The Pharma Innovation Journal 2018; 7(5): 88-93

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(5): 88-93

www.thepharmajournal.com
Received: 16-03-2018
Accepted: 18-04-2018

Shweta Choudhary
a) Scindia Kanya Vidyalaya, Moti Mahal Road, Gwalior, Madhya Pradesh, India.
b) Department of Home Science, Govt. KRGPG Autonomous College, Kampoo, Gwalior, Madhya Pradesh, India

Shailja Jain
Department of Home Science, Govt. KRGPG Autonomous College, Kampoo, Gwalior, Madhya Pradesh, India

Correspondence
Shweta Choudhary
a) Scindia Kanya Vidyalaya, Moti Mahal Road, Gwalior, Madhya Pradesh, India.
b) Department of Home Science, Govt. KRGPG Autonomous College, Kampoo, Gwalior, Madhya Pradesh, India

Role of fiber rich diets in management of blood pressure of human type ii diabetes mellitis (with special reference to Gwalior)

Shweta Choudhary and Shailja Jain

Abstract
Type II Diabetes mellitus is a long term metabolic disorder that is characterized by high blood sugar, insulin resistance, and relative lack of insulin. Diet plays very important role in the management of Diabetes mellitus. Calories in the form of complex carbohydrate and fiber have multiple benefits in this disease. Since Diabetes raises the risk of high blood pressure and other heart and circulation problems, so this study is designed to know the impact of fiber in the management of blood pressure in human Type II Diabetes Mellitus. 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. Though there wasn't seen an impact on systolic blood pressure, but there was a significant difference in the mean scores of diastolic blood pressure of the subjects, meaning thereby fiber place an important role in reducing hypertension in the subjects.

Keywords: Diabetes mellitus, fiber, oats, blood pressure

Introduction
Diabetes mellitus type II (also known as type 2 diabetes) is a long term metabolic disorder that is characterized by high blood sugar, insulin resistance, and relative lack of insulin. Common symptoms include increased thirst, frequent urination, and unexplained weight loss. Symptoms may also include increased hunger, feeling tired, and sores that do not heal. Often symptoms come on slowly. Long-term complications from high blood sugar include heart disease, strokes, diabetic retinopathy which can result in blindness, kidney failure, and poor blood flow in the limbs which may lead to amputations. The sudden onset of hyperosmolar hyperglycemic state may occur however, ketoacidosis is uncommon [1].
Having diabetes makes high blood pressure and other heart and circulation problems more likely, because diabetes damages arteries and makes them targets for hardening (atherosclerosis).[2] About 25% of people with Type 1 diabetes and 80% of people with Type 2 diabetes have high blood pressure. Having diabetes raises your risk of heart disease, stroke, kidney disease and other health problems. Diabetes and high blood pressure together raise the risk of health problems even more [3]. It is essential to keep blood pressure well controlled with Diabetes. Treatment includes a change in lifestyle risk factors where these can be improved. Many people with diabetes need to take medication to lower their blood pressure.

Blood pressure
Blood pressure is the pressure of blood in your blood vessels (arteries). Blood pressure is measured in millimeters of mercury (mm Hg). Our blood pressure is recorded as two figures for example, 124/80 mm Hg. This is said as 124 over 80.

- The top (first) number is the systolic pressure. This is the pressure in the arteries when the heart contracts.
- The bottom (second) number is the diastolic pressure. This is the pressure in the arteries when the heart rests between each heartbeat. [4]

Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are two pre diabetic conditions associated with insulin resistance. In these conditions, the blood glucose concentration is above the normal range. Subjects with IGT and/or IFG are at substantially higher risk of developing diabetes and cardiovascular disease than those with normal glucose tolerance. [5]

Type II diabetes makes up about 90% of cases of Diabetes, with the other 10% due primarily to Type I diabetes mellitus and gestational diabetes. In type I diabetes mellitus there is an absolute lack of insulin, due to an autoimmune induced breakdown of the islet cells in the pancreas. Diagnosis of diabetes is by blood tests such as fasting plasma glucose, oral glucose tolerance test, or A1C [1].

