

# DIETARY MANAGEMENT OF DIABETES MELLITUS; BIOCHEMICAL EVALUATION OF AFFECTS OF WHEAT BRAN AND GRAM BRAN FIBROUS DIETS

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## ABSTRACT

**O**BJECTIVES: To compare the efficacies of wheat and gram bran diets while seeing their effects on serum glucose and some of the lipids in alloxan-induced diabetic rats. **DESIGN:** Comparative study. **PERIOD:** May 1997 to June 1997 (A total of 5 weeks). **MATERIAL & METHOD:** A total of 8 mixed-sex albino rats were made diabetic by injecting 5 percent alloxan, intra-peritoneally. Rats were divided into 2 groups of 4 rats each and fed separately on 5 percent wheat and gram bran diets for one month. **RESULTS:** Serum glucose decreased by 66.3 percent, triglycerides 38.17 percent, serum cholesterol 24.17 percent and faecal cholesterol 75.47 percent in rats fed on gram bran supplemented diet, while rats fed on wheat bran supplemented diet showed serum glucose decreased by 54.5 percent, triglycerides 29.2 percent, serum cholesterol 16.26 percent and faecal cholesterol 69.09 percent. **CONCLUSION:** Results revealed that gram bran showed more serum glucose and lipids lowering action as compared to wheat bran.

**KEY WORDS:** Diabetes mellitus, Dietary fibre, Serum glucose, Lipide profile.

## INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder

that has affected the human beings throughout the world.

Dramatic increase in the prevalence of diabetes and

its related complications like dyslipidaemia and atherogenecity have precipitated the need for prediction of some preventive and prophylactic measures. Control of diabetes mellitus is the only way to fight against it. Maximum attention should, therefore, be given on dietary manipulation in order to achieve better results. The basis of effective therapy against diabetes and related ailments are diet and regular exercise. Trowel et al. (1995) have postulated that fibre deficient diets may be involved in the aetiology of the disease. Diets providing 20 gm or more of plant fibre have been associated with reduction in post-prandial plasma glucose, total cholesterol, LDL-cholesterol and insulin requirements, this is why high fibre diets are believed to decrease insulin requirements, improve control of blood sugar, decrease serum lipids and help in weight loss in diabetics (Bruttomesso et al., 1989). The present study was thus undertaken with the following aims and objectives;

1. To see the action of cereal bran fibrous diet for dietary management of diabetes mellitus.
2. To compare the efficacies of wheat and gram bran diets while seeing their effects on serum glucose and some of the lipids in alloxan-induced diabetic rats.

## MATERIALS & METHODS

A total of 8 mixed-sex adult albino rats were used in this study. The animals were divided into 2 groups of 4 rats each and kept separately in metabolic cages. These were rendered diabetic by injecting 5 percent solution (150 mg/kg of body weight) of alloxan intraperitoneally. Two experienced diets were formulated supplementing separately 5 percent wheat and 5 percent gram brans (Table-1). Proximate compositions of the brans (Table-2) were determined using techniques

as outlined in AOAC methods (1975). The brans were also made fat-free before mixing into the diets and the diets were made iso-caloric and iso-nitrogenous. The diets were then randomly assigned to both the groups of rats.

**Table-1 Composition of Experimental Diets.**

INGREDIENTS	DIETS	
	Wheat bran (gm)	Gram bran (gm)
Skimmed milk	14.00	39.50
Starch	5.50	15.20
Glucose	10.00	10.00
Banaspati ghee	20.00	20.00
Wheat bran	45.50	-
Gram bran	-	10.30
Vit & Mineral mixtures	5.00	5.00

The diets were fed ad libitum to the rat groups for one month while fresh potable water was served to them throughout the experimental period. Each rat was weighed prior to the start of the experiment and thereafter weekly.

## BIO-CHEMICAL DETERMINATIONS

Two ml of blood was drained off from the heart of the each rat under anaesthetized conditions. The blood samples were allowed to clot, the serums were separated and stored at -20°C to be used subsequently for the determination of serum glucose, cholesterol and triglycerides following the methods as described by young and Setal (1977). Stadtman (1979) and Koop and Glaneck (1982), respectively.

**Table-2 Proximate Composition of Wheat and Gram Brans on Fat Free and Dry Matter Bases**

Types of bran	Moisture (%)	Crude protein (%)	Crude fibre (%)	Total ash (%)	NFE (%)
Wheat bran	4.6	16.56	12.00	13.75	53.09
Gram bran	5.0	5.73	48.75	10.03	30.49

### STATISTICAL ANALYSIS

The data collected were analyzed applying Analysis of Co-variance (ANCOVA) technique (Steel and Torrie, 1981). Efficacies of both the fibrous diets were compared using the package MINI TAB for statistical analysis (1989) on PC-Computer.

### RESULTS & DISCUSSION

#### Weight Gain

The results (Table-3) revealed that the ultimate

mean weight gain in wheat bran fed group of rats was less (20.28%) against more (20.76%) in rats fed on gram bran diet, though the difference between the weight gains was non-significant ( $P>0.01$ ).

