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Impact of Wheat Bran Supplementation on Body Weight, Blood Pressure, Blood Glucose and Blood Lipids Among Obese Diabetic Women in Holy Makkah

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ABSTRACT

Dietary fiber is part of a healthy diet and may exert a protective effect against several chronic diseases. A total of thirteen diabetic obese women with (BMI ≥ 30) were selected and instructed to consume 6 gm/d of wheat bran while they continued their usual diets for 8 weeks. Measures of body weight, BMI, blood pressure, blood glucose and blood lipids were undertaken and recorded at baseline, 4th and 8th weeks of the study for all subjects. Results showed that the mean body weight and BMI was reduced significantly ($p < 0.05$). The reduction in the blood lipid (cholesterol, LDL, triglyceride), blood glucose and the mean systolic and diastolic blood pressure after intervention weren't significant ($p > 0.05$). While the reduction in the (HDL) level after intervention was statistically significant. The findings from the present study support epidemiological evidence that addition of dietary fiber supplements to the diet has beneficial effects on body weight and controlling the obesity. While lipid profile, fasting blood glucose and blood pressure tend to lessen with using wheat bran for short period but not significantly.

Keywords: Wheat Bran, Supplementation, Body Weight, Blood Pressure, Blood Glucose, Blood Lipids, Obese Diabetic

Introduction

Dietary fiber is generally defined as plant material, mainly derived from plant cell walls, that is resistant to digestion by human gastrointestinal enzymes (1). There are two main groups of fiber: viscous (water soluble) including pectin, gum, mucilage and psyllium, and non-viscous (water insoluble) including cellulose, hemicellulose and lignin (2).

Dietary Reference Intakes recommend consumption of 14 gm dietary fiber per 1,000 kcal, or 25 gm for adult women and 38 gm for adult men (3) and the insoluble/soluble fiber ratio should be 3:1 (4).

Dietary fibers induce a number of physiological effects,

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depending upon the physical and chemical properties of the individual sources (5). generous intake of dietary fiber reduces risk for developing the following diseases: coronary heart disease, stroke, hypertension, diabetes, obesity and certain gastrointestinal disorders (6). Epidemiological and clinical studies demonstrate that consumption whole grain is inversely related to obesity, type two diabetes, cancer and cardiovascular disease (7). Most whole-grain wheat kernels are composed of $\approx 80\%$ endosperm (the predominant component of refined flour, which is rich in starch and protein but poor in most micronutrients), 15% bran (a major source of fiber, micronutrients, antioxidants, and phytochemicals) and 5% germ (plant embryo) (8). Bran, the residue left when flour is made from cereal grains, the bran comprises water-insoluble fiber. More than half the bran consists of fiber components (53%)(9). Also wheat bran contain specific nutrients include high concentrations of B vitamins (thiamin, niacin, riboflavin, and pantothenic acid) and minerals (Ca, Mg, K, P, Na, and Fe), numerous phytochemicals, some common in many plant foods (phytates and phenolic compounds) and some unique to grain



products (avenanthramides, avenalumic acid), are responsible for the high antioxidant activity of wholegrain foods (10). Coronary heart disease continues to be a leading cause of morbidity and mortality among adults in Europe and North America. Risk factors have included blood pressure, cigarette smoking, cholesterol (TC), (LDL), (HDL), and diabetes. Factors such as obesity, left ventricular hypertrophy and family history of premature (CHD) have also been considered in defining (CHD) risk (11). Intake of whole grains is associated with a reduced incidence of coronary heart disease (CHD).

Cereal antioxidants include that vitamin E, tocotrienols, selenium, phenolic acids, and phytic acid are associated with significant protection against (CHD) by reducing lipoprotein oxidation (8).

Wheat bran is a rich source of potassium, which has been recognized as contributing to reduction of blood pressure (12). Increased consumption of dietary fiber and grain products is widely recommended to maintain healthy body weight (13). Insoluble fibers have effects on gastric emptying, macronutrient absorption from the gut, postprandial glucose responses, and blood lipids.

