

# Efficacy of value added foxtail millet therapeutic food in the management of diabetes and dyslipidemia in type 2 diabetic patients

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## Abstract

**Introduction:** The dietary strategies aim at improving both diabetes control and cardiovascular risk factors is the use of low-glycemic index diets. Diet has been the sheet anchor in the management of diabetes. We studied the effect of increasing the intake of millet based diet in patients with type 2 diabetes mellitus.

**Methods:** In a randomized, crossover study, we assigned 300 patients with type 2 diabetes mellitus to follow millet based diabetic diet, each for 90 days: a diet containing moderate amounts of fiber similar to as recommended by the American Diabetes Association (ADA). The diet is being prepared in a research laboratory of NAIP of UAS Dharwad. We compared the effects of the millet based diet on glycemic control and plasma lipid concentrations. Fasting plasma total cholesterol and triglycerides were measured. Cholesterol in the low-density lipoprotein (LDL) fraction was estimated.

**Results:** Compliance with the diets was excellent. The millet based diet lowered HbA1c (19.14%), fasting glucose (13.5 %), insulin (1.9%) concentrations, total cholesterol concentrations (13.25 %), triglyceride concentrations (13.51%), and very-low-density lipoprotein cholesterol concentrations by 4.5 percent in the patients with type 2 diabetes. However, the group did not differ for changes in body weight.

**Conclusions:** A high intake of millet based dietary fiber, improves glycemic control, decreases hyperinsulinemia, and lowers plasma lipid concentrations in patients with type 2 diabetes.

**Keywords:** Type 2 diabetics, glycemic index, foxtail millet diet

## INTRODUCTION

Millets are small seeded grasses that are hardy and grow well in dry zones as rain-fed crops, under marginal conditions of soil fertility and moisture in semi arid tropic region. They are highly nutritious, non-glutinous and not acid forming foods. Compared to rice, especially polished rice, millets release lesser percentage of glucose and over a longer period of time. This lowers the risk of diabetes. The global increase in the prevalence of diabetes is due to population growth, aging, urbanisation and an increase of obesity and physical inactivity. The primary determinants of the epidemic are the rapid epidemiological transition associated with changes in dietary patterns and decreased physical activity. The importance of diet in diabetes can be traced back to the days of the ancient ayurvedic physician Sushruta. He reported the consumption of wholesome foods, beside hereditary factors, to be a culprit for the development of diabetes. Indeed, before the discovery of insulin, diet was the only treatment and was successful at the level of near starvation, for a limited period of time. Today, the pendulum has swung from the starvation diet of Allen to modern high carbohydrate and high fiber diet<sup>1</sup>. The primary goal of the management of diabetes

mellitus is the attainment of near normal glycaemia. The target for good glycaemic control recommended by the American Diabetes Association (ADA) is glycated hemoglobin A1c (HbA1c) < 7.0%. Diabetes can be managed by slight modification in diet and low dosage of medicine<sup>2</sup>. Millet grains superior to major cereals with respect to protein, energy, vitamins and minerals. Beside, they are a rich source of dietary fiber, phytochemicals, non starchy polysaccharides and have a low glycemic index<sup>3</sup>, and hence can be used in therapeutic diet. The dietary strategy aim at improving both diabetes control and cardiovascular risk factors is the use of low-glycemic index diets. Hence we aimed to study the effect of increasing the intake of millet based diet for long period of 90 days in patients with type 2 diabetes mellitus.

## MATERIALS AND METHODS

In a randomized, crossover study, we assigned 300 patients with type 2 diabetes mellitus to follow foxtail millet based diabetic diet (80 gm), each for 90 days: a diet containing moderate amounts of fiber similar to that recommended by the American Diabetes Association (ADA). The foxtail millet based diabetic diet was supplied by National Agricultural Innovation Project laboratory of University of Agricultural Sciences Dharwad. This diet was combination of foxtail millet, split black gram and spice mix in specific ratio, thus had glycemic index of 49.64 percent. The 80 gm diet had approximately 16 g fibre, 248 kJ energy, 11.4 g protein, 71 mg calcium, 60 µg carotene and 3 mg iron. Approval to conduct the study was obtained from the Medical Director. All the patients were informed about the purpose and nature of the study and a written informed consent was

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obtained from each subject. The investigations were carried out during 2012 at the KLES Diabetes centre, Belgaum. We compared the effects of the millet based diet on glycemic control and plasma lipid concentrations. Fasting plasma, total cholesterol, lipoprotein cholesterol, and triglycerides were measured. The cross over clinical trial was carried out to check the role of confounding variables on various biochemical parameters, which may be due to the subject's physiological and behavioral variations.



