietary control, exercise) and placebo capsules for two months. RESULTS: At baseline both the groups were similar in anthropometric and clinical variables. Oral glucose tolerance test, lipid levels, fasting C-peptide, glycosylated haemoglobin, and HOMA-model insulin resistance were also similar at baseline. In group 1 as compared to group 2 at the end of two months, fasting blood glucose (148.3 +/- 44.1 to 119.9 +/- 25 vs. 137.5 +/- 41.1 to 113.0 +/- 36.0) and two hour postglucose blood glucose (210.6 +/- 79.0 to 181.1 +/- 69 vs. 219.9 +/- 41.0 to 241.6 +/- 43) were not different. But area under curve (AUC) of blood glucose (2375 +/- 574 vs 27597 +/- 274) as well as insulin (2492 +/- 2536 vs. 5631 +/- 2428) was significantly lower (p < 0.001). HOMA model derived insulin resistance showed a decrease in percent beta-cell secretion in group 1 as compared to group 2 (86.3 +/- 32 vs. 70.1 +/- 52) and increase in percent insulin sensitivity (112.9 +/- 67 vs 92.2 +/- 57) (p < 0.05). Serum triglycerides decreased and HDL cholesterol increased significantly in group 1 as compared to group 2 (p < 0.05). CONCLUSIONS: Adjunct use of fenugreek seeds improves glycemic control and
decreases insulin resistance in mild type-2 diabetic patients. There is also a favourable effect on hypertriglyceridemia.
Publication Types:
• Clinical Trial
• Comparative Study
• Randomized Controlled Trial
PMID: 11868855 [PubMed - indexed for MEDLINE]

Effect of fenugreek, onion and garlic on blood glucose and histopathology of pancreas of alloxan-induced diabetic rats.
Jelodar GA, Maleki M, Motadayen MH, Sirus S.
Department of Physiology, College of Veterinary Medicine, Shiraz University, Shiraz 71345, Iran. jelodar@shirazu.ac.ir

BACKGROUND: Many traditional treatments have been recommended in the alternative system of medicine for treatment of diabetes mellitus; however, the mechanism of most of the herbals used has not been defined. AIMS: This study was carried out to clarify the effect of fenugreek, garlic and onion, recommended in Persian folklore medicine as beneficial in the treatment of diabetes, on blood glucose and their possible effect on pancreatic tissue. METHODS AND MATERIAL: Diabetes mellitus was induced in 20 out of 25 adult male albino rats, using intraperitoneal injection of 185 mg/kg BW alloxan. The diabetic rats were divided into four groups, three of which were fed a diet containing 12.5% BW Allium sativum (garlic), Allium cepa (onion) or Trigonella foenum-graecum (fenugreek) for 15 days. The fourth group (positive control) received an ordinary diet. The remaining non-diabetic rats (negative control group) received neither alloxan nor the mentioned plants. Following consumption of plants, blood glucose was measured every day and on the last day the pancreas were removed and stained with H&E and Gomeri aldehyde fuchsin (GAF). Morphology of the pancreatic sections and the following morphometric factors were studied: volume density of B cells, volume density of islets, percent of B cells, number of islets per square millimeter, average area of islets and average volume density of B cell in whole pancreas.
STATISTICAL ANALYSIS USED: One-way Analysis of Variance (ANOVA) test and Duncan's multiple range tests were used to evaluate the data.
RESULTS AND CONCLUSION: The results of this study indicate that only garlic was able to reduce blood glucose significantly compared with the control group (P<0.05). In the control positive group all the mentioned morphometric factors were significantly changed in comparison with the control
negative (normal health) group, but the same did not show significant change between treated and untreated diabetics.

Publication Types: Comparative Study
PMID: 15738612 [PubMed - indexed for MEDLINE]

Effect of fenugreek seeds on the fasting blood glucose level in the streptozotocin induced diabetic rats.
Yousuf BM, Banu LA, Ferdousi R, Khalil M, Shamim KM.
Department of Anatomy, Khulna Medical College, Khulna.

In this experiment defatted Trigonella foenumgraecum (fenugreek seeds/methi seeds) has used as the antidiabetogenic herbal medicine. The experiment was carried out in Bangabandhu Sheikh Mujib Medical University and BIRDEM from 1996 to 1998 on a total of 58 Long Evans rats of either sex. They were 50-60 days young rats with average body weight 72-174 gm. Among the total, 10 rats were treated with only vehicle called as non-diabetic control rats, 48 rats were treated with Streptozotocin (STZ) at a dose of 90 mg in 1 ml of citrate buffer solution per kg body weight, among which 20 were diabetics. Ten (1 died, 1 escaped) diabetic rats were again treated with fenugreek called as Fenugreek-treated diabetic rats and the rest 10 diabetic rats were called as diabetic control rats. The change in the mean fasting blood glucose (FBG) level in different groups of rat from day 5 from streptozotocin injection were higher in diabetic control group and in fenugreek-treated diabetic group than in non-diabetic control group. The FBG level on day 13 the mean in non-diabetic control group was 5.21 mmol/L. In diabetic control group and in fenugreek-treated diabetic group the mean FBG level were 24.33 mmol/L and 9.89 mmol/L respectively. So, from this experiment it may be concluded that fenugreek decreases the FBG level considerably by improving diabetes mellitus.
PMID: 15284693 [PubMed - indexed for MEDLINE]
Trigonella foenum graecum (fenugreek) seed powder improves glucose homeostasis in alloxan diabetic rat tissues by reversing the altered glycolytic, gluconeogenic and lipogenic enzymes.

Raju J, Gupta D, Rao AR, Yadava PK, Baquer NZ.

Department of Foods and Nutrition, University of Manitoba, Winnipeg, Canada. Trigonella foenum graecum (fenugreek) seed powder has been suggested to have potential antidiabetic effects. The effect of oral administration of Trigonella whole seed powder (5% in the diet) for 21 days on glycolytic, gluconeogenic and NADPlinked lipogenic enzymes were studied in liver and kidney tissues of alloxan-induced diabetic Wistar rats. Diabetic rats were characterised by a 4-fold higher blood glucose level and a 0.7-fold lower body weight compared to normal controls. The activities of the glycolytic enzymes were significantly lower in the diabetic liver and higher in the diabetic kidney. The activities of gluconeogenic enzymes were higher in both liver and kidney during diabetes, however the activities of the lipogenic enzymes were decreased in both tissues during diabetes. Trigonella seed powder treatment to diabetic rats for 21 days brought down the elevated fasting blood glucose levels to control levels. The altered enzyme activities were significantly restored to control values in both the liver and kidney after Trigonella seed powder treatment. The therapeutic role of Trigonella seed powder in type-1 diabetes as exemplified in this study can be attributed to the change of glucose and lipid metabolising enzyme activities to normal values, thus stabilizing glucose homeostasis in the liver and kidney. These biochemical effects exerted by Trigonella seeds make it a possible new therapeutic in type-1 diabetes.
Modulation of some gluconeogenic enzyme activities in diabetic rat liver and kidney: effect of antidiabetic compounds.
Gupta D, Raju J, Baquer NZ.
School of Life Sciences, Jawaharlal Nehru University, New Delhi, India.

