

Effect of wheat bran on diabetic subjects

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Abstract

Worldwide, 3.2 million deaths are attributable to diabetes every year. The present study was to supplement wheat bran and evaluate the effect of diabetic subjects. Thirty diabetic subjects were selected and divided into two groups of 15 each. Group A formed the experimental group to which 60 g of wheat germ was supplemented daily for a period of six months. Group B constituted the remaining 15 diabetic subjects who served as control to whom no supplementation was given. Fasting and post prandial glucose and glycosylated haemoglobin was evaluated initially and after the supplementation period. Group A showed significance ($P < 0.01$) difference over group B in all the biochemical test performed.

Keywords: Diabetes; wheat bran; blood glucose; glycosylated haemoglobin.

Introduction

Health is a fundamental human right and a worldwide social goal. It encompasses all humans disregard of age. Geographical conditions, culture, economic status and lifestyle of people have foremost impact on their health. Poor food habits and sedentary hedonistic lifestyle have resulted in the perpetuation of diseases like obesity, diabetes mellitus. The global prevalence of Type 2 diabetes is expected to double in the period 2000 to 2025 and may reach a level of almost 30 million people, that is, 5.6% of total global population by the year 2025 (Sunkin *et al.*, 2000). In such a context, there arises an essentiality for addressing the entire gamut of issue through one single medium 'Dietary modification'.

Several antioxidant and nutrient rich foods have been identified in ameliorating the conditions associated with the scourge and the role of wheat have been highlighted in many supplementation studies conducted world over and for the present study, wheat is chosen as a principal input playing a major role in the proposed dietary supplementation in a zealous attempt to make it as a major factor in the 'dietary modification' discussed afore. But the proposed supplementation of wheat is not per se wheat as conventionally understood but in the forms of 'wheat bran'. Wheat bran, one of the richest sources of dietary fibre can reduce the fasting and post lunch glucose level in diabetics. Wheat bran acts as phytoestrogens and is believed to protect against hormonally mediated breast, prostate and colon cancers. Wheat bran is used widely as a laxation aid. Wheat bran can help in weight control as it can replace high fat and high calorie food and leads to reduction in calories. Also addition of fibre in diet leads to a feeling of fullness and aids avoid 'over eating'. As dietary fibre requires more

energy to be digested, it can help in burning excess calories (Frische *et al.*, 2003). Safe inexpensive and acceptable interventions that lower glycemia, halt or delay the progression to diabetes and reduce cardiovascular disease are highly desirable (Nathan, 2010). Against such a backdrop, the present study has been undertaken with the following specific objective to supplement wheat bran to selected subjects of diabetes and evaluate the impact.

Methodology

The locale selected for the study was the District of Villupuram from the State of Tamil Nadu, India. The diabetic subjects were selected from two private diabetic clinics from Villupuram town. The review board of Department of Food Science and Nutrition, Avinashilingam University approved the protocol used in the study and all the subjects gave informed consent for the study. The ethical guidelines were followed and the study was approved by the Committee on Health Research Ethics, Avinashilingam University for Women, Coimbatore (H.E.C.2006.04).

Based on the physicians' opinion on the clinical and biochemical picture obtained from the hospital records and the criteria framed by the investigator 30 diabetic subjects were divided randomly into two groups of 15 each respectively (Group A & Group B), Group A received wheat bran and Group B served as the control group and did not receive any supplements other than the usual medications. The selected subjects were in the age group of 45-50 years. All the subjects were examined clinically and information pertaining to age, sex, habits and health status was recorded in the questionnaire. All subjects selected were free from added risk factors like thyroid, kidney disease, smoking and alcoholism.

Determination of dosage of wheat bran

The WHO recommends 20 to 40 g of dietary fiber a day. Higher intake of dietary fiber is associated with increased glycemic index of the diet thereby improving the blood glucose levels in diabetics (Sunkin *et al.*, 2000). Nutrient analysis of wheat bran revealed that 100 g of wheat bran provides 42.8 g of dietary fibre. Cade (2006) reported the beneficial effect of 20 g of wheat bran supplementation on colon cancer patients. As 20 g of wheat bran provides 8.56 g of dietary fibre and also has been well tolerated by the colon rectal cancer subjects, it was decided to supplement 20 g of wheat bran to the diabetic Group.

