

Effect of Jaman Fruit Extract on Serum Glucose and Lipid Profile in Type 2 Diabetic Individuals

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Abstract: The effect of jaman fruit extract on glucose and lipid was studied in 10 type 2 diabetic individuals of both sexes for 12 days. Whole jaman fruit extract was prepared in distilled water. The insoluble residue was separated by filtration. Two gram potassium-metabisulphite and 30 g citric acid/L was added to the extract as preservatives. The extract was stored at room temperature for use. Ninety ml extract was given to the diabetic subjects in 3 doses per day after breakfast, lunch and dinner. Fasting blood samples were collected from the subjects on day 0, during the experiment (days 4 and 8) and 4 days after the stoppage of jaman extract (day 12). Serum glucose, TGL, total, HDL and LDL cholesterol were determined. After consumption of jaman extract, there was decrease in serum glucose in some individuals but not significant. Similar pattern was observed in serum TGL. Total cholesterol was decreased, but non-significantly. Also LDL was non-significantly decreased. HDL was not affected. The serum glucose, total cholesterol and LDL were lower on day 12, when the individuals were not using jaman extract, than the values for these parameters on day 0, when the individuals had not started yet the intake of jaman extract, making a clue that the extract effect may be appearing after some time. The results of this study are not conclusive, may be due to the preservatives used or short experimental period. Studies on jaman extract without preservatives and for longer durations are suggested.

Key words: Jaman fruit extract, glucose, lipid profile, type 2 diabetes

Introduction

Diabetes mellitus is a chronic disorder of glucose intolerance. It is characterized by high blood glucose level and glycosuria resulting from dysfunction of pancreatic β -cells and insulin resistance. The defective β -cells result in lack of total or partial synthesis of insulin. The insulin resistance is caused by cell membrane where glucose is not transported to the cells for oxidation. As glucose is not metabolized, high amount of glucose is circulating in the blood (hyperglycemia). To keep the normal level of glucose in the blood, the kidney removes the extra sugar from the blood and excretes it in the urine (glycosuria). Because glucose is not utilized by the body cells, the body is under constant impression of hunger and that is why diabetics feel increased appetite (polyphagia) and eat more frequently (Robinson *et al.*, 1986).

Diabetes is mostly common in elderly population and can be controlled with diet and spices, hypoglycemic drugs and insulin (Khan *et al.*, 1993; Khan and Ahmad, 1994). The primary objectives of the treatment of all types of diabetes include alleviation of symptoms of hyperglycemia, prevention and treatment of associated complications and disorders, improvement of the quality of life and hence reduction in mortality caused by the disease (Shera, 1999). Drug therapy (hypoglycemic agents and insulin), dietary therapy and recently spices and natural products therapy have been used for the treatment of diabetes mellitus. For Type 1 diabetes

mellitus, only insulin therapy and oral hypoglycemic agents are used. While for Type 2 diabetes mellitus, drug therapy, (both hypoglycemic agents and insulin), dietary therapy, spices and natural products therapy are used.

Control of diabetes by spices and other natural products is becoming popular and is more appropriate and economical for use in developing countries. Spices come from dried aromatic plants or trees and may be the bark, root, seeds, fruit, buds or the berry of these plants/ trees.

Jaman (*Syzygium cumini* L.) belongs to myrtaceae (myrtle family). Its synonyms are syzygium jambolanum, eugenia cumini and eugenia jambolana. It is commonly known as java plum, jambul, jaman, black plum, faux pistachier, Indian blackberry, doowet and jambolan (Morton and Miami, 1987; Zaman and Shariq, 1995).

Jaman is native to the subtropical Himalayas, India, Sri Lanka, Malaysia and Australia (Bose, 1985). Its fruits are delicious and have great importance in folk medicine (Chopera, 1956). The jaman is of wider interest for its medicinal applications than for its edible fruit. Different parts such as bark, fruit and seed possess medicinal and therapeutic values (Kirtikar *et al.*, 1990; Noomrio and Dahot, 1996).

