The Pharma Innovation Journal 2018; 7(6): 42-44

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(6): 42-44

www.thepharmajournal.com
Received: 10-04-2018
Accepted: 11-05-2018

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# To study the anti-hyperglycemic activity of porridge (A fibre rich dietary supplement) in management of type II diabetic subjects

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**Abstract**
Diabetes mellitus is a complex, chronic and metabolic disorder. It is a condition characterised by an increase of the level of glucose in the blood. The emphasis behind this study is to study the anti-hyperglycemic activity of dietary fibres and phytochemicals in lowering blood glucose level. For this, present study is designed accordingly to enhance the consumption of fibre rich diet of low glycemic index in treatment of diabetes. The participants were randomly assigned for receiving of 10, 20 and 40 gm test diet preparation. The fasting blood glucose level were evaluated at baseline, the blood glucose level were evaluated at 0, 30, 60, 90, 120, 150 and 180 minutes at 30 minutes of time interval. The data of this study shows how this anti diabetic porridge is much more beneficial in lowering blood glucose.

**Keywords:** Fibres, glycemic index, diabetes mellitus, hyperglycemic, anti-diabetic

## Introduction
Diabetes mellitus is characterized by the lack or relative lack of insulin. This has the effect of increasing blood glucose levels as uptake of glucose by cells is inhibited, resulting in glucose deficiency within the cells despite an abundance of glucose outside the cell. Epidermological data from late 19$^{th}$ century described diabetes mellitus (from the Greek “pass through” and latin “sweet as honey”) as a rather frequent disorder in man, in obese people above 50 years old, in cities and in western countries. Hyperglycemia is an important factor in the development and progression of the complications of diabetes mellitus (Luzi. 1998). Hyperglycemia caused an increase in glucose autoxidation, protein glycation and the subsequent oxidative degradation of glycated protein leads to enhanced production of reactive oxygen species (ROS) (Kakkar *et al*. 1997) [8]. According to “American Association of Cereal Chemists” (AACC), dietary fibre are termed as-Edible part of plant or analogus carbohydrate that are resistant to digestion and absorption in human small intestine with complete or partial fermentation by the help of large intestine. Polysaccarides, oligosaccharides, lignin and other plant derivatives stands under the category of dietary fibres. Naturally these dietary fibres are present in cereals, vegetables, fruits, and nuts. The fibre composition and amount varies with food to food (Desmedt and Jacobs, 2001) [3]. For this, present study is designed accordingly to enhance the consumption of fibre rich diet of low glycemic index in treatment of diabetes.

## Material and Methods
Leaves of *Moringa oleifera* were collected from botanical garden of Jiwaji University, Gwalior. Oats and Guar gum powder were purchased from the super market. One touch glucometer (ACCU-CHEK Sensor) of Roche Diagnostics, Germany was used to measure blood glucose level. This randomized controlled, clinical trial included T2D subjects from Centre for Translational Research, Jiwaji University. For anti-diabetic premix preparation moringa leaves were picked, washed, drained, coarsely ground and oven dried at 40 °C. Coarsely ground powder of oats were mixed with fine ground powder of moringa leaves, roasted oats flakes, black salt and guar gum powder in appropriate amounts given above. The premix was ready to eat and can be prepared by adding 100 ml hot water and butter milk.

**Table 1:** Formulation of Fibre rich porridge premix per 100 gm

| Ingredients | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|
| Oats flakes (gm) | - | - | - | 10 | 25 | 40 | 50 |
| Oats powder (gm) | 20 | 25 | 40 | 35 | 35 | 30 | 20 |
| Guar gum (gm) | 40 | 50 | 35 | 30 | 20 | 15 | 15 |
| Morringa leaves (gm) | 20 | 15 | 17 | 15 | 10 | 8 | 8 |
| Black salt | 20 | 10 | 8 | 10 | 10 | 7 | 7 |
| Water and Butter milk(ml) | 100+100 | 100+100 | 100+100 | 100+100 | 100+100 | 100+100 | 100+100 |

**Formulation:** Moringa leaves were picked, washed, drained, coarsely ground and oven dried at 40 °C. Coarsely ground powder of oats were mixed with fine ground powder of moringa leaves, roasted oats flakes, black salt and guar gum powder in appropriate amounts given above. The premix was ready to eat and can be prepared by adding 100 ml hot water and with 100 ml of butter milk. The efficacy of fibre rich anti diabetic porridge and its impact on blood glucose lowering capacity were analyzed, the related results are shown in the result and discussion portion.