The effects of insulin, sodium orthovanadate and a hypoglycemic plant material, Trigonella foenum graecum (fenugreek) seed powder were studied on the activities of glucose-6-phosphatase and fructose-1,6-bisphosphatase in diabetic liver and kidney. The significantly increased activities of the two enzymes during diabetes in liver and kidney were found to be lowered to almost control values by the use of the antidiabetic compounds. Diabetic liver exhibited a much greater increase in the activities of the two enzymes than diabetic kidney. The highest percentage of reversal to normal values was seen using the combination of vanadate and Trigonella seed powder. The lowered rate of growth of the animals as well as the increased blood sugar were reversed almost to the control levels by the Trigonella seed powder and vanadate treatment. The inclusion of the Trigonella seed powder overcame the toxicity of vanadium encountered when it was given alone as insulin mimetic agent.

Much lower levels of vanadate were needed when it was given in combination with Trigonella seed powder. Their combined effects were better at restoring the above parameters than those induced by insulin administration.

Publication Types:
• Research Support, Non-U.S. Gov't
PMID: 10641146 [PubMed - indexed for MEDLINE]
Effect of fenugreek seeds on blood glucose and serum lipids in type I diabetes.

Sharma RD, Raghuram TC, Rao NS.
National Institute of Nutrition, Indian Council of Medical Research, Hyderabad.

The effect of fenugreek seeds (Trigonella foenum graecum) on blood glucose and the serum lipid profile was evaluated in insulin-dependent (Type I) diabetic patients. Isocaloric diets with and without fenugreek were each given randomly for 10 d. Defatted fenugreek seed powder (100 g), divided into two equal doses, was incorporated into the diet and served during lunch and dinner. The fenugreek diet significantly reduced fasting blood sugar and improved the glucose tolerance test. There was a 54 per cent reduction in 24-h urinary glucose excretion. Serum total cholesterol, LDL and VLDL cholesterol and triglycerides were also significantly reduced. The HDL cholesterol fraction, however, remained unchanged. These results indicate the usefulness of fenugreek seeds in the management of diabetes.

Publication Types:
• Clinical Trial
• Randomized Controlled Trial

PMID: 2194788 [PubMed - indexed for MEDLINE]
Effect of fenugreek fiber on satiety, blood glucose and insulin response and energy intake in obese subjects.

Phytother Res. 2009 Apr 7. [Epub ahead of print]
Mathern JR, Raatz SK, Thomas W, Slavin JL.
Department of Food Science and Nutrition, University of Minnesota, St Paul, MN USA 55108.

Eighteen healthy obese subjects participated in a single blind, randomized, crossover study of three test breakfasts, containing 0 g (control), 4 g or 8 g of isolated fenugreek fiber. Subjects recorded ratings of hunger, satiety, fullness and prospective food consumption using visual analog scales (VAS) every 30 min for 3.5 h. Postprandial blood glucose and insulin responses were measured. Energy intake from an ad libitum lunch buffet and for the remainder of the day was assessed. The 8 g dose of fenugreek fiber significantly increased mean ratings of satiety and fullness, and reduced ratings of hunger and prospective food consumption (P < 0.05). Palatability was significantly reduced with increasing doses of fenugreek fiber (P < 0.05). No differences were observed for area under the curve (AUC) for blood glucose among treatments. An increase in insulin AUC was found with 8 g fenugreek fiber. Energy intake at an ad libitum lunch buffet was significantly lower for 8 g than 4 g fenugreek fiber, but not significantly different from control, although there was a trend towards a lower intake (p = 0.11). No differences were observed for energy intake for the remainder of the day. Fenugreek fiber (8 g) significantly increased satiety and reduced energy intake at lunch, suggesting it may have short-term beneficial effects in obese subjects. Satiety results were not related to postprandial blood glucose.
In vitro intestinal glucose uptake is inhibited by galactomannan from Canadian fenugreek seed (Trigonella foenum graecum L) in genetically lean and obese rats.

Srichamroen A, Thomson AB, Field CJ, Basu TK.
Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Alberta, Canada T6G 2P5.

Galactomannan, a soluble fiber, has been reported to reduce postprandial blood glucose response. Using this fiber, extracted from Canadian-grown fenugreek seeds (Trigonella foenum graecum L), we conducted an in vitro study to determine if galactomannan affects intestinal glucose uptake in genetically determined lean and obese rats. The segments of jejunum and ileum from these animals were incubated with labeled glucose (2 or 32 mmol/L) in the presence of different concentrations of galactomannan ranging from 0.1% to 0.5% (wt/wt). The uptake of low or high concentration of glucose was significantly and progressively reduced by increasing concentrations of galactomannan in both lean and obese rats. No significant difference was observed in the uptake of glucose between the 2 groups. The viscosity of various concentrations of galactomannan solutions was determined after stirring for 60 minutes at a temperature-controlled (37 degrees C) fixed sheer rate of 1.29 (1/s). The inhibitory effect of galactomannan on glucose uptake was found to be in parallel with the degree of viscosity of the fiber solutions. These results suggest that the galactomannan, because of its viscous property, has the
potential to reduce intestinal absorption of low or high concentrations of glucose and hence for the benefit of blood glucose management.

PMID: 19185777 [PubMed - indexed for MEDLINE]

The Modifying Effects of Galactomannan from Canadian-Grown Fenugreek (Trigonella foenum-graecum L.) on the Glycemic and Lipidemic Status in Rats.
Srichamroen A, Field CJ, Thomson AB, Basu TK.
Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Alberta T6G 2P5, Canada.

