

## EFFECT OF DIET AND EXERCISE ON BLOOD GLUCOSE LEVEL IN NON INSULIN DEPENDENT DIABETICS

BHARAT BHUSHAN<sup>1</sup>, SUNITA BEDI<sup>2</sup>, SHASHI KALA<sup>2</sup>

<sup>1</sup>Hindu College of Pharmacy, Sonapat, Haryana, <sup>2</sup>Vinayaka Missions University Salem, Tamil Nadu, India.  
Email: bbhsuhanpharma@yahoo.com

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### ABSTRACT

**Objective:** The main objective of this study is to find out the benefits of physical exercise, impact of nutrition education and to study the existing dietary pattern and nutrient intake of selected NIDDM patients.

**Method:** The survey on diabetic patients indicates that incidence of diabetes is predominant in male than females. 54% of the subjects had a positive family history with either a single parent (24%) both the parents (10%) or in sibling (22%).

**Results:** The results of the present study indicated the 68% of the subjects were not pursuing any kind of physical activity, but due to nutrition education there was a significant improvement ( $P \leq 0.01$ ). Walking was done by 32% of the subjects before nutrition education for a period of 15-30 minutes but the percentage significantly increased to 72% after nutrition education and the time increased from 30 min to 1 hour. 28% started doing stretch exercises after nutrition education. 65% of the subjects were often mentally tense but counseling resulted in a significant decrease ( $P \leq 0.05$ ) to 30%. 30% of the subjects slept for 6-8 hours which significantly ( $P \leq 0.01$ ) increased to 66% after counseling. Twenty four percent of the subjects watched religious based programmes on television and after counseling the percentage significantly ( $P \leq 0.01$ ) increased to 56%.

**Conclusion:** The present study will help in fixing the new diet pattern for diabetes patients.

### INTRODUCTION

Diabetes is the single most lethal yet common disease affecting millions in the country. Diabetes Mellitus is a chronic metabolic disorder that prevents the body to utilize glucose completely or partially. It is characterized by raised glucose concentration in the blood and alterations in carbohydrate, protein and fat metabolism. This can be due to failure in the formation of insulin or liberation or action. Many diabetics can produce sufficient insulin but some stimulus to the islets tissue is needed in order that secretion can take place. Appropriate use of diet and exercise by the diabetics can improve insulin sensitivity and glycemic control and decrease the need for oral medications or insulin [1]. In the early stages of the disease the Insulin Like Activity (ILA) of the blood is often increased, but most of this insulin appears to be bound to protein and is not available for transport across the cell membrane and action of the cell. The body releases hormones that raise blood glucose levels to provide a quick source of energy for coping with stress. In the stress conditions diabetes mellitus may precipitate with genetic predisposition [2]. Diabetes is of three types: Type I (The Juvenile onset type or Insulin Dependent Diabetes Mellitus)(IDDM), Type II (The Adult or Maturity onset type or Non-insulin Dependent Diabetes Mellitus)(NIDDM) and Malnutrition Related Diabetes Mellitus (MRDM)

Regular exercise is especially important for people with diabetes. It helps with blood sugar control, weight loss, and high blood pressure.. People with diabetes who exercise are less likely to experience a heart attack or stroke than diabetics who do not exercise regularly [3]. The aim of the study is to find out the benefits of physical exercise, impact of nutrition education and to study the existing dietary pattern and nutrient intake of selected NIDDM patients.

### MATERIALS AND METHODS

The present study was designed to investigate the effect of Diet & exercise on blood glucose level of Non Insulin Dependent Diabetes Mellitus (NIDDM). It involves a dietary survey of NIDDM patients and also studies the effect of exercise on the blood glucose level.

**1. Locale of the Study** The present study was conducted in Narender Nagar, Model Town, Sector-14 areas of Sonapat city in Haryana, India. An Interview schedule was designed to collect information relating to Diabetic disorder, complication condition, family history, dietary habits, physical activities, and personal habits etc. of the subjects.

- 2. Selection of the subjects** Fifty NIDDM persons of the age (40-60) in Sonapat city were selected by simple, unrestricted random sampling technique.
- 3. Development of Interview schedule** An interview schedule was drafted to obtain the desired information in various aspects. The developed questionnaire was pretested in five NIDDM subjects and necessary changes were made.
- 4. Data collection: Phase I (Sept. 2007 – Dec. 2007)** Information regarding general, occupation, family history, life style aspects, physical exercise and food Intake of all the subjects were recorded. Information regarding knowledge was also collected.

**Phase II (January 2008 – March 2008)** Based on nutrition knowledge test scores. Nutrition education was imparted and diabetic diet chart was distributed among selected subjects. (veg dalia, Sprouted pulses, Mixed flour (wheat + chana + Barley 1:1:1) for a period of two months. Salad was also included.