**Evaluation of therapeutic efficacy**

**Study design and participants**

This is the single blind, randomized control trial conducted for dose estimation. Written informed consent was obtained from each patient before any procedure was performed. This randomized controlled, clinical trial included T2D subjects. The participants were randomly assigned for receiving of 10, 20 and 40 gm preparation of anti-diabetic Dalia. The fasting blood glucose level were evaluated at baseline, the blood glucose level were evaluated at 0, 30, 60, 90, 120, 150 and 180 minutes at 30 minutes of time interval.

**Subjects**

A diabetes clinic runs by School of Studies in Biochemistry, Jiwaji University, Gwalior, India under the supervision of an Ayurvedic Physician. The diabetic patients were provided with regular counseling on the causes, symptoms, complications of diabetes. From the diabetes clinic a total of thirty subjects were selected to participate in this study by inclusion and exclusion criteria. The subjects were enrolled for the dose optimization study that how much anti diabetic porridge preparation shows greater elevation in lowering blood glucose. We educated all subjects to perform in the same protocol for diet and exercise during the study. The following criteria were employed for selecting the subjects for the study.

| Inclusion criteria | Exclusion criteria |
|---|---|
| **Pre diabetic subjects** | |
| 1. Subjects with abnormal glucose tolerance/fasting glucose/pre diabetes. | 1. Those with hypertension |
| 2. Subjects (male and female) in the age group of 30-60 years and BMI 25-30. | 2. Those with diabetic complications (micro and macro). |
| 3. Subjects fasting glucose of 100-125 mg/dl. | 3. Those with personal habits like smoking. Drinking, etc. |
| 4. Subjects adhere to prescribed life style. | 4. Those suffering from any other chronic, metabolic and non-metabolic disorders. |
| **Type II diabetic subjects** | |
| 1. Subjects with fasting glucose levels between 125-140mg/dl and PP levels between 140-199mg.dl. | |
| 2. Subjects (male and female) in the age group of 30-60 years and BMI 25-30. | |
| 3. Subjects adhere to prescribed life style. | |

**Dose Optimization studies**

The subjects were fasted for twelve hours for dose optimization studies. Blood glucose level was checked using ACCU-CHEK sensor glucometer at baseline followed by administration of supplement doses of different concentrations (10, 20 and 40gm respectively) a day on empty stomach. After thirty minutes of dose supplementation glucose level was monitored at different time intervals over a period of 3 hrs.

**Observations**

As seen in Figure 1 the difference between from baseline to end of the dose estimation time interval there is no peak in blood glucose level in any test (porridge) formulation of 10, 20 or 40gm, but with respect to reference diet there is peak in elevated blood glucose level that show how the normal breakfast meal shoots up the blood glucose concentration significantly. From the graph it can be easily concluded that how the constituents of anti-diabetic porridge premix maintains blood glucose concentration just equivalent to fasting condition of diabetic patients after 3 hours of digestion and absorption. This is because of the edible part of plant or analogous carbohydrate that are resistant to digestion and absorption in human small intestine with complete or partial fermentation by the help of large intestine. Polysaccharides, oligosaccharides, lignin and other plant derivatives stand under the category of dietary fibres.