Using high sucrose-fed male Sprague-Dawley rats, a study was conducted to determine the effects of feeding Galactomannan (GAL), a soluble dietary fiber extracted from Canadian-grown fenugreek seeds, on blood lipid and glucose responses. Rats (n = 8, 175-200 g) were randomly assigned to one of three high sucrose diets containing 10% cellulose (control), 7.5% cellulose + 2.5% GAL, and 5% cellulose + 5% GAL, respectively for 4 weeks. After 3 weeks, an oral glucosetolerance test (OGTT) was performed on each rat. A week later blood samples were collected to determine the effect on blood lipids. A significant reduction in glycemic response was observed only in 5% GAL group at 120 min following OGTT, when compared with that of control and 2.5% GAL groups. The plasma level of insulin was also significantly reduced (p<0.001) in 5% GAL-fed rats but at all times during OGTT. These animals also showed a reduction in body weight gain (p<0.05) in parallel with less food intake (p<0.05). All GAL-fed (2.5% and 5.0%) rats had significantly reduced plasma levels of triglycerides and total cholesterol in association with a reduction in epididymal adipose weight. Overall, this study demonstrated that feeding GAL from Canadian-grown fenugreek seeds has the potential to alter glycemic and lipidemic status and reduce abdominal fat in normal rats.
Soluble dietary fibre fraction of Trigonella foenum-graecum (fenugreek) seed improves glucose homeostasis in animal models of type 1 and type 2 diabetes by delaying carbohydrate digestion and absorption, and enhancing insulin action.

Hannan JM, Ali L, Rokeya B, Khaleque J, Akhter M, Flatt PR, Abdel-Wahab YH.
School of Biomedical Sciences, University of Ulster, Coleraine, Northern Ireland, UK.

Trigonella foenum-graecum (fenugreek) seeds have been documented as a traditional plant treatment for diabetes. In the present study, the anti diabetic properties of a soluble dietary fiber (SDF) fraction of T. foenum-graecum were evaluated. Administration of SDF fraction (0 x 5 g/kg body weight) to normal, type 1 or type 2 diabetic rats significantly improved oral glucose tolerance. Total remaining unabsorbed sucrose in the gastrointestinal tract of non-diabetic and type 2 diabetic rats, following oral sucrose loading (2 x 5 g/kg body weight) was significantly increased by T. foenum-graecum (0 x 5 g/kg body weight). The SDF fraction suppressed the elevation of blood glucose after oral sucrose ingestion in both non diabetic and type 2 diabetic rats. Intestinal disaccharidase activity and glucose absorption were decreased and gastrointestinal motility increased by the SDF fraction. Daily oral administration of SDF to type 2 diabetic rats for 28 d decreased serum glucose, increased liver glycogen content and enhanced total antioxidant status. Serum insulin and insulin secretion were not affected by the SDF fraction.
Glucose transport in 3T3-L1 adipocytes and insulin action were increased by T. foenum-graecum. The present findings indicate that the SDF fraction of T. foenum-graecum seeds exerts antidiabetic effects mediated through inhibition of carbohydrate digestion and absorption, and enhancement of peripheral insulin action.

Publication Types:
- Evaluation Studies
- Research Support, Non-U.S. Gov't

PMID: 17313713 [PubMed - indexed for MEDLINE]

MANNANS AND CHOLESTEROL/OBESITY

Effect of partially hydrolyzed guar gum (PHGG) on the bioaccessibility of fat and cholesterol.
Minekus M, Jelier M, Xiao JZ, Kondo S, Iwatsuki K, Kokubo S, Bos M, Dunnewind B, Havenaar R.TNO Quality of Life, Zeist, the Netherlands. minekus@voeding.tno.nl

The addition of a compound that lowers the intestinal uptake of fat and cholesterol might be an interesting strategy to reduce the risk of vascular disease. Partially hydrolyzed guar gum (PHGG) has been shown to have this effect in healthy volunteers after intake of a yogurt drink with 3 to 6% PHGG. In the present study a yogurt drink with 3% sunflower oil and 4% egg yolk was tested with 3% and 6% PHGG, and compared to a control without PHGG. Experiments were performed in a multi-compartmental model of the gastrointestinal tract, equipped to study the digestion and availability for absorption (bioaccessibility) of lipids. The results show that PHGG decreases the bioaccessibility of both fat and cholesterol in a dosedependent manner. The bioaccessibility of fat was 79.4+/−1.7%, 70.8+/−2.5% and 60.1+/−1.1% for the control experiments and the experiments with 3% and 6% PHGG respectively. The bioaccessibility of cholesterol was 82.2+/−2.0%, 75.4+/−1.2% and 64.0+/−4.3% for the control and the experiments with 3% and 6% PHGG respectively. Additional experiments indicated that PHGG reduces bioaccessibility through the depletion flocculation mechanism. Depletion flocculation antagonizes
the emulsification by bile salts and thus decreases lipolytic activity, resulting in a lower bioaccessibility of fat and cholesterol. Depletion flocculation with polymers might be an interesting mechanism, not described before, to reduce fat and cholesterol absorption.

PMID: 15914912 [PubMed - indexed for MEDLINE]

Suppressive effects of dietary fiber in yogurt on the postprandial serum lipid levels in healthy adult male volunteers.

Kondo S, Xiao JZ, Takahashi N, Miyaji K, Iwatsuki K, Kokubo S.
Food Research and Development Laboratory, Morinaga Milk Industry Co, Ltd, Zama, Japan.

This study assessed the effect of partially hydrolyzed guar gum (PHGG) in yogurt on the elevation of postprandial serum lipid levels. Eleven healthy adult male subjects were given yogurt with or without 6 g of PHGG in a fat tolerance test as a crossover study. Supplementation with 6 g of PHGG significantly suppressed the incremental peaks and areas under the incremental curve (AUIC) of postprandial serum remnantlike lipoprotein particle cholesterol (RLP-C) and triglyceride (TG). The results suggest the potential of PHGG to reduce the risk of hyperlipemia.

PMID: 15170121 [PubMed - indexed for MEDLINE]
Guar Gum. A review of its pharmacological properties, and use as a dietary adjunct in hypercholesterolaemia.
Drugs. 1990 Jun;39(6):917-28
Todd PA, Benfield P, Goa KL.
ADIS Drug Information Services, Auckland, New Zealand.

