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EVALUATION OF FIBER RICH DIETS IN LIPID MANAGEMENT OF HUMAN TYPE II DIABETES MELLITIS

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ABSTRACT

Objective: This study is designed to evaluate the effects of fiber in lipid management (blood level of cholesterol, triglyceride, HDL, LDL, VLDL, RR) of human Type II Diabetes Mellitus. **Method:** Under this study three diets viz. control diet (no fiber), low fiber diet (5 gm fiber), high fiber diet (10 gm fiber) were given to Control group, Experimental group 1, Experimental group 2 respectively. Data were recorded after three months supplementation and statistically analyzed. **Result:** After the continuous consumption of test diets by all three groups, it was inferred from statistical analysis that fiber has no influence on level of cholesterol. Similar behaviour was observed in the case of triglycerides, HDL, VLDL, LDL and RR. **Conclusion:** It was concluded that prescribed amount of fiber brought about some changes in different lipid levels but the changes were not found significant enough to manage lipid profile of Type II Diabetes Mellitus patients.

KEYWORDS: Diabetes mellitus, fiber, lipid management, Oats.

INTRODUCTION

Diabetes mellitus is a common metabolic disorder resulting from defects in insulin action, insulin production, or both. Insulin, a hormone secreted by the pancreas, helps the body use and store glucose produced during the digestion of food. It is mainly characterized by hyperglycemia. Other symptoms are frequent urination, increased thirst, dehydration, weight loss, blurred vision, fatigue, occasionally coma, etc. Uncontrolled hyperglycemia over time damages the eyes, nerves, blood vessels, kidneys, and heart, causing organ dysfunction and failure. Family history, age, ethnicity, social group characteristics, behavior, life style, psychological and clinical factors are the risk factors of disease. Diabetes mellitus is classified into four categories: type I, type II, gestational diabetes, and others. Type II Diabetes is the most common form of diabetes mellitus, accounting for 90 to 95 percent of all diabetes cases worldwide.[1]

Treatment for diabetes involves following a regimen of diet, exercise, self-monitoring of blood glucose, and taking medication or insulin injections. The number of calories needed to maintain weight depends upon person's age, sex, height, and weight and activity level. 45 - 65% of total daily calories should be provided by carbohydrates. The type and amount of carbohydrates both are important. Best choices are vegetables, fruits, beans, and whole grains. These foods are also high in fiber. Carbohydrate intake can be monitored by diabetic person either through carbohydrate counting or meal planning exchange lists. 25 - 35% of daily calories should be provided by fats. Monounsaturated and omega-3 polyunsaturated fats are the best types. 12 - 20% of daily calories should be fulfilled by protein. Fish, soy, and poultry are better protein choices than red meat. Weight reduction is advised if body mass index (BMI) is 25 - 29 (overweight) or higher (obese).[2]

Fiber

Fiber or "roughage" as it is also known, is essentially a carbohydrate and is found solely in plants. Two types of fiber are insoluble ans soluble fiber.[3] Cellulose, hemicellulose and lignin are some insoluble fibers. Stool is made soft and bulky by this kind of fibers, which is then easily passed through bowel and thus constipation is prevented. On the other hand Gums and pectins are known as soluble fibers. They can be found in all fruits and vegetables. It is showed by the different studies that cholesterol level may be reduced with the help of soluble fiber in the blood. Digestion is also slowed down by soluble fiber and the sudden release of energy is delayed, especially from carbohydrates into the bloodstream. This means that blood sugar levels are more stable, which is good for people with diabetes.

Requirement of Fiber

According to current Canadian guidelines, at least 26 grams of fiber - ideally 26 to 35 grams should be consumed daily by healthy adults.[5] According to National Academy of Sciences, US, the average American's daily intake of fiber is about 5 to 14 grams per day.[4] According to the British Nutrition Foundation it is advised that 18g fiber a day should be aimed by healthy adults.[4] There have been no studies on evaluating the dietary fiber requirements in Indians. It was investigated by the data from diets of the Western part of the country that the dietary fiber content is about 30-40 gm/day. The intake was being increased with increasing level of energy intake, 39 gm -47 gm/day in young men. The fiber intake is lower in women (15-30 gm/day) and is much less in tribal population (15-19 gm/day). It was also showed by another report from North India that the average total fiber intake per day is about 52 gm. More data needs to be generated in the Indian context to understand the phenomenon of health transition.[6] The main objective of this study is to optimize the amount of fiber in type II Diabetes mellitus in Indian scenario.