Treatment for Diabetes involves following a regimen of diet, exercise, self-monitoring of blood glucose, and taking medication or insulin injections. Diet plays very important role in the management of Diabetes mellitus. 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 BMI is 25 - 29 (overweight) or higher (obese) [6].

Fiber

Dietary fiber is a plant-based nutrient that is sometimes called roughage or bulk. It is a type of carbohydrate but, unlike other carbohydrate, it cannot be broken down into digestible sugar molecules. Therefore, fiber passes through the intestinal tract relatively intact. However, on its journey, fiber does a lot of work.

Fiber is important for digestion and regularity, weight management, blood sugar regulation, cholesterol maintenance and more. It has also been linked to longevity and decreasing the risk of cancer [7].Two types of fibers are Insoluble and soluble fibers. 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. 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 [8].

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. At present average 4.5 to 11 grams only are taken by a Canadian in a day. Ideally 25 to 50 grams per day should be consumed by people with diabetes [9].

According to National Academy of Sciences, US, the average American's daily intake of fiber is about 5 to 14 grams per day. The current recommendations are to achieve an adequate intake (AI) of fiber based on one's gender and age [10].

According to the British Nutrition Foundation it is advised that 18g fiber a day should be aimed by healthy adults [10].

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 [11].

Oats

Oats is the one super food that can easily fit itself to suit our needs. Protein-packed, full of fiber and low on fat, oats are designed to boost energy levels and help lead a healthy lifestyle. They are not only good for the stomach but are interestingly super filling, satisfying and versatile. Oats contain a wide range of nutrients like fiber, vitamin E, essential fatty acids, etc. which make them top the healthy food charts. Oats are rich in soluble fibers (known as beta glucan) which help in lowering cholesterol levels. These soluble fibers help increase intestinal transit time and reduce glucose absorption. Oats is a low calorie food which slows digestion and makes you feel full longer. Cholecystokinin, a hunger-fighting hormone, is increased with the oatmeal compound beta-glucan. Oats are also a rich source of magnesium, which is key to enzyme function and energy production and helps prevent heart attacks and strokes by relaxing blood vessels [12].

Table 1: Amount of nutrients per serving of one cup (156.0 gm) of oats [13]

Calories	607 Kcal
Total fat	10.8 gm
Saturated fat	1.9 gm
Poly unsaturated fat	4.0 gm
Mono saturated fat	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. Subject's blood pressure was estimated by standardized equipments before and after administration.

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

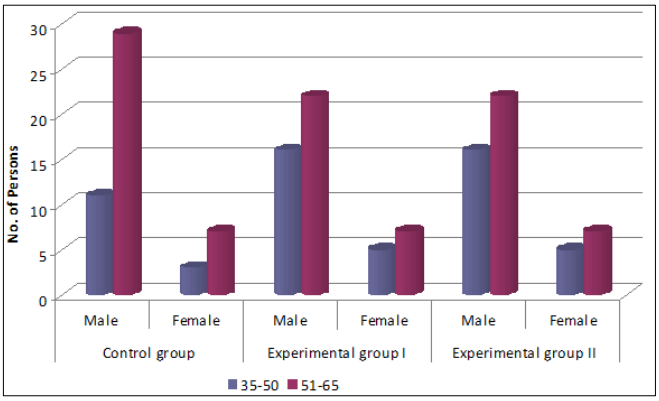
Some observations during the study have been tabulated below, and for quick and better understanding data have also been represented by bar diagrams.