Guar gum is a dietary fibre advocated for use in lowering serum total cholesterol levels in patients with hypercholesterolaemia. Its mechanism of action is proposed to be similar to that of the bile-sequestering resins. Although guar gum is also employed as an adjunct in non-insulin-dependent diabetic patients this review is restricted to its efficacy as a hypolipidaemic agent. Clinical trials indicate that, when used alone, guar gum may reduce serum total cholesterol by 10 to 15%, although some studies show no significant response. An attenuation of this effect during longer term treatment has been seen but evidence of this effect is equivocal. As an adjunct to established therapies (bezafibrate, lovastatin or gemfibrozil) guar gum has shown some promise: it may produce a further reduction in total cholesterol of about 10% in patients not responding adequately to these drugs alone. Gastrointestinal effects, notably flatulence, occur relatively frequently and may be considered unacceptable by some patients. Standardization of formulations and methods of administration of guar gum is required to clarify its pharmacological and clinical properties. Thus, on the basis of presently available evidence guar gum as monotherapy may be considered at most modestly effective in reducing serum
cholesterol levels. Nonetheless, further investigation of guar gum is warranted, particularly its use as an adjunct to produce additional reductions in serum cholesterol in patients not responding optimally to other lipid-lowering agents. PMID: 2164467 [PubMed - indexed for MEDLINE]

**Partially hydrolyzed guar gum supplement reduces high-fat diet increased blood lipids and oxidative stress and ameliorates FeCl3-induced acute arterial injury in hamsters.**

Kuo DC, Hsu SP, Chien CT.
Department of Cardiovascular Surgery, Kuang-Tien General Hospital, Taichung, Taiwan. 2542365@ms27.hinet.net

Increased reactive oxygen species (ROS) and hyperlipidemia can promote arterial thrombus. We evaluated the potential of a partially hydrolyzed guar gum (PHGG) as dietary fiber on lipid profiles and FeCl3-induced arterial thrombosis in the high fat diet fed hamsters. Our in vitro results found that PHGG is efficient to scavenge O2-*, H2O2, and HOCl. High fat-diet increased plasma triglyceride, total cholesterol, LDL, VLDL, methylguanidine and dityrosine level and accelerated FeCl3-induced arterial thrombosis formation (from 463 +/- 51 to 303 +/- 45 sec). Low dose PHGG supplement significantly decreased the total cholesterol, LDL, methylguanidine and dityrosine level and delayed the time for arterial thrombosis formation (528 +/- 75 sec). High dose PHGG supplement decreased the level in triglyceride, total cholesterol, LDL and VLDL and further delayed the time for arterial thrombus (671 +/- 36 sec). The increased Bax protein and decreased Bcl-2 and HSP-70 protein expression was found in the carotid and femoral arteries of high fat-diet hamsters. Low and high dose of PHGG supplement decreased Bax expression and increased Bcl-2 and HSP-70 protein expression. We found that FeCl3 significantly enhanced intercellular adhesion molecule-1 and 4-hydroxynonenal expression in the endothelial site of damaged artery after 150-sec FeCl3 stimulation. PHGG supplement decreased the endothelial ICAM-1 and 4-hydroxynonenal expression
after 150-sec FeCl₃ stimulation. Based on these results, we conclude that PHGG supplement can increase antioxidant protein expression and thus decrease oxidative stress induced arterial injury.

EFFECT ON IRON ABSORPTION

Partially hydrolyzed guar gum increases intestinal absorption of iron in growing rats with iron deficiency anemia.
de Cássia Freitas K, Amancio OM, Ferreira Novo N, Fagundes-Neto U, de Morais MB.
Pediatric Gastroenterology Department, Paulista School of Medicine (UNIFESPEPM), Federal University of Sao Paulo, Rua Pedro de Toledo, 441, Sao Paulo-SP, CEP 04039-031, Brazil.

OBJECTIVE: The objective of this study was to evaluate the effect of partially hydrolyzed guar gum (PHGG) dietary fiber towards intestinal iron absorption, for dietary intake and on the growth of rats with iron deficiency anemia in comparison to those fed on a diet with cellulose and without dietary fiber. MATERIALS AND METHODS: Male Wistar rats (n=24) weaned at 21 days were fed with AIN93-G diet without iron for 2 weeks in order to induce iron deficiency anemia. At 36 days old, the anemic rats were divided into three groups: (1) PHGG group-100g of PHGG per kg of diet; (2) Cellulose group-100g of cellulose per kg of diet; (3) Control group-diet without dietary fiber. All the diets had 25mg of elemental iron/kg of diet added to lead to recovery from iron deficiency anemia. RESULTS: The final hemoglobin values in g/dl, for the PHGG group, the cellulose group and the control group were, respectively: 11.3+/−1.2, 8.6+/−0.7 and 8.1+/−0.9 (P<0.001). The levels of hepatic iron, in mug/g of dry tissue, in the same order, were: 322.2+/−66.6, 217.2+/−59.1 and 203.7+/−42.4 (P<0.001). Apparent iron intestinal absorption was, respectively: 67.5+/− 8.9%, 35.4+/−15.3% and 31.3+/−24.9% (P<0.001). The three groups
consumed similar quantities of diet. The changes in weight and in body length were similar in the three groups studied. CONCLUSION: PHGG led to greater intestinal absorption of iron, regeneration of hemoglobin and hepatic levels of iron than diet with cellulose and diet control. 

PMID: 16678310 [PubMed - indexed for MEDLINE]

Therapeutic potential of (-)-epigallocatechin 3-O-gallate on renal damage in diabetic nephropathy model rats.

Yamabe N, Yokozawa T, Oya T, Kim M.
Institute of Natural Medicine, University of Toyama, 2630 Sugitani, Toyama 930-0194, Japan.

Previous investigations have demonstrated that green tea polyphenols and partially hydrolyzed guar gum as dietary fiber have antioxidative and hypolipidemic activity, respectively, supporting their reduction of risk factors in the course of diabetic nephropathy via a hypoglycemic effect and ameliorating the decline of renal function through their combined administration to rats with subtotal nephrectomy plus streptozotocin (STZ) injection. As a further study, we examined whether (-)-epigallocatechin 3-O-gallate (EGCg), the main polyphenolic compound, could ameliorate the development of diabetic nephropathy. Rats with subtotal nephrectomy plus STZ injection were orally administrated EGCg at doses of 25, 50, and 100 mg/kg body weight/day. After a 50-day administration period, EGCg-treated groups showed suppressed hyperglycemia, proteinuria, and lipid peroxidation, although there were only weak effects on the levels of serum creatinine and glycosylated protein. Furthermore, EGCg reduced renal advanced glycation end-product accumulation and its related protein expression in the kidney cortex as well as associated pathological conditions. These results suggest that EGCg ameliorates glucose toxicity and renal injury, thus alleviating renal damage caused by abnormal glucose metabolism-associated oxidative stress involved in renal lesions of diabetic nephropathy. 

PMID: 16835369 [PubMed - indexed for MEDLINE]
Influence of intact and partially hydrolysed guar gum on iron utilization in rats fed on iron-deficient diets.

Comp Biochem Physiol Physiol. 1994 Sep;109(1):75-82
Takahashi H, Yang SI, Ueda Y, Kim M, Yamamoto T.
Central Research Laboratories, Taiyo Kagaku Co. Ltd., Yokkaichi, Japan.