Oats

Oats are a nutritional power food and have many health benefits including decreasing risk of the incidence of heart disease and diabetes. This grain is packed with vitamins and minerals such as silica and other trace elements to help the body build sturdy bones and muscles, maintain joint elasticity and much more. Oatmeal also contains a wide array of antioxidants and is a good source of protein, complex carbohydrates, fats and iron. It is mainly considered for high fiber source. Oats is rich in β-glucan soluble fiber.

Table 1. Amount of nutrients per serving of one cup (156.0 gm) of oats (7)

Calories	607 Kcal
Total fat Saturated fat Poly unsaturated fat Mono saturated fat	10.8 gm 1.9 gm 4.0 gm 3.4 gm
Cholesterol	0 mg
Sodium	3 mg
Total Carbohydrate	103.4 gm
Dietary fiber	16.5 gm
Protein	26.3 gm

METHODOLOGY

In this study, the sample was selected from Type II Diabetic population of Diabetic camp, centre for translational research, Jiwaji University, Gwalior by probability random sampling method. The samples included male and female subjects in the age group of 35 to 65 years. For the purpose of study, subjects were divided into following three groups:

1. Control group (diabetic subjects without fiber diet)
2. Experimental group 1(diabetic subjects with low fiber diet 5 gm)
3. Experimental group 2 (diabetic subjects with high fiber diet 10 gm).

Subjects were chosen randomly from various areas of greater Gwalior city.

Size and Classification of Sample

100 diabetic subjects were randomly chosen irrespective of sex, age (35-65), occupation, income, religion etc. Out of these, 50 were assigned as control group and other 50 as Experimental group 1. The same 50 subjects, assigned as Experimental group 1, were then assigned as Experimental group 2 (after three months of intervention).

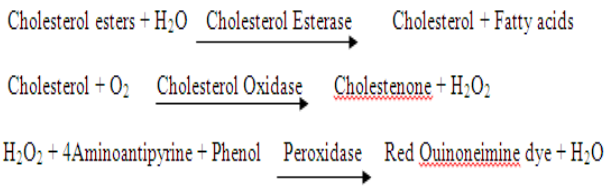
A self made interview schedule was applied to collect the information from the subjects. This schedule was prepared considering all the possible aspects related to study. Blood lipid levels were estimated by following standard methods.

Lipid Analysis

The lipid profile parameters such as total cholesterol (Cholesterol oxidase- peroxidase method), serum triglyceride (GPO-POD method), serum HDL–cholesterol (Phosphotungstate method), low density lipoprotein (LDL) and very low density lipoprotein (VLDL) were calculated from Freidewald's formula. All the estimations were carried out fasting serum samples using commercial kits manufactured by Crest Bio systems India Pvt. Ltd. The detailed methodology is described below:

(a) Estimation of Total Cholesterol: (CHOD-PAP method)

Principle: Cholesterol esterase hydrolyses esterifies cholesterols to free cholesterol. The free cholesterol is oxidized to form hydrogen peroxide which further reacts with phenol and 4-aminoantipyrine by the catalytic action of peroxidase to form a red coloured quinoneimine dye complex. Intensity of the colour formed is directly proportional to the amount of cholesterol present in sample.[8]



Procedure

	Sample	Standard	Blank
Serum or plasma	10 µl	-	-
Standard	-	10 µl	-
Reaction solution	1 ml	1 ml	1 ml

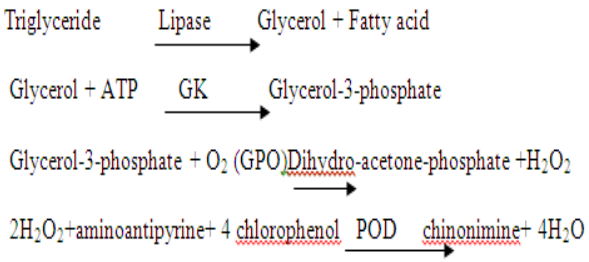
The contents were vortexed and incubated for 10 min at 20 to 25ºC. Then the absorbance was taken against the cholesterol working reagent as blank and measured at 546 nm.