All subjects were also suggested to do the exercise daily for 40-45 minute.

**General Information** Information pertaining to age, sex, marital status, and Educational qualification were recorded.

**Occupation related information** It includes their nature of job, working hrs, work load etc.

**Family related information** Information pertaining to type of family, family composition, relationship with other people, total and per capital income were recorded.

**Diabetic History related to other disease also. (Or Medical History)** Family history of the subjects was recorded and information about family history of diabetes and associated complications was collected.

**Life style related information** Information on sleeping pattern, mental stress and relaxation technique were obtained.

**Information related to smoking and drinking habits of subjects** In this study the smoking and drinking habits of the patients were collected.

**Physical Activity related information** Information regarding physical activity, their relaxation technique, their sleeping hrs and

their leisure hrs, how they were spend, were obtained from the selected NIDDM patients.

**Dietary Survey** Diet survey was carried out by 24 hour recall method. Detailed information regarding food preference and food avoidance before and after giving the knowledge of nutrition education was also collected.

**Nutrition Education to the subjects** Nutrition education was imparted to the selected patients by lecture method. A meal plan schedule was developed and was distributed among selected subjects and asked to follow the same.

#### Statistical Analysis

The data on nutrient intake, physical activity was analyzed statistically. The mean, standard error, t-value and their test of significance was calculated using a computer program package CPCI & CSII (Graph pad prism).

### RESULTS AND DISCUSSIONS

The present study was conducted to investigate the role of diet and exercise in management of non insulin dependent diabetes mellitus (NIDDM) (Table 1).

#### Information about patients

##### General Information

The information regarding age, sex, education and marital status is presented in (Table 1). Forty percent of the patients were in the age group of 40-50 years, followed by 60 percent in 50-60 years of age. 44 percent were male and 56 percent were female [4]. We have also noticed that incidence of diabetes is predominant in male than females. Maximum patients 48% were having high school education followed by graduate 24% and 16 percent were educated upto graduation, while only 12 percent of patients were illiterate. All the patients were married.

##### Occupation related information

The occupation related information of the subjects is presented in Table 2. Most of the female patients 48% were housewives. Major Job responsibility was desk work 28% and 24 percent of the subjects were engaged in teaching work. Office work was brought home by 40 percent of the subjects.. Similar finding were also reported earlier [5].

##### Family related information

Table 3 presents the Family related information of the subjects. According to the family type 68 percent of the subjects were from nuclear families indicating they had more family responsibilities and they had fewer persons to share their problems with average family size ranged from 4-6 family members. Similar finding were reported [6].Maximum number of subjects (44 percent) had family income of Rs. 10-12,000/- only and 12 percent had their income more than Rs. 15,000/- per month reported higher incidence in same income group [7].

Major decision maker at home was the husband in 60 percent of the subjects. Majority of the subjects (64%) in the study were partially satisfied with their family members and 72 percents of the subjects shared strained relations with their family.

Most of the subjects (68%) were involved in the household activities. Majority of the subjects (64%) had no help for cooking (64%) forty four percent of of the subjects had domestic help for sweeping, mopping and washing clothes work load at office and household duties, added to the stress level in the subjects cause diabetes 56 percent of the subjects went once a year for outing, similar reports were given[8].

##### Personal Habits

**Smoking:** Majority of patients were non smokers (Table 4). The male patients (16 percent) of 40-50 of age have smoking habits and majority of them used to smoke cigarettes [9]. Clinical practice recommended that a diabetic need to quit smoking because smoking

makes problems caused by diabetes worse. People with diabetes can experience blood flow problems in the legs and feet, which can sometimes lead to amputation. Smoking can decrease blood flow even more. Smoking can also worsen sexual impotence in men, cause high levels of LDL cholesterol and can raise the risk of heart attack and stroke.

#### Drinking / Alcohol Consumption

Maximum male patients (24 percent) of 50-60 age used to consume alcohol (Table 4) majority of patients were taking 60-100 ml of alcohol weekly. Clinical practice recommended that alcohol in small amounts can be fit into ones meal plan if ones blood sugar is under good control, drinking alcohol on an empty stomach can cause low blood sugar [10]. Alcohol can contribute to complications of diabetes.

#### History of the diabetes in the relatives

Familiar history of the diabetes was recorded and it was observed that 54 percent of the subjects had a positive family history with either a single parent (24%) both the parents (10%) or in sibling (22%) (Table 5). Offsprings of diabetic parents had slower glucose removal rates and higher insulin level than control subjects suggesting that the primary defect is in peripheral tissue response to insulin and glucose[11].Reported that genetic and environmental factors play an important role in the pathogenesis of this condition[12]. Adult children of mothers with type I diabetes, in which the body produces no insulin, show a weakened response to sugar that could be a precursor of type 2 diabetes [13].