Effects of partially hydrolysed guar gum (PHGG) or intact guar gum (GG) on iron utilization in rats fed on several iron-deficient diets were examined. Hemoglobin, serum iron and iron storage in liver of rats fed on iron-deficient diets as a control group (without PHGG and GG) significantly decreased, while those of the test group fed together with PHGG or GG were unchanged. In an iron balance test for 3 days, administration of PHGG or GG caused an increase in iron absorption. The results suggested that PHGG or its metabolites increase the bioavailability of dietary iron in deficiency.

PMID: 8076455 [PubMed - indexed for MEDLINE]
EFFECT ON IRRITABLE BOWEL SYNDROME

Role of partially hydrolyzed guar gum in the treatment of irritable bowel syndrome.

Giannini EG, Mansi C, Dulbecco P, Savarino V.
Gastroenterology Unit, Department of Internal Medicine, University of Genoa, Genoa, Italy. egiannini@unige.it

Irritable bowel syndrome (IBS) is the world's most common gastrointestinal functional disorder and is associated with several social and economic costs. Healthrelated quality of life is often impaired in patients with IBS. The pathophysiologic mechanisms underlying IBS remain poorly defined. The therapeutic approach to patients with IBS is based on symptoms, and fibers may play an important role in treatment. Among the various types of fiber, water-soluble, non-gelling fibers seem to be a promising option for treatment of IBS. Partially hydrolyzed guar gum (PHGG) is a water-soluble, non-gelling fiber that has provided therapeutic benefits. In clinical trials, PHGG decreased symptoms in constipation-predominant and diarrheapredominant forms of IBS and decreased abdominal pain. Further, an improvement in quality of life was observed in patients with IBS during and after treatment with PHGG. Moreover, PHGG seems to have prebiotic properties because it increases the colonic contents of short-chain fatty acids, Lactobacilli, and Bifidobacteria.
Irritable bowel syndrome affects 10 to 15 percent of the U.S. population to some degree. This condition is defined as abdominal pain and discomfort with altered bowel habits in the absence of any other mechanical, inflammatory, or biochemical explanation for these symptoms. Irritable bowel syndrome is more likely to affect women than men and is most common in patients 30 to 50 years of age. Symptoms are improved equally by diets supplemented with fiber or hydrolyzed guar gum, but more patients prefer hydrolyzed guar gum. Antispasmodic agents may be used as needed, but anticholinergic and other side effects limit their use in some patients. Loperamide is an option for treatment of moderately severe diarrhea. Antidepressants have been shown to relieve pain and may be effective in low doses. Trials using alosetron showed a clinically significant, although modest, gain over placebo, but it is indicated only for women with severe diarrhea-predominant symptoms or for those in whom conventional treatment has failed. Tegaserod has
an advantage over placebo in constipation-predominant irritable bowel syndrome; it is indicated for up to 12 weeks of treatment in women. However, postmarketing reports of severe diarrhea and ischemic colitis further limit its use. Herbal therapies such as peppermint oil also may be effective in the treatment of irritable bowel syndrome. Therapies should focus on specific gastrointestinal dysfunctions (e.g., constipation, diarrhea, pain), and medications only should be used when nonprescription remedies do not work or when symptoms are severe.

Publication Types:
• Review

PMID: 16370407 [PubMed - indexed for MEDLINE]

Treatment effects of partially hydrolyzed guar gum on symptoms and quality of life of patients with irritable bowel syndrome. A multicenter randomized open trial.
Servizio di Gastroenterologia, Casa di Cura Abano Terme, ULSS 16, Padova, Italy.

The effects of partially hydrolyzed guar gum (PHGG) were compared in patients with irritable bowel syndrome, at 10 g/day (N = 40) and 5 g/day (N = 46) for 12 weeks. Gastrointestinal symptoms (GSRS), quality of life (SF-36), and psychological symptoms (HADS) were evaluated at baseline, during treatment (months 1 and 3), and at follow-up (month 6). In both groups symptoms and quality of life improved significantly after the first month of administration until follow-up compared to those at baseline. However, the improvement was significantly reduced at follow-up compared to the end of treatment. PHGG was effective for improving somatic (gastrointestinal symptoms) and psychological (quality of life and psychological distress) symptoms over the short term. Since the improvement tended to decrease after the end of the treatment period, further studies should evaluate the benefits of PHGG at a maintenance dosage.

PMID: 15986863 [PubMed - indexed for MEDLINE]
Partially hydrolyzed guar gum: a fiber as coadjuvant in the irritable colon syndrome
Divisione di Gastroenterologia, Presidio Ospedaliero S. Caterina Novella, Azienda Unità Sanitaria Locale Le/1, Via Roma, 73013 Galatina LE.

PURPOSE: Partially hydrolyzed guar gum (PHGG) is a water-soluble dietary fiber, possessing non-gelling properties. The objective of this clinical experience was to evaluate the progress of symptoms and the modifications in the frequency of evacuation in subjects affected by IBS and regularly taking PHGG. PATIENTS AND METHODS: The group was made up of 134 out-patients of both sexes, average age 43.12, suffering from IBS, both obese and of normal weigh, with a mean number of weekly evacuations between 2 and 35. The subjects, divided in 2 groups on the basis of Body Mass Index (BMI), were submitted for 24 weeks to a balanced, low or normal calorie diet supplemented by 5 g a day of PHGG. The following information was gathered: number of weekly evacuation, typical symptoms of IBS, cholesterol, triglycerides and glucose levels. In a few subjects (n. = 34) also the plasmatic electrolyte levels, before and during PHGG intake, were evaluated. RESULTS: Both groups showed positive results in the evacuation frequency (p < 0.01 at 12th week) and a decrease, after 3 weeks of PHGG intake, in frequency of IBS symptoms such as flatulence (-55.6%), abdominal tension (- 4.7%) and abdominal spasm (-35%). On the other hand an increased number of subjects showed normal levels of cholesterol (+12.2%), lipids (+26.9%) and glucose (+16%). Concentrations of plasmatic
Partially hydrolyzed guar gum: clinical nutrition uses.
Slavin JL, Greenberg NA.
Department of Food Science and Nutrition,
University of Minnesota, 1334 Eckles
Avenue, St. Paul, MN 55108, USA. jslavin@umn.edu

OBJECTIVE: This paper provides a review of research on partially hydrolyzed guar gum that is relevant to clinical nutrition practice. METHODS: All relevant papers published on partially hydrolyzed guar gum were reviewed and the results summarized. RESULTS: Partially hydrolyzed guar gum (PHGG) is a water-soluble dietary fiber with a wide range of uses in clinical nutrition. Its low viscosity allows its use in enteral products and beverages. PHGG can be added to enteral formulas and food products as a dietary fiber source. PHGG provides the benefits associated with dietary fiber ingestion. Addition of PHGG to the diet reduced laxative dependence in a nursing home population. PHGG also reduced the incidence of diarrhea in septic patients receiving total enteral nutrition and reduced symptoms of irritable bowel syndrome. PHGG also

electrolytes didn't change during PHGG intake, except for a marked increase of selenium levels, compared to preintake levels. CONCLUSIONS: The observations obtained from this clinical experience reassert that dietary fiber supplementation is useful in cases of altered intestinal motility. PHGG, due to its water-solubility and non-gelling properties, can be useful also in IBS.
PMID: 11382164 [PubMed - indexed for MEDLINE]
increased production of Bifidobacterium in the gut. CONCLUSION: The ease of use of PHGG and its clinical effectiveness make it a good choice in clinical nutrition practice.