Calculation

$$\text{Total Cholesterol} = \frac{\text{Absorbance of the test}}{\text{Absorbance of the standard}} \times 200\text{mg/dl}$$

(b) Estimation of Triglycerides: (GPO-POD Method; Burtis et al., 1999)

Principle: Triglyceride (a form of lipid), by the action of Lipase, hydrolyzes to glycerol and fatty acid. Glycerol by the enzymatic reaction of Glycerol Kinase (GK) gets converted to Glycerol-3-phosphate. In the subsequent enzymatic oxidation by Glycerol-3-phosphate oxidation (GPO), H2O2 is formed. This is converted into colored chinonimine in a reaction with aminoantipyrine andchlorophenol catalyzed by peroxidase (POD) (9).



Procedure

	Sample	Standard	Blank
Serum or plasma	10 µl	-	-
Standard	-	10 µl	-
Reaction solution	1 ml	1 ml	1 ml

The contents were vortexed and incubated for 15 mins at room temperature. Absorbance was observed at 546 nm using reagent as blank.

Calculation

$$\text{Triglyceride} = \frac{\text{Absorbance of the test}}{\text{Absorbance of the standard}} \times 200\text{mg/dl}$$

(c)Estimation of HDL-cholesterol: Phosphotungstate Method; Lopes (Virella et al., 1977)

Principle: Chylomicrons, VLDL (very low density lipoproteins), and LDL (low-density lipoproteins) in serum or plasma are separated from HDL (High density lipoprotein) by precipitating with Phosphotungstic acid and Magnesium chloride. After centrifugation, the cholesterol in the HDL fraction, which remains in the supernatant is assayed with enzymatic cholesterol method, using Cholesterol Esterase, Cholesterol Oxidase-Peroxidase and the Chromogen 4-Aminoantipyrine/Phenol.

Procedure: The contents were mixed well and incubated for 10 minutes at room temperature. The tubes were then centrifuged for 10 minutes at 4000 rpm. After centrifugation the clear layer (supernatant) was separated and used as a sample and the cholesterol was determined by the CHOD-POD method. The standard was prepared by diluting the cholesterol standard (100 µl) with 250 µl of normal saline, 200 µl of sample and 200 µl of precipitant were used (10).

Constituents	Amount
Sample	200 µl
Precipitant	200 µl

All the contents were mixed well and incubated for 20 minutes at room temperature. The absorbance was measured at 546nm against cholesterol reagent as blank.

Calculation

$$\text{HDL Cholesterol} = \frac{\text{Absorbance of the test}}{\text{Absorbance of the standard}} \times 100\text{mg/dl}$$

$$\text{VLDL Cholesterol} = \frac{\text{Triglycerides}}{5}$$

LDL Cholesterol = Total cholesterol – (VLDL + HDL)
Risk ratio = Total cholesterol/ HDL

Formulation of Different Test Diets

In order to carry out the study in a systematic manner, it was planned to formulate three test diets. First of which would contain no fiber, the second would have low fiber while the third one would have high fiber.

(a) Formulation of Control Diet

Firstly rice flakes and bengal gram were roasted separately. Bengal gram was dehusked and then rice flakes and bengal gram were mixed. After that measured amount of oil was taken, heated up to desired temperature and then spices were added into oil. This oil was mixed into mixture of bengal gram and rice flakes. At last salt was added to this in required amount. All the ingredients were mixed properly. Three different diets were prepared as per table.

Table 2: Amount of ingredients for formulation of control diet.

Ingredients	P1	P2	P3
Rice flakes (gm)	40	50	60
Bengal gram(gm)	30	20	10
Oil (ml)	5	5	5

The amounts of ingredients for formulation of control diet were taken as per the above table. No fiber source was used. The ingredients were processed as per the formulation procedure mentioned earlier.

(b) Formulation of Test diet I

Firstly rice flakes and oats were roasted separately. Rice flakes and oats were mixed. After that measured amount of oil was taken, heated up to desired temperature and then spices were added into oil. This oil was mixed into mixture of oats and rice flakes. At last salt was added to this in required amount. All the ingredients were mixed properly. Here also three different diets were also prepared as per the ingredients.

Table 3. Amount of ingredients for formulation of Test diet 1.

Ingredients	P4	P5	P6
Oats (gms)	25	50	-
Wheat bran (gms)	6	-	15
Rice flakes (gms)	40	20	50
Oil (ml)	3	3	3

The amounts of ingredients for formulation of Test diet 1 were taken as per the above table. Oats and wheat bran were used here as a fiber source. The ingredients were processed as per the procedure mentioned earlier.