#### Morbidity prevalence

The data regarding presence of various complications in patients is presented in Table 6. It was found that as age increased, there was decrease in percentage of patients having no complications. Patients with diabetes mellitus have at least a three-fold greater risk of CHD than does the general population. Hypertension was found most prevalent complications in patients of all age groups. The world health organization has estimated that high blood pressure causes one in every eight deaths world-wide making hypertension the third leading killer in the world [14]. It is also found that females are more hypertensive and obese than the male.

#### Diabetics Information of the Subject

##### Symptoms and status of diabetes

The most common symptoms were polydypsia, polyphagia, tiredness, delayed healing, polyurea and loss of weight. Some of the other symptoms were drowsiness, burning sensation under feet, itching and headache. Patients of (40-50) years of age observed symptoms like weight loss (45%), headache (40%), excessive sweating (25%). Patients of 50-60 years of age also observed symptoms like tiredness (60%) delayed healing (46.6%).In male patient, polyurea was also found to be major diagnostic symptom followed by weight loss (54.4%) excessive thirst (45.45%), delayed healing (45.45%) similarly in female patients, most common diagnostic symptom was also tiredness (85.71%).

##### Life Style related information

It increases energy expenditure, improves blood circulation and tones up the muscle. Exercise relives tension and helps one to relax and sleep properly. Physiologically speaking, exercises increases electrical stability of the heart, decreases blood glucose, blood pressure and blood lipids. Regular exercise helps the body to make the best use of fats and sugars. Walking was done by 32 percent of the subjects before nutrition education for a period of 15-30 minutes but the percentage significantly increased to 72 percent after nutrition education and the time increased from 30 min to 1 hour. 28 percent started doing stretch exercises after nutrition education. Similar findings were reported recommended 30 minutes of exercise for a total of at least 2 hours a week for reducing the risk of CHD and blood sugar level [11].Sixty per cent of the subjects were often mentally tense but counseling resulted in a significant decrease ( $P \leq 0.05$ ) to 30 percent. Relaxation technique most commonly followed by the subjects was sitting idle.

**Food consumption frequencies prior to the disease**

Wheat, rice and unrefined wheat flour were the major source of cereals. Eighteen percent subjects never consumed these in any period of their life. Unrefined cereals had been their stable diet with an intake of thrice/day in 90 percent subjects while the rest had consumed it once or twice/day. Seventy percent had consumed both split and whole pulses in rotation during the week, 10 percent had a daily consumption of only whole pulses, another 11 percent

consumed only split pulses. About 42 percent of the subjects consumed one of these fruits twice a day 35 percent, once a day and nearly 11.5 percent each thrice a week and twice a week. As majority of the subjects were vegetarian, intake of flesh food was low and only 8 percent had consumed flesh food daily which included egg, meat or chicken. Being vegetarian, the consumption of milk and milk product was high, 45 percent of the subjects were consuming it twice a day, 25 percent, thrice a day and 22 percent daily and rest occasionally (Table 7).

**Table 1: Personal profile of selected NIDDM patients**

S. No.	Particulars	Frequency (n=50)
1.	Age (yrs.)	
	40-50	20 (40)
2.	50-60	30 (60)
	Sex	
3.	Male	22 (44)
	Female	28 (56)
4.	Marital Status	
	Single	-
	Married	50 (100)
	divorced	-
5.	separated	-
	Education	
	Uneducated	6 (12)
	Matric	24 (48)
	graduate	12 (24)
6.	> graduate	8 (16)

Figures in parentheses indicate percentages.

**Table 2: Occupation related information of the related subjects**

S. No.	Particulars	Frequency (n=50)
1.	Job involves	
	Teaching	12 (24)
	Desk work	14 (28)
2.	House wife	24 (48)
	Working hrs.	
	5-8 hr.	14 (28)
	8-10 hr.	10 (20)
3.	>8 hr.	26 (52)
	Bring office work at home	
	Often	20 (40)
4.	few times a week	12 (24)
	rarely	18 (36)
	Satisfied with job	
5.	Yes	28 (56)
6.	No	22 (44)

Figures in parentheses indicate percentages.