Publication Types:
• Review
PMID: 12781858 [PubMed - indexed for MEDLINE]

High-fiber diet supplementation in patients with irritable bowel syndrome (IBS): a multicenter, randomized, open trial comparison between wheat bran diet and partially hydrolyzed guar gum (PHGG).
Servizio di Gastroenterologia, Casa di Cura Abano Terme USL 16, Padova, Italy.

High-fiber diet supplementation is commonly used in IBS, although it poses several management problems. Partially hydrolyzed guar gum (PHGG) has shown beneficial effects in animal and human studies, but its potential role in IBS symptom relief has not been evaluated yet. We investigated PHGG in IBS patients and compared it to a wheat bran diet. Abdominal pain, bowel habits, and subjective overall rating were longitudinally evaluated in 188 adult IBS patients (139 women and 49 men) for 12 weeks. Patients were classified as having diarrhea-predominant, constipation-predominant, or changeable bowel habits and were randomly assigned to groups receiving fiber (30 g/day of wheat bran) or PHGG (5 g/day). After four weeks, patients were allowed to switch group, depending on their subjective evaluation of their symptoms. Significantly more patients switched from fiber to PHGG (49.9%) than from PHGG to fiber (10.9%) at four weeks. Per protocol analysis showed that both fiber and PHGG were effective in improving pain and bowel habits, but no difference was found between the two groups. Conversely, intention-to-treat analysis showed a significantly greater success in the PHGG group (60%) than in the fiber group (40%). Moreover, significantly more patients in the PHGG group reported a greater subjective improvement than those in the Fiber group. In conclusion, improvements in core IBS symptoms (abdominal pain and bowel habits) were observed with both bran and PHGG, but the latter was better tolerated and
preferred by patients, revealing a higher probability of success than bran and a lower probability of patients abandoning the prescribed regimen, suggesting that it can increase the benefits deriving from fiber intake in IBS, making it a valid option to consider for high-fiber diet supplementation.

Publication Types: Multicenter Study Randomized Controlled Trial
PMID: 12184518 [PubMed - indexed for MEDLINE]

FENUGREEK (others) Dietary fiber.
Madar Z, Thorne R.

Studies done on dietary fiber (DF) over the past five years are presented in this Review. The involvement of dietary fiber in the control of plasma glucose and lipid levels is now established. Two dietary fiber sources (soybean and fenugreek) were studied in our laboratory and are discussed herein. These sources were found to be potentially beneficial in the reduction of plasma glucose in non-insulin dependent diabetes mellitus subjects. They are shown to be acceptable by human subjects and are easy to use either in a mixture of milk products and in cooking. The mechanism by which dietary fiber alters the nutrient absorption is also discussed. The effect of DF on gastric emptying, transit time, adsorption and glucose transport may contribute to reducing plasma glucose and lipid levels. DF was found to be effective in controlling blood glucose and lipid levels of pregnant diabetic women. Dietary fiber may also be potentially beneficial in the reduction of exogenous insulin requirements in these subjects. However, increased consumption of DF may cause adverse side effects; the binding capabilities of fiber may affect nutrient availability, particularly that of minerals and prolonged and high DF dosage supplementation must be regarded cautiously. This is particularly true when recommending such a diet for pregnant or lactating women, children or subjects with nutritional disorders. Physiological effects of DF appear to depend heavily on the source and composition of fiber. Using a combination of DF from a variety of sources may reduce the actual mass of fiber required to obtain the desired metabolic effects and will result in a more palatable diet. Previously observed problems, such as excess flatus, diarrhea and mineral malabsorption would also be minimized.
Complementary and alternative medicine for the treatment of type 2 diabetes.
Nahas R, Moher M.
Department of Family Medicine at the University of Ottawa, Seekers Centre for Integrative Medicine, 6 Deakin St, Ottawa, ON K2E 1B3, Canada.
richard@seekerscentre.com

OBJECTIVE: To review clinical evidence supporting complementary and alternative medicine interventions for improving glycemic control in type 2 diabetes mellitus. QUALITY OF EVIDENCE: MEDLINE and EMBASE were searched from January 1966 to August 2008 using the term type 2 diabetes in combination with each of the following terms for specific therapies selected by the authors: cinnamon, fenugreek, gymnema, green tea, fibre, momordica, chromium, and vanadium. Only human clinical trials were selected for review. MAIN MESSAGE: Chromium reduced glycosylated hemoglobin (HbA(1c)) and fasting blood glucose (FBG) levels in a large meta-analysis. Gymnema sylvestre reduced HbA(1c) levels in 2 small openlabel trials. Cinnamon improved FBG but its effects on HbA(1c) are unknown. Bitter melon had no effect in 2 small trials. Fibre had no consistent effect on HbA(1c) or FBG in 12 small trials. Green tea reduced FBG levels in 1 of 3 small trials. Fenugreek reduced FBG in 1 of 3 small trials. Vanadium reduced FBG in small, uncontrolled trials. There were no trials evaluating microvascular or macrovascular complications or other clinical end points.
CONCLUSION: Chromium, and possibly gymnema, appears to improve glycemic control. Fibre, green tea, and fenugreek have other benefits but there is little evidence that they substantially improve glycemic control. Further research on bitter melon and cinnamon is warranted. There is no complementary and
alternative medicine research addressing microvascular or macrovascular clinical outcomes.