(C) Formulation of Test diet II

Firstly Oats and coriander seeds were roasted separately. The coriander seeds were crushed and then oats and coriander seeds were mixed together. After that measured amount of oil was taken, heated up to desired temperature and then spices were added into oil. This oil was mixed into mixture of oats and coriander seeds. At last salt was added to this in required amount. All the ingredients were mixed properly.

Table 4: Amount of ingredients for formulation of Test diet II.

Ingredients	P7	P8	P9
Oats (gms)	35	-	70
Rice flakes (gms)	25	50	
Wheat bran (gms)	10	20	-
Coriander seeds (gms)	5	5	5
Oil (ml)	1	1	1

The amounts of ingredients for formulation of Test diet II were taken as per the above table. Oats and wheat bran were used here as a fiber source. The ingredients were processed as per the procedure mentioned earlier.

On the basis of the sensory evaluation scores P1 (Control diet), P5 (Test diet I), P9 (Test diet II) were decided for Control group, Experimental group 1and Experimental group 2 respectively.

Statistical Analysis

Percentage method was used for making simple comparison. For drawing significant conclusion, ANCOVA (software by SPSS 13.0) is a suitable analytical method, which was applied here.

RESULTS AND DISCUSSION

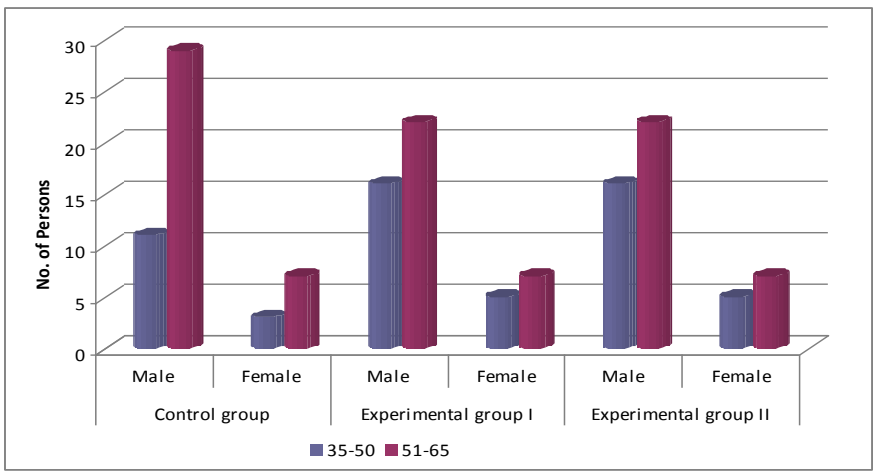
Some observations during the study have been tabulated below, and for quick and better understanding data have also been represented by bar diagrams.

Table 5: Distribution of subjects belonging to chosen three groups.

Groups	Value Label	Number of subjects
Control group	No fiber	50
Experimental group 1	5 gm fiber (Test diet I)	50
Experimental group 2	10gm fiber (Test diet II)	50

Table 6: Distribution of subjects according to age and Sex.

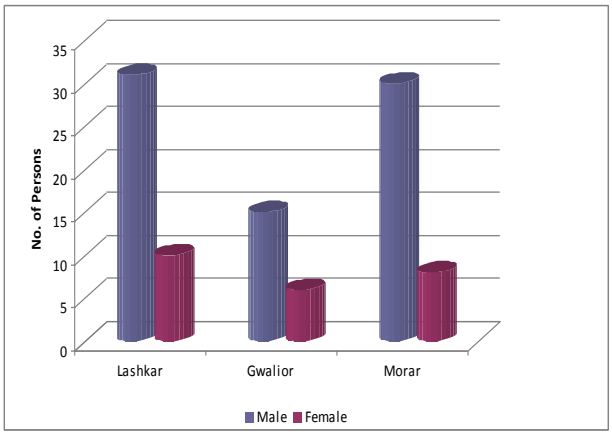
S. No.	Age group	Control group				Experimental group 1				Experimental group 2			
		Male	Female	Total	%	Male	Female	Total	%	Male	Female	Total	%
1	35-50	11	3	14	28	16	5	21	42	16	5	21	42
2	51-65	29	7	36	72	22	7	29	58	22	7	29	58



Above table shows the distribution of subjects according to age and sex. 50 subjects each were included in three groups viz. control group, Experimental group 1 and Experimental group 2. In age group of 35-50years 28% subjects were in control group and 42% subjects were in Experimental group 1 and 2, respectively whereas in age group of 51-65 years 72% were in control group and 58% were in Experimental group 1 and 2 respectively.