**Table 3.1: Family related information of the subjects**

S. No.	Particulars	Frequency (n=50)
1.	Type of family	
	Joint	16 (32)
2.	Nuclear	34 (68)
	Family Size	
3.	2-4	12 (24)
	4-6	24 (48)
	> 6	14 (28)
4.	Family Income / Month (Rs.)	
	8000 - 10000	10 (20)
	10000 - 12000	22 (44)
	12000 - 15000	12 (24)
5.	> 15000	6 (12)
	Decision maker at home	
	self	8 (16)
6.	husband	30 (60)
	in-laws	12 (24)
7.	Satisfaction level	
	Fully	18 (36)
8.	Partially	32 (64)
9.	Relationship shared with family	

**Table 3.2: Family related information of the subjects.**

1.	Involvement in household activities	
	often	34 (68)
2.	a few times	10 (20)
	weekly	6 (12)
3.	Domestic help at home	
	Yes	32 (64)
	No	18 (36)
	If no, who cooks food	
	Self	32 (64)
	Children	18 (36)
4.	Sweeping & mopping	
	Children	10 (20)
	You	18 (36)
	Maid	22 (44)
5.	Frequency for outing	
	6 mts	9 (18)
	once a yr	28 (56)
	rarely	13 (26)

Figures in parentheses indicates percentages.

**Table 4: Smoking and Drinking habits of selected subjects**

S. No.	Particulars	Frequency (n=50)
Smoking		
1.	Non Smoker	14 (28)
2.	Smoker	8 (16)
	Cigarattes	6 (12)
	Biddi	2 (4)
Alcohol drinking		
1.	Non drinkers	10 (20)
2.	drinkers	12 (24)
	Daily	2 (4)
	Weekly	4 (8)
	Monthly	--
	Occasionally	3 (6)

Figures in parentheses indicates percentage

**Table 5: History of the diabetes in the relatives of the subjects**

Relation	Subjects	Frequency (n=50)
Family history	28	28 (56)
Parent		
Single	12	12 (24)
Both	5	5 (10)
Siblings	11	11 (22)

**Table 6.1: Prevalence of symptoms of diabetes among subjects**

S. No.	Symptoms	Frequency (n=50)
1.	Polydypsia	27 (54)
2.	Polyphagia	22 (44)
3.	Polyurea	31 (62)
4.	Nocturia	18 (36)
5.	Tiredness	37 (74)
6.	Delayed healing	26 (52)
7.	Weight Loss	16 (32)
8.	Excessive Sweating	8 (16)
9.	Drowsiness	2 (4)
10.	Burning Sensation under feet	3 (6)
11.	Itching	4 (12)
2.	Headache	14 (28)

**Table 6.2: Complications present in diabetic patients in relation to age and sex**

Variables	Total	Hypertension n=50	Obesity	CHD	Abscene of these Complication
Age (yrs)					
40-50	20	5	8	3	4
50-60	30	6	9	4	1
Sex					
Male	22	6	4	7	5
Female	28	9	12	6	--

Table 7: Exercise and relaxation related information of the subjects

S. No.	Particulars (n=50)	Beginning of the Study	End of the study	z-value
1.	Physical activity			
	Walking	16 (32)	36 (72)	3.35***
	Brisk walking	---	---	
	Yoga	---	---	
	Stretch exercise	---	14 (28)	3.41***
	None	34 (68)	---	6.04***
2.	Frequency of being			
	Mentally tense			
	Often	30 (60)	15 (30)	2.40***
	Few times	14 (28)	24 (48)	1.72*
	Rarely	6 (12)	11 (22)	0.99 <sup>NS</sup>
3.	Relaxation technique			
	Sit idle	15 (30)	0 (0.00)	3.61***
	Yoga	0 (0.00)	7 (14)	2.32**
	Music	13 (26)	3 (6)	2.05**
	Meditation	16 (32)	26 (52)	1.70*
	Deep breath	6 (12)	14 (28)	1.46 <sup>NS</sup>
4.	Sleep hours			
	< 6	32 (64)	14 (28)	2.88***
	6 - 8	15 (30)	33 (66)	2.87***
	> 8	3 (6)	3 (6)	0 <sup>NS</sup>
5.	T.V. programmes			
	Films	5 (10)	7 (14)	0.36 <sup>NS</sup>
	Serial	33 (66)	15 (30)	3.11***
	Religious	12 (24)	28 (56)	2.93***

Figures in parenthesis indicate the percentages.

\*\*\* Significant at 1% level

\*\* Significant at 5% level

\* Significant at 10% level

NS non-significant

## CONCLUSIONS

Exercise is a very useful measure in the management of diabetes. Exercise training can improve glucose uptake by muscle in the type 11 diabetic that is retained for a upto a 48 h during the recovery from a single about long term exercise is also beneficial for the type 11 diabetic, but not because of a continued improvement in exercise- included insulin sensitivity. Walking was done by 32 percent of the subjects before nutrition education for a period of 15-30 minutes but the percentage significantly increased to 72 percent after nutrition education and the time increased from 30 min to 1 hour. 28 percent started doing stretch exercises after nutrition education. Sixty per cent of the subjects were often mentally tense but counseling resulted in a significant decrease ( $P < 0.05$ ) to 30 percent.

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