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

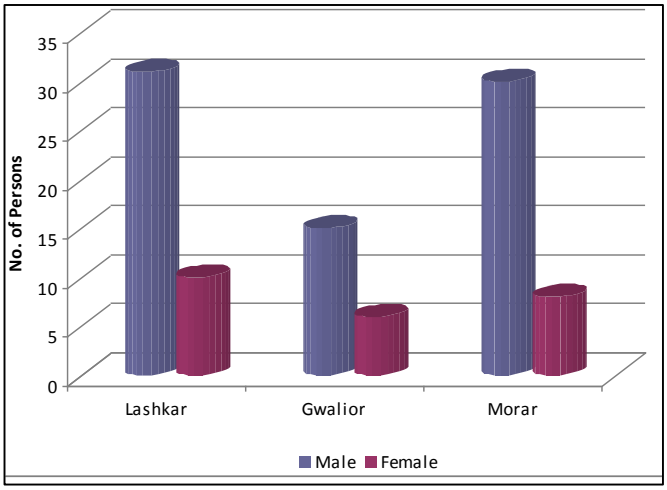


Graph 1: Distribution of subjects according to age and Sex

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 35-50yrs 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

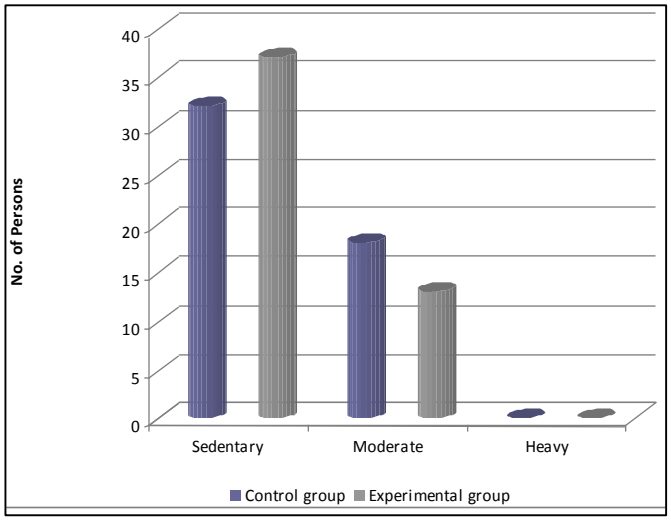


Graph 2: Demographic profile of the respondents

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



Graph3: Distribution of subjects according to activity

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 8. Table and graph showing the descriptive statistics like Mean, Standard deviation of post scores of Systolic Pressure (mmHg) 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	118.00	8.741	50
Experimental group 1	116.04	8.164	50
Experimental group 2	119.14	7.188	50
	117.73	8.105	150

Std. Deviation: Standard Deviation

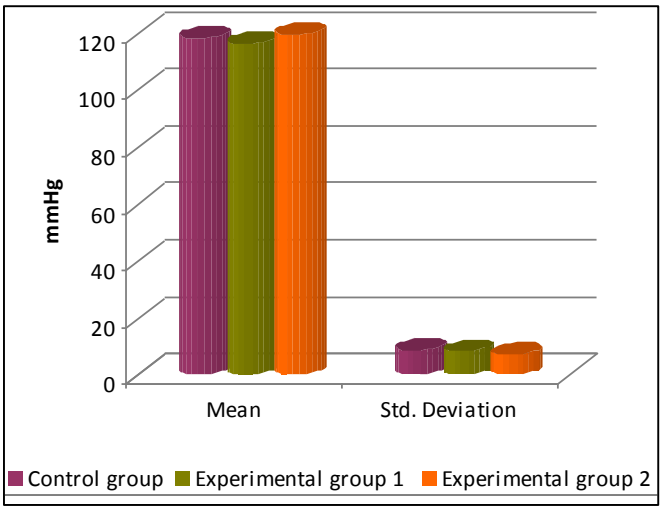


Table 9: Summary of one way ANCOVA of post scores of Systolic Pressure of subjects in three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm fiber in the breakfast

	Type III Sum of Squares	DF	Mean Square	F	Remark
Group	148.399	2	74.199	1.591	p > 0.05
Error	6807.901	146	46.629		
Total	2088723.000	150			
Corrected Total	9787.793	149			

ANCOVA: Analysis of covariance F: Variance ratio
P: Probability DF: Degree of freedom

From the above table, it is evident that the F value for group being 1.591 is nonsignificant with df= 2/146. It indicates that the adjusted mean scores of Systolic Pressure 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 Systolic Pressure as covariate, do not differ significantly. Thus the null hypothesis "There is no significant difference in the adjusted mean scores of Systolic Pressure when the subjects are not given fiber; when they are treated with test diet I (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 Systolic Pressure of the subjects.
This also decides that intake of 5gm or 10 gm of fiber all alone cannot influence the Systolic Pressure, the upper score of blood pressure.