Nevertheless, the results were found to be in disagreement with those of Trowel et al, (1985) who reported that high fibre diets, like gram bran in this study, were believed to cause more weight loss in diabetes. This disfavouring observation might be attributed to some differed strain/genetics and the behaviour of the experimental animals.

**Table-3 Weight Gain by Rats fed on wheat and gram bran diets (Mean + SD)**

Diet	Weeks				
	1st	2nd	3rd	4th	5th
Wheat bran	220.94±29.04	238.58±22.06	242.94 ±8.89	250.51±1.56	265.76±8.98
Gram Bran	224.88±21.15	239.61±27.89	260.76±34.01	264.04±42.84	271.58±42.69

### SERUM GLUCOSE

The results Table 4 revealed that mean serum glucose level decreased by 66.3 % in rats fed on gram bran diet, whereas the rats fed on wheat bran diet showed decrease in serum glucose by 54.50 % (table 4). The observation inferred that the gram bran diet, a high fibre diet had greater serum

glucose lowering action than wheat bran diet.

Our findings appeared to be in agreement with those reported by Valler and Hanssen (1988) who observed significant decrease in post-prandial blood glucose when they administered high fibrous guar gum and wheat bran supplemented diets to insulin dependent diabetes mellitus patients.

Table 4 Serum Glucose Levels in Rats fed on wheat and gram bran diets (Mean  $\pm$  SD)

Diet	Weeks				
	1st	2nd	3rd	4th	5th
Wheat bran	89.2 $\pm$ 24.3	227.2 $\pm$ 37.9	143.2 $\pm$ 20.2	124.3 $\pm$ 36.1	124.1 $\pm$ 18.5
Gram Bran	112.5 $\pm$ 35.2	254.8 $\pm$ 54.1	158.5 $\pm$ 48.4	129.0 $\pm$ 31.1	118.0 $\pm$ 25.4

### SERUM TRIGLYCERIDES

The results table 5 revealed that more serum triglycerides lowering action 32.17% was seen in the rats group fed on gram bran diet, while wheat bran fed rats showed decrease in serum triglycerides by 29.2 %. The observation again indicated that high fibrous (gram) diet reduced also serum triglycerides level.

These results were found in agreement with those reported by Harold et al. (1985) who also noticed significant reduction in serum triglycerides levels in

insulin dependent diabetics fed on high fibre diet supplemented with wheat bran and cellulose diet for six weeks.

### SERUM CHOLESTEROL

The results table 6 showed that gram bran diet decreased more 24.17% serum cholesterol as compared to wheat bran diet 16.26%. Our results were found in accordance with those of Goswamy et al. 1985 who also reported decline in the trend of serum cholesterol in rats fed on wheat bran diet 10% in a 21 day biological trial.

Table 5 Serum triglycerides level in rats fed on wheat and gram bran supplemented diets (Mean  $\pm$  SD)

Diet	Weeks				
	1st	2nd	3rd	4th	5th
Wheat bran	143.80 $\pm$ 59.45	457.68 $\pm$ 133.67	135.29 $\pm$ 31.61	122.04 $\pm$ 20.17	126.95 $\pm$ 19.62
Gram Bran	100.82 $\pm$ 22.0	197.95 $\pm$ 77.66	138.11 $\pm$ 34.77	120.96 $\pm$ 29.23	75.76 $\pm$ 14.11

Table 6. Serum cholesterol levels in rats fed on wheat and gram bran supplemented diets (Mean  $\pm$  SD)

Diets	Weeks				
	1st	2nd	3rd	4th	5th
Wheat bran	295.3 $\pm$ 93.9	709.7 $\pm$ 119.1	268.0 $\pm$ 43.8	28.4 $\pm$ 46.5	115.4 $\pm$ 6.8
Gram Bran	279.0 $\pm$ 34.0	539.5 $\pm$ 85.2	396.3 $\pm$ 24.0	241.1 $\pm$ 51.7	130.4 $\pm$ 22.8

### FAECAL CHOLESTEROL

Mean faecal cholesterol level in gram bran fed rats was significantly higher (75.47%) than that (69.09%) in wheat bran fed rats (Table-7).

Significantly raised faecal cholesterol level in gram bran fed rats clearly indicated reduced cholesterol level in the serum of rats.

**Table 7 Faecal cholesterol levels in rats fed on wheat and gram bran supplemented diets (Mean  $\pm$ SD)**

Diets	Weeks			
	1st	2nd	3rd	4th
Wheat bran	30.19 $\pm$ 12.35	32.99 $\pm$ 11.17	69.18 $\pm$ 5.03	65.93 $\pm$ 12.34
Gram bran	57.18 $\pm$ 29.00	27.51 $\pm$ 12.12	61.83 $\pm$ 10.90	75.37 $\pm$ 10.44

These results are clearly indicative of the proven action of high fibre diet in lowering of serum lipids, towards dietary managements of diabetes mellitus.

## CONCLUSIONS

Gram bran diet was found to be more efficient than wheat bran in serum glucose and lipids lowering action and hence have tendency to reduce the risk of diabetes mellitus and coronary heart diseases.

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