Table 7: Demographic profile of the respondents.

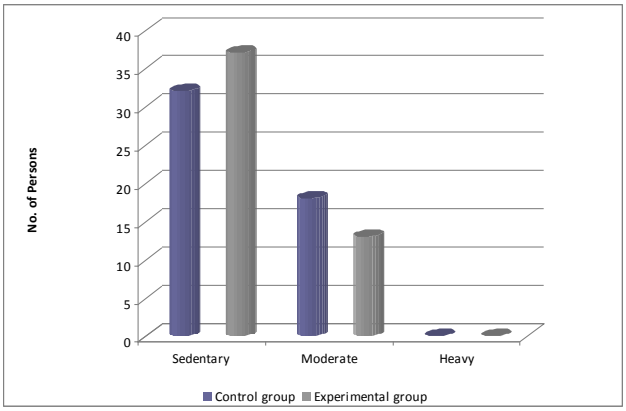
S. No.	Study Area	Distribution of subjects according to sex		
		Male	Female	Total
1	Lashkar	31	10	41
2	Gwalior	15	6	21
3	Morar	30	8	38
Total		76	24	100



Above table and graph shows the demographic profile of subjects (control and Experimental group 1, 2) under study. The study group comprised of 100 subjects. As the study area was greater Gwalior which is composed of three regions viz. Gwalior, Lashkar, Morar, among the total 100 subjects 31 male and 10 female from lashkar, 15 male and 6 female from Gwalior and 30 male and 8 female were randomly chosen from Morar for the purpose of study.

Table 8: Distribution of subjects according to activity.

S.No.	Activity	Control group		Experimental group	
		No.	%	No.	%
1	Sedentary	32	64	37	74
2	Moderate	18	36	13	26
3	Heavy	0	0	0	0
	Total	50	100	50	100



As is evident in the above table majority of the subjects under study were sedentary active (control group 64% experimental group 74%). Remaining patients had moderate active. None of them undertook heavy activity.

Table 9: Table showing the descriptive statistics like Mean, Standard deviation of post scores of Total Cholesterol (mg/dl) under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Group	Mean	Std. Deviation	N
Control group	141.2580	35.40699	50
Experimental group 1	151.3538	20.19639	50
Experimental group 2	139.5000	20.24563	50
	144.0373	26.62094	150

1. N: Number of people
2. Std. Deviation: Standard Deviation

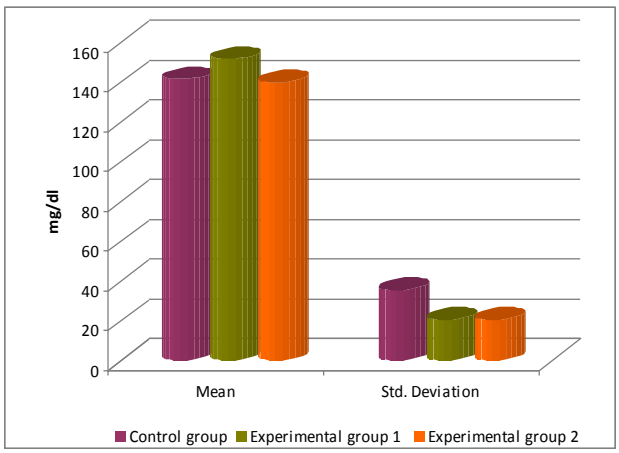


Table 10: Summary of one way ANCOVA of post scores of Total Cholesterol under three Conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Source	Type III Sum of Squares	DF	Mean Square	F	Remark
Group	2326.124	2	1163.062	2.060	**p > 0.05**
Error	82445.732	146	564.697		
Total	3217602.588	150			
Corrected Total	105592.459	149			

1. ANCOVA: Analysis of covariance
2. DF: Degree of freedom
3. F: Variance ratio
4. P: Probability

From the above table, it is evident that the F value for group being 2.060is non significant with df=2/146. It indicates that the adjusted mean scores of total cholesterol levels of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast, considering the baseline of total cholesterol levels as covariate, do not differ significantly. Thus the null hypothesis "There is no significant difference in the adjusted mean scores of total cholesterol levelswhen the subjects are not given fiber; when they are treated with test diet I (5gm fiber in the breakfast) and when they are treated with test diet II (10 gm fiber in the breakfast)" is accepted. This proves that oatmeal which is rich in fiber may not influence the cholesterol levels of the subjects.