Supplementation of wheat bran

Before starting the feeding trials, all the 15 subjects in the Group A were educated about the beneficial effect of the supplements in alleviating the disease conditions. 20 g of bran were supplied in sachets to the diabetic group every fortnight at the clinic premises.

The following procedure was adopted for feeding the supplements:

- Ten gram of wheat bran mixed in 50 g of wheat flour was prepared as chappathi and taken twice a day (breakfast & dinner)
- Thus on a daily basis 20 g of wheat bran was consumed by each subject in the respective experimental groups for a period of six months.

Evaluation of the impact of supplementation

Impact of supplementation of wheat bran on selected subjects was evaluated by physiological symptoms and biochemical assessment.

Physiological symptoms: The physiological symptoms of diabetes was evaluated before and after the supplementation period using a check list. The physiological symptoms screened for diabetes include: Polydypsia, polyphagia, nocturia, constipation, insomnia, shivering, giddiness, excessive sweating, burning sensation in extremities, impaired vision, burning sensation during micturition, hesitancy during micturition and frequency of micturition.

Biochemical analysis: Biochemical changes can be expected to occur prior to clinical manifestation. Therefore biochemical tests which can be conducted on easily accessible body fluids such as blood and urine can help to diagnose disease at the sub clinical stage (Davidson, 1990). All the biochemical parameters were evaluated initially and after six months of supplementation for all the subjects.

The procedure for collection of blood and the method followed in the estimations is elaborated below:

Table 1. Changes in physiological symptoms of diabetic subjects

Symptoms*	Group A		Group B	
	I	F	I	F
Polydypsia	12	9	9	2
Polyphagia	14	10	10	-
Polyuria	13	13	12	-
Nocturia	14	10	10	1
Constipation	10	5	5	-
Insomnia	1	-	-	1
Giddiness	-	2	2	-
Impaired vision	2	-	-	2

* Multiple responses I-Initial; F-Final

10ml of venous blood was collected after overnight fasting in different containers

Sodium fluoride bulb

One ml of blood for glucose estimation.

EDTA bulb

5 ml of blood was added. Red blood cells were washed three times with ice cold normal saline and used for the estimation of glycosylated hemoglobin.

(i) Fasting and postprandial blood glucose were measured using commercial kits from Accurex, India,

on automated analyzer.

(ii) Glycosylated hemoglobin (GHb) was determined by the method of Fluckiger *et al.*(1976).

Statistical analysis

Mean, standard deviation and standard error were calculated. Students't' test was applied to assess the significance of the result.

Results and discussion

Table I gives the physiological symptoms at the initial and final phase of the study period. Of the various clinical parameters for diabetes, polyuria, polydypsia, polyphagia, nocturia and constipation were found to be the most frequently occurring symptoms in all the groups studied. In the initial phase it was found that 12 and nine subjects in Group A and Group B expressed the occurrence of polydypsia and 14 and 10 subjects of the Group A and Group B expressed polyphagia as a symptom. Around 10 to 15 subjects in the entire supplemented groups were suffering from constipation initially. After six months of supplementation with bran there was a drastic reduction in the physiological symptoms expect for one or two subjects in whom symptoms like polyuria, polyphagia, nocturia and polydypsia were reduced. Further it was found that the subjects who expressed constipation as a problem expressed the relief of constipation after the supplementation. This can be owed to the high amount of soluble fiber in the supplements. As observed from the Table, there was not much improvement in the physiological symptoms in the control group. Many in the experimental group studied desired to continue the supplementation even after the completion of the study due to the improvement shown in the various physiological symptoms. Table 2 provides the mean serum fasting, postprandial glucose and glycosylated hemoglobin levels at the initial and final phases of the study period.