The jaman fruit contains 83.7-85.8g moisture, 0.7-0.129g protein, 0.15-0.3g fat, 0.3-0.9g crude fiber, 14g carbohydrate, 0.32-0.4g ash, 8.3-15mg calcium, 35mg magnesium, 15-16.2 phosphorus, 1.2-1.62mg iron,

26.2mg sodium, 55mg potassium, 0.23mg copper, 13mg sulfur, 8mg chlorine, 80 I.U. vitamin A, 0.008-0.03mg thiamine, 0.009-0.01mg riboflavin, 0.2-0.29mg niacin, 5.7-18mg ascorbic acid, 7 mg choline and 3 mcg folic acid per 100 g of edible portion (Noomrio and Dahot, 1996).

Jaman seeds contain alkaloids namely jambosine, glycoside and antimellin. These alkaloids stop the conversion of starch into sugar. The seeds also contain a phenolic substance called ellagic acid, traces of pale yellow essential oil, chlorophyll, fat, resin, gallic acid and albumen. Chang *et al.* (1999) isolated 4-epifriedelin and 12 terpenoids from the leaves of jaman (*Syzygium formosanum*). These 12 compounds were caryophyllene oxide, friedelin, canophyllal, glutinol, alpha-terpineol, phytol, betulinic acid, uvaol, lupeol, betulin, ursolic acid, and oleanolic acid.

The jaman seed possess many medicinal properties in Ayurveda system of medicine (Chopera *et al.*, 1958). The fresh seeds are most effective in diabetes as they quickly reduce sugar in urine (Ashok and Daradka, 2001; Zaman and Shariq, 1995). Jaman fruit is used for the prevention of diarrhea, stomachache, astringent, diuresis and diabetes. The fresh jaman juice is mixed with goat's milk and then given to children in diarrhea (Zaman and Shariq, 1995). It is also used for enlarged spleen, chronic diarrhea and urine retention. Water diluted juice is used as a gargle for sore throat and as a lotion for ringworm of the scalp. The extract of jaman seed lowers blood pressure more than 30% and this action is attributed to the ellagic acid content of the extract (Morton and Miami, 1987).

Anita (2002) administered bitter gourd, jaman, and fenugreek seed to diabetic individuals. They reported that fasting and postprandial glucose level of the individuals was reduced along with a significant improvement in the serum lipid profile.

Ashok and Daradka (2001) reported the hypoglycemic response of jaman seed extract (50% ETOH) on diabetic mice. Jaman dosage decreased 37.2% blood glucose just after 3 hours of intake with 6 hours intake the blood glucose further decreased by 46.7%. Similarly, the blood glucose levels of the alloxan induced diabetic animals were also depleted after 3 hours and 6 hours by 46.1 and 65.7% respectively.

Arbab *et al.* (1989) tested the hypoglycemic activity of different doses of four extracts prepared from jaman leaves in different solvents. The extracts were tested on normal and hyperglycemic adult rabbits of both sexes and two diabetic volunteers (40-50) years. Twenty and 40 mg/kg Jaman ethanol extract gave significant results. Whereas, a dose of 40mg/kg body weight of normal rabbits gave insignificant results at the rate of 40 and 80 mg/kg, chloroform extract and 40 mg/kg aqueous extract. Dietrich (1974) tested aqueous extracts of fresh Jaman seeds (*Syzygium cumini*) on diabetic rabbits. A single

dose of the extract reduced fasting blood sugar (15 to 35%) in four to five hours. Prince *et al.* (1998) have recommended a dose of 2.5, 5.0, and 7.5g/kg body weight of aqueous extract of jaman seed for the treatment of diabetes.

Recently Khan and Anderson (2003) have shown that jaman fruit and seed have an insulin-potentiating factor that enhances carbohydrate metabolism in rats. This study was designed to see the effect of jaman extract on serum glucose and lipid profile in type 2 diabetic individuals.

Materials and Methods

Location of the study: The study was conducted in the department of Human Nutrition, NWFP Agricultural University Peshawar. The diabetic volunteers were registered from Peshawar University, Engineering University and Jinnah College for Women Peshawar in the university campus.