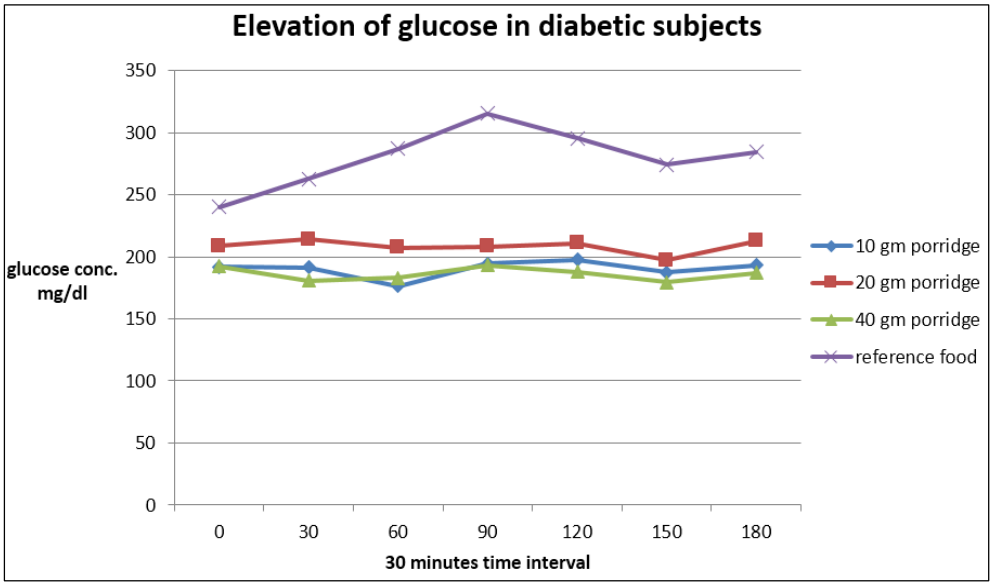


**Fig 1:** Effect of anti-diabetic Dalia on variation in blood glucose level (Diabetic Subjects)

## Result

After the primitive study on T2D subjects it was concluded from the graph that in management of diabetes, dietary management signifies that apart from lifestyle management and chemo therapy it is one of the important parameter for or controlling blood sugar level on controlled condition. However, this anti diabetic Dalia show significant reduction in blood glucose level with reference to normal other breakfast meal. The data of this study shows how this anti-diabetic dalia (porridge) is much more beneficial in lowering blood glucose. From the graph it can be easily concluded that how this ant diabetic dalia (porridge) is far more better than the normal breakfast meal, from this graph it is observed that the normal reference diet shows rapid glucose increase in the blood stream at 90 min shows the highest peak value under the curve in accordance to different test diet (Porridge) formulation.

## Discussion

From the current study, it was found that the anti-diabetic porridge had significant effect on lowering blood glucose levels. Type 2 diabetes is characterized by abnormalities in carbohydrate, lipid, and lipoprotein metabolism, which may cause hyperglycemia and many complications such as hyperlipidemia. The inconsistent picture regarding the antidiabetic effectiveness of natural, herbal therapeutic formulation draws through the entire literature, with either positive or negative results in human and animal studies. When low-glycemic diet have been incorporated by soluble fibres of oats, helps in improving postprandial glycemic and insulinemic response in both insulin and non-insulin dependent diabetes mellitus (Brand *et al*. 199) [2].

## Conclusion

After the primitive study on T2D subjects it was concluded from the findings that in management of diabetes, dietary management signifies that apart from lifestyle management and chemo therapy it is one of the important parameter for or controlling blood sugar level on controlled condition. However, this anti diabetic Dalia show significant reduction in blood glucose level with reference to normal other breakfast meal.. From the graph it can be easily concluded that how this antidiabetic porridge is far more better than the normal breakfast meal, from this graph it is observed that the normal reference diet shows rapid glucose increase in the blood stream at 90 min shows the highest peak value under the curve in accordance to different test diet (Porridge) formulation. Dried moringa leaves has been shown to posses anti-diabetic property. Transforming the leaves of moringa, oats and guar gum powder into a anti diabetic porridge with butter milk, which serves as a food as well as a therapeutic food and will be developed as functional food premix for a diabetic patient.

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