### Statistical analysis

Student's t-test was used to find out differences before and after the supplementation.

### RESULTS

Daily consumption of 80 gm of foxtail millet diabetic diet by diabetic volunteers lowered the HbA1c (19.14%), fasting glucose (13.5 %), and Homocysteine (0.85%) concentrations and increased the insulin (1-9%) in their blood. Reduction was also noticed in the plasma lipid parameters viz, total cholesterol concentrations by 13.25 percent, triglyceride concentrations by 13.51 percent, and very-low-density lipoprotein cholesterol concentrations by 4.5 percent in the patients with type 2 diabetes. Whereas increase was noticed in the concentration of high density lipoprotein cholesterol by 17.39 percent. The detailed information on the changes in biochemical parameters that occurred in the patients after feeding millet based therapeutic diet is presented in Table 1.

Table 1. Effect of foxtail millet therapeutic diet on biochemical parameters in type 2 diabetic patients

| Biochemical parameters        | PRE (Mean)      | POST (Mean)      | Percent change |
|-------------------------------|-----------------|------------------|----------------|
| Fasting glucose (mg/dl)       | 152.55 (67-419) | 131.86 (70-279)  | - 13.5         |
| Post prandial glucose (mg/dl) | 200.81 (73-480) | 171.21 (86-370)  | - 14.74        |
| Random glucose                | 134.23 (65-383) | 128.22 (60-200)  | - 4.47         |
| HbA1c                         | 8.37 (5.3-17)   | 6.77 (4.8-9.2)   | - 19.14        |
| Total Cholesterol (mg/dl)     | 180.27 (90-303) | 156.38 (90-255)  | - 13.25        |
| HDL-C                         | 42.36 (28-83)   | 49.73 (30-84)    | + 17.39        |
| LDL-C                         | 117.63 (28-258) | 112.82 (6.3-250) | - 4.08         |
| Triglycerides                 | 141.97 (12-335) | 122.79 (13-234)  | - 13.51        |
| VLDL-C                        | 23.90 (4-53)    | 22.77 (4-45)     | - 4.73         |
| Homocysteine                  | 13.37 (8-25)    | 13.26 (3-31)     | - 0.85         |
| Lipoprotein- A                | 22.25 (7-45)    | 21.24 (10-38)    | - 4.53         |
| Insulin                       | 27.42           | 27.97            | + 1.9          |
| C-peptide                     | 2.18 (0.5-5)    | 2.28 (0.1-6)     | + 4.8          |
| <b>Renal Panel</b>            |                 |                  |                |
| Urea                          | 27.71 (3.9- 53) | 25.97 (5-45)     | - 6.27         |
| Creatinine                    | 0.90 (0.1-3.6)  | 0.76 (0.1-1.8)   | - 14.75        |
| Sodium                        | 134.81 (13-175) | 130.79 (15-150)  | - 2.98         |
| Potassium                     | 3.47 (0.5-34)   | 3.12 (0.4-32)    | - 10.15        |
| Uric acid                     | 3.67 (0.9-8.9)  | 3.57 (0.5-7.6)   | - 2.76         |

Renal panel studies also indicated desirable improvements in the diabetic patients studied. The study involved different experiences of people taking medicine and millet based diet. However, the group did not differ for changes in body weight, or the other diet intake.

### DISCUSSION

A high intake of millet based dietary fiber, improved the glycemic control, decreased the hyper insulinemia, and lowered the plasma lipid concentrations in patients with type 2 diabetes. The observations are in line with other studies<sup>4-7</sup> regarding lowering the serum triglycerides, serum cholesterol and serum glucose in patients taking low glycemic index diet. Considerable level of positive change in glyco-lipemic parameters may be attributed to presence of fibre content in foxtail millet which is slowly digested and absorbed in the intestine. Further specific combination of five spices used in the diet mix exhibit hypoglycemic and hypocholesterolemic effects when consumed with the diet. Thus, it can be concluded that millets do have a potential for a protective role in the management of diabetes. Hence this foxtail millet based diabetic diet can be used by diabetic patients for the management of diabetes as well dyslipidemia to certain extent. To elucidate the present findings further studies with large sample is warranted.

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