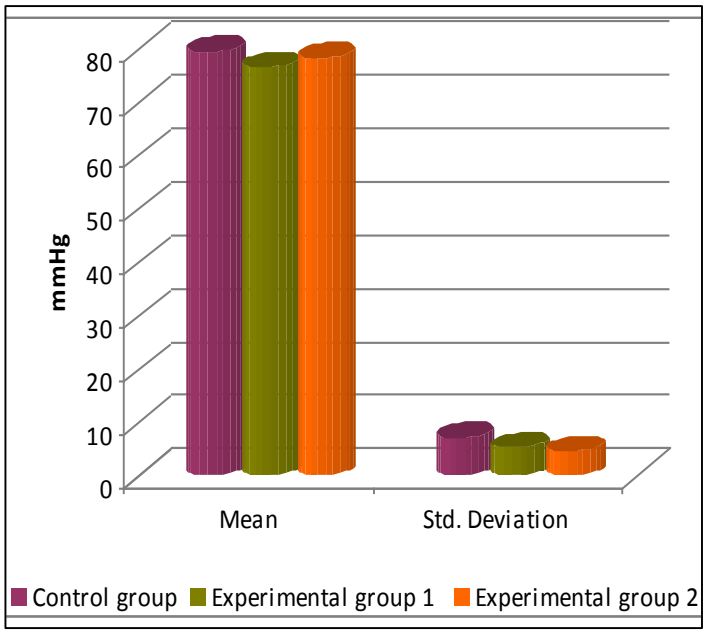


Table 10: Table showing the descriptive statistics like Mean, Standard deviation of post scores of Diastolic Pressure (mmHg) of subjects under three conditions viz. group provided with no fiber; 5 gm fiber in the breakfast and 10 gm

Group	Mean	Std. Deviation	N
Control group	79.3600	7.18490	50
Experimental group 1	76.4200	5.20631	50
Experimental group 2	78.1200	4.51139	50
	77.9667	5.83488	150

Table 11: Summary of one way ANCOVA of post scores of Diastolic Pressure 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	269.975	2	134.988	6.728	.p < 0.05
Error	2929.433	146	20.065		
Total	916893.000	150			
Corrected Total	5072.833	149			

From the above table it is evident that the F value for group being 6.728 is significant with df= 2/146. It indicates that the adjusted mean scores of Diastolic Pressure 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 Diastolic Pressure as covariate, differ significantly. Thus the null hypothesis "There is no significant difference in the adjusted mean scores of diastolic Pressure 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 rejected. This evidently proves that oatmeal which is rich in fiber creates a substantial effect in reducing hypertension thereby reducing the diastolic Pressure of the subjects which is the lower score of the blood pressure and the decisive factor. Interestingly test diet I group subjects showed a lower diastolic pressure than the test diet II group subjects and the control group had a larger score of the diastolic pressure in comparison with the both.

Conclusion

Diabetes mellitus is more prevalent in obese peoples. This study was designed to assess the therapeutic importance of dietary fiber in the management of BMI and waist circumference. 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 (one control and two experimental). The subjects were tested for their systolic and diastolic blood pressures with reference to fiber diet. Though there wasn't seen an impact on systolic blood pressure, but there was a significant difference in the mean scores of diastolic blood pressure of the subjects, meaning thereby fiber place an important role in reducing hypertension in the subjects. Surprisingly test diet I (5 gm fiber) was seen to lower the diastolic blood pressure by a larger value than the test diet II (10 gm fiber). There could