Criteria for selection of diabetic individuals: The criterion for selection of Type-2 diabetic individuals was that they should not be on insulin therapy and should not be taking any medication other than the diabetes. Their fasting serum glucose should be in the range of 125-300 mg/dl and their age should be between 40-60 years.

Sample size and subject selection: Ten (3 male and 7 female) type 2 diabetic individuals were selected on the above criteria and were registered for the study. After registration, the individuals were told that the study would continue for 12 days. During the study the individuals would take their routine diet.

The jaman extract was given for the first 8 days of the experiment and for the remaining 4 days no jaman extract was given. Fasting blood samples were taken on the starting day (day 0) of the experiment and on the 4th, 8th and finally on the 12th day of the experiment.

Preparation of jaman extract: Fresh and healthy jaman fruit were washed in the Lab. to remove dust etc. One kg fruits were ground in distilled water with 1:1 ratio. The mixture was filtered and re-blended with 1L of distill water. The procedure was repeated for 5 times, to completely squeeze the jaman extract. Thus 1:5 was the final dilution ratio of jaman and water. The extract was filtered again by using glass wool filter. Then 2g and 30g potassium metabisulphite (K₂ S₂ O₅) and citric acid respectively were added in the jaman extract for preservation purposes.

The mixture was stirred thoroughly to completely ensure the dissolution of chemicals. The mixture was kept in a glass jar for 2-3 days and the clear jaman extract was sucked by using a pipe, leaving the residue at the bottom of the jar. The jaman extract was stored at room temperature in clean and dried glass bottles with lids tightly closed to avoid spoilage.

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Table 1: Effect of Jaman Fruit Extract on Serum Glucose and Lipid Profile in Diabetic Individuals¹

Dose of Jaman Extract/day	Serum parameters	Fasting Serum Glucose, TGL, Cholesterol, HDL and LDL Levels ² (mg/dl)			
		Day 0	Day 4	Day 8	Day 12
90 ml	Glucose	174±59 ^a	160±58 ^a	188±70 ^a	158±54 ^a
90 ml	TGL	195±78 ^{ab}	145±45 ^b	243±154 ^a	187±97 ^a
90 ml	Cholesterol	200±30 ^a	191±31 ^a	194±41 ^a	189±23 ^a
90 ml	HDL	53±8 ^a	52±6 ^a	54±8 ^a	55±6 ^a
90 ml	LDL	109±38 ^a	110±31 ^a	104±35 ^a	94±15 ^a

¹The figures in table are mean and standard deviation of 10 individuals.

²Means followed by different letters in row are significantly different at $P < 0.05$ as determined by analysis of variance and LSD test.

Feeding of jaman extract: Jaman extract was given to the patients at a dose of 90ml per day for a total period of 8 days. The capacity of one jaman bottle was 720ml. Individuals were asked to take 30 ml of jaman extract, three times a day after each meal. Due to astringent taste of fruit and preservatives the individuals were asked to take extract with 50% dilution with water.

Collection of blood sample and serum separation: Approximately 5ml fasting blood samples were taken from each individual on day 0, 4, 8 and 12. Blood samples were transferred to sterilized centrifuge tubes and allowed for clotting at room temperature. The blood samples were centrifuged for 10 minutes in a centrifuge at 4000 rpm for serum separation. Serum samples were stored in freezer at 0°C for later analysis of glucose, TGL, total, high- and low-density lipoproteins (HDL and LDL) cholesterol.

Determination of glucose and lipid profile: Glucose was determined by the enzymatic calorimetric method of Trinder (1969). TGL were determined by the enzymatic calorimetric method of Werner *et al.* (1981). Cholesterol was determined by enzymatic calorimetric method of Allain *et al.* (1974). Chylomicrons, VLDL (very low-density lipoproteins), and LDL (low-density lipoproteins) were precipitated by adding phosphotungstic acid and magnesium ions to the sample. Centrifugation left only the HDL (high-density lipoproteins) in the supernatant; their cholesterol content was determined (Lopes-Virella, 1977). LDL cholesterol was calculated by the following formulae:

$$\text{LDL cholesterol (mg/dL)} = \frac{\text{TGL}}{5} - \text{HDL cholesterol}$$

$$\text{LDL cholesterol (mmol/L)} = \frac{\text{TGL}}{2.2} - \text{HDL cholesterol}$$

These tests were done in the Main Laboratory, Hayyat Abad Medical Complex by using auto analyzer (Express plus, Ciba coming USA). The calculations were done automatically.