Materials and Methods

Subjects and methods:

A total of thirteen subjects of obese women with uncontrolled type 2 diabetes at the age range 20 -64 years and body mass index (BMI ≥ 30 kg/m²) were selected from an outpatient clinic of diabetes care clinic in AL-Noor hospital in Makkah city during the period from February to May of 2012 to participate in this experimental trial. Subjects who using bulk laxatives or diuretics, patients with clinically significant renal, hepatic, gastrointestinal and thyroid disease, individuals with a history of major surgical procedures within the previous 6 months or pregnant women were excluded from the study. Measures of body weight, height and BMI [weight (kg)/ height (m²)] were undertaken before start the intervention and at 4th, 8th weeks of the study for all participants and as part of routine medical examination the blood pressure was measured in sitting position after 5-10 minute rest. Fasting blood samples were drawn from all subjects and analyzed for triglyceride, total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL) and fasting blood glucose. The initial investigation results were used as a baseline for the sample. While the mean of the follow up evaluations in 4th, 8th weeks of the study were used as after intervention results.

The intervention phase consisted of 8 weeks in which subjects continued the usual diets and chemical drugs but were also received 2 g wheat bran three times daily to provide a fiber supplements of about 6 gm/d. Subjects were instructed to consume the fiber tablets at least 60 min before the meals. Adherence to fiber supplements and any possible side effects was checked by conducting interviews with the subjects during

the monthly follow-up sessions.

Results and Discussion

Coronary heart disease (CHD) remains the leading cause of death worldwide, dietary fiber play an important role in reducing the risk factors of (CHD). In this study, we examined the effects of wheat bran on body weight, blood sugar, blood pressure and blood lipids among group of obese women. Table (1) of the study showed that The mean body weight of the studied group was reduced significantly ($p < 0.05$) from 82.46 ± 13.28 kg before intervention to 81.48 ± 13.42 kg after intervention. This result is confirm with Rigaud *et al* (14) who examined the effect of 7gm /d of fiber supplement with energy restricted diet on f Find all citations by this author (default) Or filter your current search ifty-two overweight patients, and Birketvedt *et al* (15) who suggested that a dietary fiber supplements in combination with a hypocaloric diet can introduce as an adjunct in the management of overweight and obesity. Also Kristensen *et al* (16) investigated the effect of whole-grain wheat among group of obese women and found that the body weight decreased significantly by $(3.6 \pm 3.2$ kg). On other side some researchers found that the fiber supplements had no effect on the body weight. Jenkins *et al* (12) found that wheat bran taken in supplements for 3 months did not seem to improve the body weight and the same result was found by Bodinham *et al* (17) who reported that 48 g of whole grain wheat consumed daily for 3 weeks didn't cause significant changes in body weight.

The results of the study (Table 1) illustrated that the mean (BMI) values reduced significantly among the studied group ($p < 0.05$). The Mean BMI value before intervention was 34.48 ± 4.21 kg/m² and it became 34.09 ± 4.32 kg/m² after intervention. BMI is inversely related to the fiber intake, as reported by Newby *et al* (18), Bortolotti *et al* (19) and Neil *et al* (20). The result showed that the reduction in the mean diastolic blood pressure among studied group was statistically insignificant ($p > 0.05$). The mean diastolic blood pressure reduced from 82.08 ± 8.97 mm.Hg Before intervention to 80.57 ± 5.84 mm.Hg after intervention and the reduction in the mean systolic blood pressure among studied group from 139.15 ± 14.04 mm.Hg before intervention to 132.07 ± 15.10 mm.Hg after intervention was statistically insignificant ($p > 0.05$). Table (3) of the study revealed that the reduction in the mean blood glucose level among the studied group from $186.8599.65$ mg/dL before intervention to $173.2679.46$ mg/dL after intervention was statistically insignificant ($p > 0.05$). Most prospective studies have found that insoluble fiber is inversely related to the incidence of type 2 diabetes mellitus (21). According to the long term studies of Haripriya and Premakumari (22) who evaluated the effect of 60 gm of wheat germ supplemented daily for 6 months on fifteen diabetic subjects and Ludwig *et al* (23) who examined the effect of dietary fiber among group of healthy adult for 10 years, there were significant changes in the blood glucose level

Table 1: Distribution of the studied group according to weight and BMI

Stage	Weight (Kg)		BMI (kg/m ²)	
	Mean	SD	Mean	SD
Before intervention	82.4692	13.28981	34.485	4.2152
After intervention	81.4885	13.42707	34.0923	4.32627
Paired	2,364		2,239	
P-value	< 0.05		< 0.05	