Publication Types: Review
PMID: 19509199 [PubMed - indexed for MEDLINE]
PMCID: PMC2694078

Efficacy of dietary supplementation with botanicals on carbohydrate metabolism in humans.
Cefalu WT, Ye J, Wang ZQ.
Division of Nutrition and Chronic Diseases, Pennington Biomedical Research Center, Baton Rouge, LA 70808, USA. William.Cefalu@pbrc.edu

Botanical products are widely used in nutritional supplementation for promotion of health or prevention of diseases. With the high prevalence of obesity and type 2 diabetes, abnormalities in carbohydrate metabolism are common in the general population and obtaining glycemic control is important in reducing the complications of diabetes. If shown to be effective, botanical products have a unique position in potentially aiding the general public in regard to obesity and diabetes. They can be obtained "over-the-counter" and may have less side effects compared to many synthetic drugs. Although most of the popular botanicals have a long history in folk medicine, there is paucity of data regarding their efficacy and safety, particularly as it relates to human studies. In this review, we discuss the data that was available in the literature for nine botanicals that are frequently promoted to help manage blood glucose. They are Bitter Melon (Momordica charantia), Fenugreek (Trigonella foenum graecum), Gymnema Sylvestre, Ivy Gourd (Coccinia indica), Nopal or Prickly Pear Cactus (Opuntia streptacantha), Ginseng, Aloe Vera, Russian Tarragon (Artemisia dracunculus), and Garlic (Allium sativum). The discussion is emphasized on the clinical aspect of these botanicals. Due to the lack of sufficient evidence from clinical studies for any of the botanicals reviewed, it is premature to actively recommend use of any particular herb to treat either glucose or other risk factors. Thus, well defined randomized clinical trials are warranted in this area.

Publication Types:
Effect of Trigonella foenum-graecum (fenugreek) extract on blood glucose, blood lipid and hemorheological properties in streptozotocin-induced diabetic rats.

Department of Public Health, School of Medicine, Xi'an Jiaotong University, 76 West Yanta Road, Xi'an, Shaanxi, China 710061. xwl0908@163.com

Trigonella foenum-graecum (fenugreek) seeds have previously been shown to have hypoglycemic and hypocholesterolemic effects on type 1 and type 2 diabetes mellitus patients and experimental diabetic animals. The Trigonella foenum-graecum extract has now been investigated for its effects on general properties, blood glucose and blood lipid, and hemorheological parameters in experimental diabetic rats. Streptozotocin-induced diabetic rats were administrated by oral intragastric intubation separately with low dose (0.44 g/kg.d), middle dose (0.87 g/kg.d), high dose (1.74 g/kg.d) of Trigonella foenum-graecum extract, and Metformin HCl (0.175 g/kg.d) for 6 weeks. Compared with diabetic group, rats treated with Trigonella foenum-graecum extract had an increase in body weight and a decrease in kidney/body weight ratio (p<0.05). Compared with diabetic group, rats treated Trigonella foenum-graecum extract had lower blood glucose, glycated hemoglobin, triglycerides, total cholestrol and higher higher-density-lipoprotein-cholesterol in a dose-dependent manner (p<0.05). The plasma viscosity, whole blood viscosity of high shear rate (200 s-1) and low shear rate (40 s-1), erythrocyte sedimentation rate, whole blood reduction viscosity and platelet conglutination were significantly reduced in diabetic rats treated with high and middle doses of Trigonella foenum-
graecum extract, but not in those treated with low dose of Trigonella foenum-graecum extract. It may be concluded that Trigonella foenum-graecum extract can lower kidney/body weight ratio, blood glucose, blood lipid levels and improve hemorheological properties in experimental diabetic rats following repeated treatment for 6 weeks.

Publication Types:
• Research Support, Non-U.S. Gov't
PMID: 17392143 [PubMed - indexed for MEDLINE]

Modulatory effect of fenugreek seed mucilage and spent turmeric on intestinal and renal disaccharidases in streptozotocin induced diabetic rats.
Kumar GS, Shetty AK, Salimath PV.
Department of Biochemistry and Nutrition, Central Food Technological Research Institute, Mysore-570 020, India. paramahans1954@yahoo.com

To elucidate the effect of feeding fenugreek seed mucilage and spent turmeric (10%) on disaccharidases activities, the specific activities of intestinal and renal disaccharidases viz., sucrase, maltase and lactase were measured in streptozotocin induced diabetic rats. Specific activities of intestinal disaccharidases were increased significantly during diabetes and amelioration of these activities during diabetes was clearly visible by supplementing fenugreek seed mucilage and spent turmeric in the diet. However during diabetes renal disaccharidases activities were significantly lower than those in the control rats. Fenugreek seed mucilage and spent turmeric supplementations were beneficial in alleviating the reduction in maltase activity during diabetes, however not much change in the activities of sucrase and lactase was observed upon feeding. This positive influence of feeding fenugreek seed mucilage and spent turmeric on intestinal and renal disaccharidases clearly indicates their beneficial role in the management of diabetes.

Publication Types:
• Research Support, Non-U.S. Gov't
PMID: 16021836 [PubMed - indexed for MEDLINE]
Development of food products based on millets, legumes and fenugreek seeds and their suitability in the diabetic diet.

Pathak P, Srivastava S, Grover S.
Department of Foods and Nutrition, College of Home Science, GB Pant University of Agriculture and Technology, Pantnagar, Nagar, India.

A multitude of investigations have demonstrated the beneficial hypoglycemic effect of millets, fenugreek seeds and legumes in diabetic subjects. However, the bitter taste of fenugreek seeds and coarse nature of millets have been limitations in using them in daily dietaries. Moreover, as of today, the availability of special foods for diabetics in the Indian market is negligible. The millets, fenugreek seeds and legumes in judicious combination, after suitable processing, were used to formulate three nutritious food products--dhokla (leavened steamed cake), uppuma (kedgeree) and laddu (sweet balls), which are popular traditional snack foods in India. Evaluation of these food products for glycemic response in five normal and five diabetic subjects showed hypoglycemic effects in terms of glycemic-index (GI). The highest GI was observed for dhokla (34.96) followed by laddu (23.52) and uppuma (17.60) in normal subjects. All three food products differed significantly from each other in GI. Comparison of GI of all three food products in normal subjects with diabetes did not show significant differences (P approximately 0.05). The food products were well tolerated and acceptable to the subjects. These food products may have an important role in dietary management for diabetic people and may cater for their needs on a large scale if commercialized.

Publication Types:
• Comparative Study
New sources of dietary fibre.
Int J Obes. 1987;11 Suppl 1:57-65
Madar Z.