This also decides that intake of 5 gm or 10 gm of fiber all alone cannot influence the cholesterol level of the subjects.

Table 11: Table showing the descriptive statistics like Mean, Standard deviation of post scores of Triglycerides (mg/dl)of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Group	Mean	Std. Deviation	N
Control group	125.0860	35.06268	50
Experimental group 1	123.7200	29.58356	50
Experimental group 2	123.3112	26.82632	50
	124.0391	30.48530	150

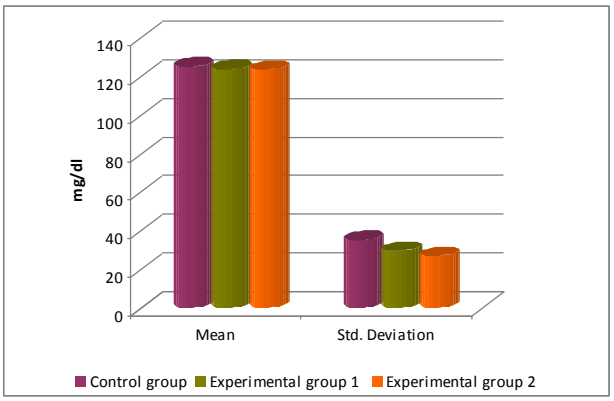


Table 12: Summary of one way ANCOVA of post scores of Triglycerides of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Source	Type III Sum of Squares	DF	Mean Square	F	Remark
Group	76.138	2	38.069	.051	**p > 0.05**
Error	108990.939	146	746.513		
Total	2446327.164	150			
Corrected Total	138473.655	149			

From the above table, it is evident that the F value for group being 0.051 non significant with df= 2/146. It indicates that the adjusted mean scores of triglycerides level of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast, considering the baseline of triglycerides level as covariate, do not differ significantly. Thus the null hypothesis "There is no significant difference in the adjusted mean scores of triglycerides when the subjects are not given fiber; when they are treated with test diet1 (5gm fiber in the breakfast) and when they are treated with test diet II (10 gm fiber in the breakfast)" is accepted. This proves that oatmeal which is rich in fiber may not influence the triglycerides levels of the subjects.

This also decides that intake of 5gm or 10 gm of fiber all alone cannot influence the triglycerides level of the subjects.

Table 13: Table showing the descriptive statistics like Mean, Standard deviation of post scores of HDL level (High Density Lipoprotein) (mg/dl) of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Group	Mean	Std. Deviation	N
Control group	36.1060	6.67276	50
Experimental group 1	36.1528	7.69477	50
Experimental group 2	35.2730	6.17397	50
	35.8439	6.84208	150

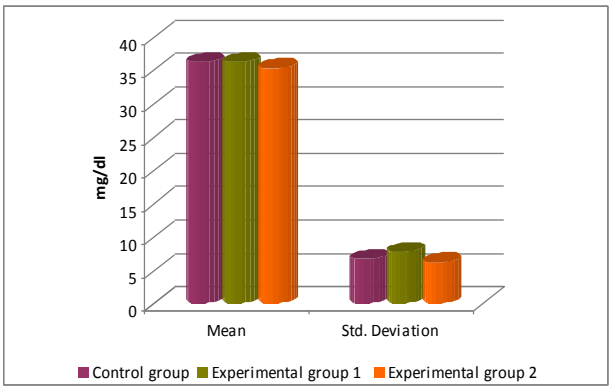
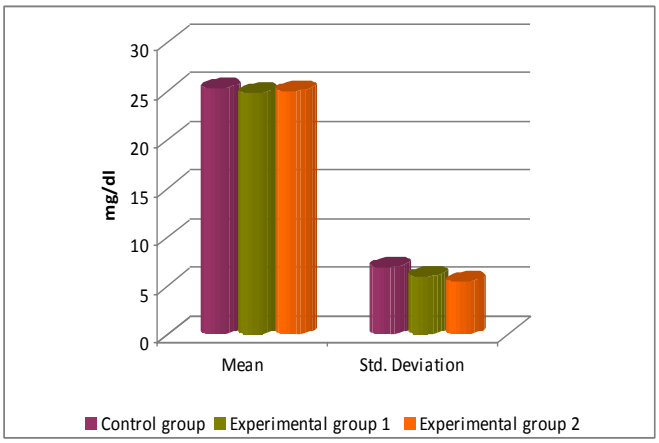