Statistical analysis: Two- way Analysis of Variance was used for statistical analysis (MSTAT-C with MGRAPH, Russell D. Freed, MSTAT Director, Crop and Soil Sciences Department, Michigan State University, Version 2.00).

Results and Discussion

The results of Jaman extract on serum glucose and lipid profile is shown in Table 1.

The results in Table 1 indicate that there was no significant effect of Jaman extract on serum glucose and lipid profile in diabetic individuals. Pepato *et al.* (2005) reported that the therapeutic potential of *Eugenia jambolana* is related to the geographic region in which the plant was grown and to the part of the plant used. They investigated Brazilian *Eugenia jambolana* fruit using the same preparation and experimental methods as have been used in India. No change was observed in the masses of epididymal or retroperitoneal adipose tissue or of soleus or extensor digitorum longus muscles. This lack of any apparent effect on the diabetes may be attributable to the regional ecosystem where the fruit was collected and/or to the severity of the induced diabetes. Pepato *et al.* (2001) treated streptozotocin-diabetic rats for 17 days with a decoction of *Eugenia jambolana* (Myrtaceae) leaves (15%, w/v) as a substitute for water and reported that, at least in their experimental model, *Eugenia jambolana* leaf decoction had no antidiabetic activity. Teixeira *et al.* (2000) reported that increasing doses of the crude extract prepared from leaves of *S. cumini* administered for 2 weeks had no antihyperglycemic effect on the post-prandial blood glucose level of both normal rats and rats with streptozotocin-induced diabetes mellitus. These results do not rule out hypoglycemic effects in patients with Type 2 diabetes mellitus, but strongly suggest that, for a while, the jambolan cannot be recommended as an antihyperglycemic treatment.

In this study, though there were individuals whose serum glucose dropped with jaman extract however when statistics was applied to the data the effect became non significant. The mean values hidden the reduced values. Anita (2002) administered jaman to diabetic individuals. They reported that fasting and postprandial glucose level of the individuals was

reduced along with a significant improvement in the serum lipid profile. Ashok and Daradka (2001) reported the hypoglycemic response of jaman seed extract (50% ETOH) on diabetic mice. Jaman dosage decreased 37.2% blood glucose just after 3 hours of intake with 6 hours intake the blood glucose further decreased by 46.7%. Similarly, the blood glucose levels of the alloxan induced diabetic animals were also depleted after 3 hours and 6 hours by 46.1 and 65.7% respectively. Dietrich (1974) tested aqueous extracts of fresh Jaman seeds (*Syzygium cumini*) on diabetic rabbits. A single dose of the extract reduced fasting blood sugar (15 to 35%) in four to five hours. Prince *et al.* (1998) have recommended a dose of 2.5, 5.0, and 7.5g/kg body weight of aqueous extract of jaman seed for the treatment of diabetes.

A possible reason of not having effect on serum glucose and lipid profile was that the experimental individuals were not very much particular in the intake for the prescribed dose. Also on the blood collecting day some of the individuals were not fasting. Another more valid reason seems to be that the experimental design was too short and in this period the diabetic individuals might be adjusting their system to the doses and therefore the effect was not shown. If the experimental design were for longer duration it would have shown the lowering effect in diabetic individuals.

The author feels that there is another very strong reason for jaman not showing effect in diabetic individuals. The reason is, citric acid and potassium-metabisulphite were used in jaman extract for preservation purposes. These chemicals might have affected the biological activity of jaman extract. It is suggested that experimental trials without the use of chemical preservatives should be conducted. Such experiment might show glucose and lipid profile lowering effect in diabetic individuals.

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