Two sources of dietary fibre were discussed in this presentation: soybean and fenugreek. Soybean dietary fibre (SDF) was found to be effective in reducing plasma glucose levels in diabetic and fa/fa rats, ob/ob mice and in non-insulin dependent diabetes mellitus (NIDDM) subjects. Supplementation of SDF in bread was more effective in glucose reduction than powder. SDF was also found to be more effective in subjects with fasting blood glucose levels above 7.2 mmol/l. SDF had no effect on insulin levels in rats or NIDDM subjects although the insulin levels in ob/ob mice were lower after 180 d feeding. SDF had no effect on body weight or lipid levels in rats and human subjects. However, in diabetic rats with high levels of blood cholesterol, SDF feeding decreased the cholesterol levels after 45 d SDF administration. Addition of powdered fenugreek to an oral glucose tolerance test significantly reduced the subsequent postprandial blood glucose level in diabetic rats. Inclusion of fenugreek to the meal tolerance test given to NIDDM also decreased the postprandial blood glucose levels. Fenugreek was found to reduce the rate of gastric emptying and to inhibit glucose transport, indicating the blood modulating effect of fenugreek to be due mainly to delayed gastric emptying with direct interference with intestinal glucose absorption. Soybean and fenugreek dietary fibres reveal a potential benefit for the control of glucose metabolism in diabetes with additional advantages resulting from their ease in usage either in a mixture of water or milk products or in cooking.

Publication Types:
• Review

PMID: 3032826 [PubMed - indexed for MEDLINE]
Allotransplantation of sulphate glucomannan-alginate barium (SGA)-microencapsulated rat islets for the treatment of diabetes mellitus.


**Abstract**

To offer a more effective microencapsulation technique of islets for the treatment of diabetes, we have developed a new type of microcapsule comprising sulphate glucomannan-alginate barium (SGA). We compared it with traditional microencapsulated APA (alginate-poly-L-lysine-alginate) and ABa (Ba(2+)-alginate) microencapsulated islets. These three types of microencapsulated islets were prepared and cultured in vitro and we studied their morphology and activity. To determine their effects on insulin secretion and cytokine production (MCP-1, IL-1, IFN-gamma, TNF-alpha) the islets were transplanted into diabetic rats. There was no difference in the morphologies of the three types of microencapsulated islets or their insulin secretory capacity in vitro. However, the SGA microencapsulated islets had higher activity and produced more insulin than the APA and ABa microencapsulated islets after transplantation. Normoglycemia was maintained for longer in the SGA-transplanted group than in the other two groups. The
concentrations of cytokines in the peritoneal fluid were significantly decreased in the SGA group, as was the infiltration of inflammatory cells around the microcapsules. In conclusion, the novel SGA microencapsulated islets can maintain normoglycemia in diabetic rats without immunosuppression for longer than APA and ABa microencapsulated islets.

PMID: 19811421 [PubMed - indexed for MEDLINE]

Immediate and long-term effects of glucomannan on total ghrelin and leptin in type 2 diabetes mellitus.

Diabetes Res Clin Pract. 2009 Feb;83(2):e40-2. Epub 2008 Dec 23.Chearskul S, Kriengsinyos W, Koopitiwut S, Sangurai S, Onreabroi S, Churintaraphan M, Semprasert N, Nitiyanant W. Department of Physiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand. sisch@mahidol.ac.th

Abstract

Effects of glucomannan as a supplementary treatment in type 2 diabetes mellitus were investigated by measuring ghrelin, leptin and insulin responses to OGTT. Glucomannan enhanced prandial ghrelin reduction when given before glucose load and impeded the rise of fasting ghrelin after 4-week supplement. Ghrelin-induced feeding may be attenuated by glucomannan.

PMID: 19108925 [PubMed - indexed for MEDLINE]
Glycemic and lipid responses to glucomannan in Thais with type 2 diabetes mellitus. J Med Assoc Thai. 2007 Oct;90(10):2150-7. Chearskul S, Sangurai S, Nitiyanant W, Kriengsinyos W, Kooptiwut S, Harindhanavudhi T. Department of Physiology, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, Thailand. sisch@mahidol.ac.th

Abstract

OBJECTIVE: To evaluate the benefits of glucomannan supplement on glycemic and lipid controls in type 2 diabetic patients. MATERIAL AND METHOD: A single-blind, placebo-controlled, crossover trial with two treatments separated by a 2-week washout period was performed in 10 men and 10 women with type 2 diabetes mellitus. Two separated protocols of experiments were sequentially followed. Initially, purified glucomannan (1 g) or placebo was ingested 30 min before 75-g glucose load to evaluate their effects on glucose absorption and insulin secretion in oral glucose tolerance test (OGTT). Later, the glycemic and lipid changes after 4-week intervention with 3 g/day glucomannan comparing to the placebo were determined. The standard OGTT was performed before and after ending of each intervention. RESULTS: Glucomannan taken before performing the OGTT can lower the rise of blood glucose and insulin from 1 to 2 hour in comparison with the placebo, though a statistically significance of insulin was not achieved. Long-term glucomannan supplement significantly reduced the 120-min glucose area under the curve of OGTT. Glucomannan also decreased the rise of low-density lipoprotein cholesterol (LDL-C). Reductions of HOMA-insulin resistance index and body mass index were detected in glucomannan-treated group though the former was shown only in females. No within- and between-group differences of insulin, fructosamine,
and other lipids were observed in glucomannan- nor placebo- treated groups.

CONCLUSION: In type 2 diabetes, pre-prandial glucomannan ingestion attenuated a rise of blood glucose without significantly affecting insulin levels. Long-term supplement of glucomannan to the regular diabetic regimen lessened post challenge glucose AUC and impeded the rise of LDL-C. Supplement of glucomannan may be beneficial to the glycemic and lipid controls in type 2 diabetes mellitus.

PMID: 18041436 [PubMed - indexed for MEDLINE]

Guar gum: a miracle therapy for hypercholesterolemia, hyperglycemia and obesity.


Abstract
The number of hypercholesterolemic and hyperglycemic people is increasing rapidly in the world. The prevention against these health problems is related to a complex management of conventional and non-conventional risk factors. The inclusion of dietary fiber in the diet is the right approach to reduce these risks. Cholesterol and glucose lowering effects are most often associated with gelling, mucilaginous, and viscous fibers such as guar gum, an edible thickening agent. It has widespread applications in the food industry due to its ability to hydrate without heating. The demand for guar gum is still growing rapidly because in addition to its indispensable role in lowering serum cholesterol and glucose levels, it is also considered helpful in weight loss programs. The main thrust of therapeutic and medicinal properties lies in the soluble dietary fiber content of guar gum to improve the serum biochemical profile of human and non-human primates, reducing total serum cholesterol, triglycerides, increasing the high density lipoprotein cholesterol level, and the management of glycemic indices and obesity. Among the various intervention strategies, diet diversification is the right approach to overcome these problems. Composite flours containing wheat and legumes have proven practical uses and are being utilized in many parts of the world to improve the nutritional and functional
properties of flour. The main focus of this manuscript is to review the available information on various aspects of guar gum with special reference to its effectiveness in reducing the cardiovascular disease risk, diabetes and weight loss programs.

PMID: 17457723 [PubMed - indexed for MEDLINE]