Table 14: Summary of one way ANCOVA of post scores of HDL level (High Density Lipo protein) of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Source	Type III Sum of Squares	DF	Mean Square	F	Remark
Group	89.065	2	44.532	1.160	**p > 0.05**
Error	5603.172	146	38.378		
Total	199693.432	150			
Corrected Total	6975.299	149			

From the above table, it is evident that the F value for group being 1.160is non significant with df= 2/146. It indicates that the adjusted mean scores of HDL (HIGH Density Lipoprotein of subjectsunder three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast, considering the baseline of total HDL(High Density Lipo Protien) levelsas covariate, do not differ significantly. Thus the null hypothesis, stated, "There is no significant difference in the adjusted mean scores of HDL (High Density Lipo Protien)when the subjects are not given fiber; when they are treated with test diet I (5gm fiber in the breakfast) and when they are treated with test diet II (10 gm fiber in the breakfast)" is accepted. This proves that oatmeal which is rich in fiber may not influence the HDL (High Density Lipo Protien**)** of the subjects.



This also decides that intake of 5gm or 10 gm of fiber all alone cannot influence the HDL level, the good cholesterol level of the subjects.

Table 15: Table showing the descriptive statistics like Mean, Standard deviation of post scores of VLDL level (Very Low Density Lipoprotein) (mg/dl) of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Group	Mean	Std. Deviation	N
Control group	25.2088	6.89137	50
Experimental group 1	24.7304	5.91775	50
Experimental group 2	24.9212	5.34192	50
	24.9535	6.04629	150

Table 16: Summary of one way ANCOVA of post scores of VLDL level (Very Low Density Lipo protein) (mg/dl) of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Source	Type III Sum of Squares	DF	Mean Square	F	Remark
Group	1.545	2	.772	.027	**p > 0.05**
Error	4252.192	146	29.125		
Total	98848.415	150			
Corrected Total	5447.090	149			

From the above table, it is evident that the F value for group being 0.027 is non significant with df= 2/146. It indicates that the adjusted mean scores of VLDL level (Very Low Density Lipoprotein) of subjects of three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast, considering the baseline of total VLDL levels (Very Low Density Lipoprotein) as covariate, do not differ significantly. Thus the null hypothesis "There is no significant difference in the adjusted mean scores of VLDL level (Very Low Density Lipoprotein) when the subjects are not given fiber; when they are treated with test diet I (5 gm fiber in the breakfast) and when they are treated with test diet II (10 gm fiber in the breakfast)" is accepted. This proves that oatmeal which is rich in fiber may not influence the VLDL level (Very Low Density Lipoprotein) of the subjects.

This also decides that intake of 5gm or 10 gm of fiber all alone cannot influence the VLDL level, the worse cholesterol level of the subjects.

Table 17: Table showing the descriptive statistics like Mean, Standard deviation of post scores of LDL level (Low Density Lipoprotein) (mg/dl) of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Group	Mean	Std. Deviation	N
Control group	83.3632	26.70598	50
Experimental group 1	90.5004	20.09495	50
Experimental group 2	79.3652	18.20253	50
	84.4096	22.30825	150

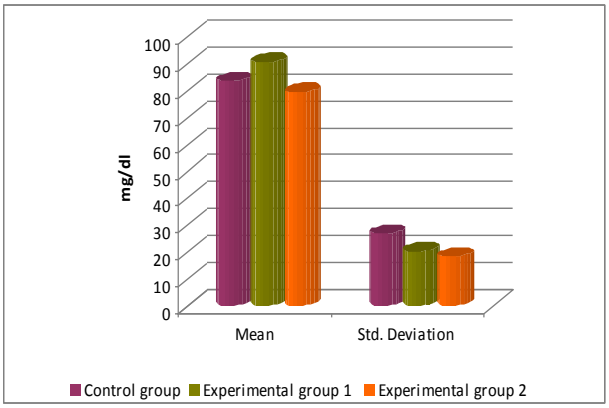


Table 18: Summary of one way ANCOVA of post scores of LDL level (Low Density Lipo protein) of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Source	Type III Sum of Squares	DF	Mean Square	F	Remark
Group	177.586	2	88.793	0.277	**p > 0.05**
Error	46755.936	146	320.246		
Total	1142898.100	150			
Corrected Total	74151.014	149			

From the above table, it is evident that the F value for group being 0.277is non significant with df= 2/146. It indicates that the adjusted mean scores of LDL level (Low Density Lipoprotein) of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast, considering the baseline of total cholesterol levels as covariate, do not differ significantly. Thus the null hypothesis "There is no significant difference in the adjusted mean scores of LDL level (Low Density Lipoprotein) when the subjects are not given fiber; when they are treated with test diet I (5gm fiber in the breakfast) and when they are treated with test diet II (10 gm fiber in the breakfast)" is accepted. This proves that oatmeal which is rich in fiber may not influence the LDL level (Low Density Lipoprotein) of the subjects.This also decides that intake of 5 gm or 10 gm of fiber all alone cannot influence the LDL level, the bad cholesterol level of the subjects.