Table 2: Distribution of the studied group according to blood lipids

Stage	Blood lipids							
	Cholesterol (mg/dL)		Triglycerides (mol/L)		HDL (mg/dL)		LDL (mg/dL)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Before intervention	170.23	35.313	170.08	130.605	50.00	8.841	88.95	30.027
After intervention	165.6538	34.97641	133.5769	72.23337	45.3846	6.40037	87.5273	35.7028
Paired t	1.012		1.173		2,804		0.409	
P-value	> 0.05		> 0.05		< 0.05		> 0.05	

Table 3: Distribution of the studied group according to Blood pressure and Blood glucose

Stage	Blood pressure (mm.Hg)				Blood glucose (mg/dL)	
	Diastolic blood pressure		Systolic blood pressure		Mean	SD
	Mean	SD	Mean	SD		
Before intervention	82.08	8.976	139.15	14.041	186.85	99.654
After intervention	80.5769	5.84468	132.0769	15.10360	173.2692	79.46058
Paired t	0.528		1.414		0.855	
P-value	> 0.05		> 0.05		> 0.05	

and other glycemic parameters such as fasting insulin level. While short term studies as that done by Hollenbeck *et al.*, (24) and Mani (25) concluded that supplementation with 27gm and 11 gm respectively of wheat bran daily for 8 weeks didn't improve the glycemic control. According to our result using 6 gm of wheat bran for 8 weeks had no effect on the blood glucose level.

Table (2) in the study displayed that the reduction in the blood lipid (cholesterol, LDL, triglyceride) from 170.23 ± 35 mg/dL, 88.95 ± 30.02 mg/dL, 170.08 ± 130.60 mol/L

respectively)before intervention to (165.65±34.97 mg/dL, 87.52±35.70 mg/dL, 133.57±72.23 mol/L respectively) after intervention weren't significant (p>0.05). While the reduction in the (HDL) level from (50±8.84 mg/dL) before intervention to (45.38±6.40 mg/dL) after intervention was statistically significant.

Other studies reported that fiber supplements had no effects on serum lipid as Lithell *et al* (26) who examined the effect of bran product for 6 weeks found that There were no statistically significant changes in HDL triglycerides and

cholesterol in association with the bran consumption and Roberts *et al* (27) reported that there was no significant changes in total serum cholesterol or triglyceride concentrations after consuming ready-to-eat cereal containing wheat bran for .On the other hand several studies found that dietary fiber inversely associated with lipid profile, according to Van Berge-Henegouwen *et al* (28) adding fiber supplements to the diet cause a significant reduction in total serum cholesterol as well as in total serum triglycerides while (VLDL), (HDL), and (LDL) - cholesterol levels tended to diminish during bran feeding .Also there was significant drop in cholesterol level according to Kaul and Nidiry (29) who examined the effect of fiber from different food sources among group of obese patient for 8 months.

Table (8) in the present expressed that the reductions in the mean systolic and diastolic blood pressure among the studied group from (139.15±14.04, 82.08±8.97 mm.Hg respectively) before intervention to (132.0 7±15.10,80.57 ±5.84 mm.Hg respectively) after intervention were statically insignificant ($p>0.05$). Wheat bran is a rich source of potassium and magnesium which known to cause reduction in the blood pressure. Despite the positive findings in several studies such as Streppel *et al* (30) who pointed out that fiber supplementation in average dose 11.5 gm/d changed systolic blood pressure by - 1.13 mm. Hg and diastolic blood pressure by -1.26 mm.Hg and Behall *et al* (31) who compared the effect of whole wheat and brown rice as insoluble fiber and barley as soluble fiber. Increasing the potassium and magnesium intake from the bran supplements don't reduce the blood pressure according to the present study, which agree with Jenkins *et al* (12) who found that adding 19 gm/d of cereal fiber to twenty-three diabetic subjects diet for 3 months didn't cause significant changes in the blood pressure.

Conclusion and Recommendations

The findings from the present study support epidemiological evidence that addition of dietary fiber supplements to the diet has beneficial effects on body weight and controlling the obesity. While lipid profile, fasting blood glucose and blood pressure tend to diminish with using wheat bran for short period but not significantly. its recommended to Emphasize an increase in dietary fiber from different sources to all population and the obese patients should especially be targeted due to the beneficial effects of fiber in weight reduction. Long duration of using wheat bran or higher dose may required to improve blood glucose level and cause small favorable effects on lipid profile. Dietitians and other health professionals should organizing some education programs about the benefits of high fiber intake and its role in prevention and fighting of obesity and other chronic heart disease risk factors. Also efforts should be made to decrease the cost and increase the availability of different fiber supplements forms to ensure even people with low income get their needs of fiber.

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