very well be several factors other than the fiber content of diet which may have a role to play in the management of hypertension. These results are well supported by several other such studies, wherein a strong association was observed between increased fiber intake and blood pressure. It was seen that fiber supplementation (average dose, 11.5 g/d) changed systolic BP by –1.13 mm Hg and diastolic blood pressure by –1.26 mm. This reductions in BP tended to be larger in older (>40 years) and in hypertensive populations than in younger and in normotensive once (12). In another study, it was found that increased fiber consumption may reduce blood pressure in patients with hypertension. A smaller, non-conclusive reduction in bloodpressure was observed in patients with normal blood pressure (13).

Suggestions

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

Acknowledgement

It gives me great pleasure in acknowledging the support and help of Professor G B K S Prasad, School of Studies in Biochemistry, Jiwaji University, Gwalior. A well equipped lab, expert comments and friendly environment facilitated my practical work.

My work was also partly undertaken at Centre for Food Technology, Jiwaji University, Gwalior. I am thankful to the coordinator, Centre for Food technology, Jiwaji University, Gwalior for providing necessary laboratory facility to carry out the experimental work.

Coi Certificate

Certified that author Shweta Choudhary has not any conflict of interest regarding the relation of manuscript with any of the companies, patents or any other organization.

Authors' Contribution Certificate

It is certified that all the parts/sections of the manuscript have been jointly contributed by both the authors and that the work undertaken with human subjects was in accordance with norms of the ethical committee of the institution. No funding from any source.

Abbreviation List

ANCOVA: Analysis of covariance
A1C: Glycosylated hemoglobin
Df: Degree of freedom
F: Variance ratio
P: Probability
Std. Deviation:Standard Deviation

Reference

1. Diabetes mellitus type 2. Internet: https://en.wikipedia.org/wiki/Diabetes_mellitus_type_2 (Visited, 2017)
2. Diabetes and high blood pressure. Internet:www.wedmd.boot.com/diabetes/guide/diabetes-bp, 2017.
3. Diabetes and high blood pressure. Internet: www.webmd.boots.com/diabetes/guide/diabetes-bp, 2017.
4. Diabetes and high blood pressure. Internet: https://patient.info/in/health/diabetes-and-high-blood-pressure, 2017.
5. Diabetes Mellitus. Internet: http://www.faqs.org/nutrition/Diab- Em/Diabetes-mellitus.html, 2011.
6. University of Maryland Medical Center, Diabetes diet. General dietary Guidelines. Internet: http://www.umm.edu/health/medical/reports/article/diabetes-diet (Visited 13 December 2011)
7. What is fiber. Internet: www. Live science. com › Health (Visited 11 January 2017).
8. Dietary fiber. Internet: http://en.wikipedia.org/wiki/Dietary-fiber (Visited 11 January 2017)
9. Canadian Diabetes Association. The Benefits of Fiber. Internet: http://www.diabetes.ca/diabetes-and-you/health-living-resources/diet-nutrition/fiber (Visited 15 December 2011)
10. Dietary fiber. Internet: http://en.wikipedia.org/wiki/Dietary-fiber
11. Nutrient requirements and recommended dietary allowances for Indians. Internet: http://icmr.nic.in/RDA-2010. pdf (Visited 20 December 2011))
12. Amazing Benefits of Oats: Does a Bowl of Oatmeal a Day, Keep Disease. Internet: IST food.ndtv.com › Health(Visited 5 November 2017)
13. Calories in oats. Internet: caloriecount.about.com (Visited 13 December 2011) M. T. Streppel, L. R. Arends PV, Veer DE, Grobbee JM, Geleijnse. Dietary Fiber and Blood Pressure A Meta-analysis of Randomized Placebo-Controlled Trials, Arch Intern Med, 2005; 165(2):150-156.
14. Whelton SP, Hyre AD, Pedersen B, Y Yi, PK Whelton. J. He. Effect of dietary fiber intake on blood pressure: a meta-analysis of randomized, controlled clinical trials, Pub med health, 2005.