Table 19: Table showing the descriptive statistics like Mean, Standard deviation of post scores of Risk Ratio (RR) of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Group	Mean	Std. Deviation	N
Control group	4.0816	1.03164	50
Experimental group 1	4.3018	.92026	50
Experimental group 2	4.0258	.82756	50
	4.1364	.93168	150

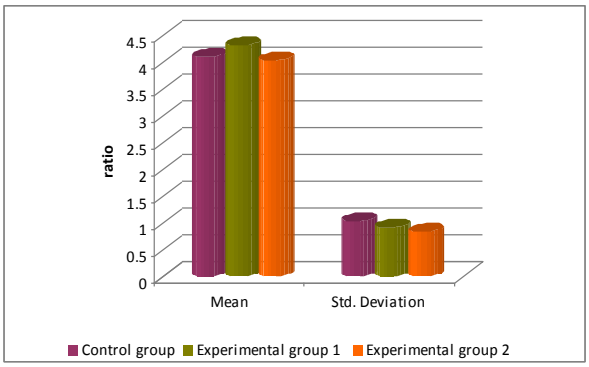


Table 20: Summary of one way ANCOVA of post scores of Risk Ratio (RR) of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast.

Source	Type III Sum of Squares	df	Mean Square	F	Remark
Group	.704	2	.352	.651	**p > 0.05**
Error	79.000	146	.541		
Total	2695.806	150			
Corrected Total	129.335	149			

From the above table, it is evident that the F value for group being 0.651is non significant with df= 2/146. It indicates that the adjusted mean scores of Risk Ratio (RR) of subjectsunder three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast, considering the baseline of Risk Ratio (RR) as covariate, do not differ significantly. Thus the null hypothesis "There is no significant difference in the adjusted mean scores of Risk Ratio (RR) when the subjects are not given fiber; when they are treated with test diet1 (5g fiber in the breakfast) and when they are treated with test diet II (10 gm fiber in the breakfast)" is accepted. This proves that oatmeal which is rich in fiber may not influence the Risk Ratio (RR) of the subjects.

This also decides that intake of 5 gm or 10 gm of fiber all alone cannot influence the Risk Ratio (RR), the risk of procuring cardio vascular disease.

CONCLUSION AND SUGGESTIONS

This study was designed to assess the therapeutic importance of dietary fiber in the lipid management of diabetes mellitus. It is already established that fiber plays important role in lipid metabolism. Through this study an attempt has been made to optimize the amount of fiber that should be incorporated in one's diet. The diabetic subjects were provided with test diets comprising of different quantities of fiber or no fiber at all. After the continuous consumption of test diets by all three groups, it was inferred from statistical analysis that fiber has no influence on level of cholesterol. Similar behavior was observed in the case of triglycerides, HDL, VLDL, LDL and RR.

As we know that diabetes with high lipid levels can be a major cause for macro vascular diseases, significant results were not shown by these two concentrations of fiber in management of these levels. This may be due to less physical activity, dietary disturbances, stress and careless medication. To corroborate the results, a more exhaustive study is required.

In modern times, Type II Diabetes is mainly caused due to life style disorders, so this is a prime responsibility of a diabetic person that life style modification must be carried out by the patients as they become aware about it. Life style modification means;

- Turn sedentary active life to moderate active life style
- Regular monitoring of sugar level
- Estimation of lipid levels at regular intervals
- Diet consciousness (high fiber, high protein and low saturated fat)
- Stress relieving exercises
- Routine checkup
- Anthropometric measurements
- Monitoring of blood pressure
- Proper medication

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CONFLICTS OF INTERESTS

All authors have none to declare.

ABBREVIATION LIST

1. ATP: Adenine tri phosphate
2. N: Number
3. Std. Deviation: Standard deviation
4. ANCOVA:Analysis of covariance
5. DF: Degree of freedom
6. F: Variance ratio
7. P: Probability

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