Serum fasting glucose levels

The mean serum fasting glucose levels ranged from 123.20 to 124.80 mg/dl in the experimental and control groups as against the normal range of 70 to 99 mg/dl as

quoted by Raghuram *et al.* (2007). It is inferred that there was a reduction in fasting glucose levels on supplementation with wheat bran. Group A supplemented with wheat bran had a reduction of serum fasting glucose of 22.80 mg/dl. The final values of the serum fasting glucose was significantly lower than the initial values ($P < 0.01$) in all the experimental group. The difference observed between the initial and final values of the control Group B was not significant.

Serum postprandial glucose levels

The mean serum postprandial glucose levels of the experimental and control groups ranged from 184.40 to 188.53 mg/dl whereas normal level ranges from 80 to 120 mg/dl as quoted by Raghuram *et al.* (2007). The serum postprandial glucose levels reduced after supplementation of wheat bran. The final mean serum postprandial glucose levels in the experimental groups after the supplementation ranged from 113.07 to 123.93 mg/dl. There was a reduction of 39.80 mg/dl noted in Group A supplemented with wheat bran. Decrease in serum postprandial glucose levels in the experimental groups were found to be significant at 1% level whereas the change observed in the control group was not statistically significant.

Serum glycosylated hemoglobin levels

The glycosylated hemoglobin test (HbA_{1C}) is an excellent index of long term diabetes control. Unlike blood sugar which tends to fluctuate from day to day and even hour to hour, the HbA_{1C} test is a true index of the average blood glucose control during previous 2-3 months. HbA_{1C} test is done in the laboratory rapidly and precisely using the "gold standards" of the HbA_{1C} testing. The interpretation of the test results are as follows: normal-below 5.6%, good control-5.6 to 7%, fair control-7 to 8%, unsatisfactory control-8 to 10% and poor control-above 10% (American Diabetic Association, 2007). The mean initial glycosylated hemoglobin levels of the subjects in both the experimental and the control groups were between 8.39 to 8.45% (unsatisfactory control). The impact evaluation showed that the HbA_{1C} had lowered by the supplementation of wheat bran over a period of six months. A similar effect was noted in Group A which had a reduction of 1.96% with the final values at 6.41 (good control). The reduction between the mean initial and final values of HbA_{1C} in the supplemented groups was significant at 1% level. No such significance was observed in Group B. Study by Yukiko *et al.* (2007) proved that HbA_{1C} reduced on supplementation with Antioxidant Biofactor (AOB) a mixture of commercially available fermented grain foods which includes wheat.

It is concluded that wheat is effective contrivance in fight against degenerative disease and could be used as an adjunct intervention in ensuring better health for diabetic subjects; if not completely cure them of the

disease. It would be a beneficial to the diabetic population, if hitherto unexplored health promoting properties of wheat like alleviation of co-morbidities are examined. In the ever changing scenario of emerging varieties of diseases, existence of medical assistance without any side effect is much sought after remedy.

Table 2. Changes in mean serum fasting & postprandial glucose & glycosylated hemoglobin levels

Groups	Fasting Glucose (mg/dl)	Post prandial Glucose (mg/dl)	Glycosylated hemoglobin (%)
Group A Initial	123.60 $\pm$ 2.72	164.60 $\pm$ 2.61	8.37 $\pm$ 0.14
Final	100.80 $\pm$ 1.15	124.80 $\pm$ 2.11	6.41 $\pm$ 0.18
Difference	-22.80 $\pm$ 3.03	-39.80 $\pm$ 3.88	-1.96 $\pm$ 0.25
t' value	29.16**	39.76**	30.85**
Group B Initial	124.80 $\pm$ 2.54	163.07 $\pm$ 2.34	8.39 $\pm$ 0.21
Final	124.20 $\pm$ 2.65	164.60 $\pm$ 2.61	8.36 $\pm$ 0.13
Difference	-0.60 $\pm$ 3.46	1.53 $\pm$ 3.74	-0.03 $\pm$ 0.13
t' value	0.65 ^{NS}	1.53 ^{NS}	0.65 ^{NS}

(N=15/group)** Significant at one per cent level;^{NS} not significant

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