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Evaluation of Type II Diabetes Mellitus in the Under Treatment Patients of Saidu Teaching Hospitals Saidu Sharif District Swat, Kpk, Pakistan

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Abstract

This study aimed to see the role of diet and exercise in the control of disease or in minimizing the complications associated with diabetes. This was hospital based study conducted on four hundred and twenty (420) human subjects, divided in to six (06) main groups of seventy (70) subjects each. Exercise and diet protocol was set according to the international standards. Blood and urinary glucose level of subjects from each group was estimated before the start and at different intervals during the study to compare the effect of diet and exercise in minimizing the disease associated complications. Blood and urinary glucose level of various groups of diet (252.66 ± 6.5/203.00 ± 5.1, 252.66 ± 6.5/159.90 ± 3.3 and 252.66 ± 6.5/158.24 ± 2.70) and diet as well as exercise (252.66 ± 6.5/201.90 ±4.7, 252.66 ± 6.5/164.30 ± 3.7 and 252.66 ± 6.5/157.80 ± 2.70) were compared with that of the control group. The data was recorded and analyzed on SPSS version 16. The role of diet and exercise was observed significant ($P \leq 0.05$) in the control of diabetes mellitus type II. Comparison of the blood and urinary glucose levels of individual of various groups under study was made. Significance improvement on the health of individuals in the diet and exercise was observed with P-values of exercise, diet and diet + exercise groups less than 0.05 each. It is concluded that a low calorie intake with regular exercise not only reduces the economic burden of the diabetics but also minimize the associated long term fatal pathologies. The disease is a growing health concern which needs lifelong treatment. Life style modification with changes in dietary habits and exercise therapy would reduce the economic burden on poor and needy diabetics, both in term of chemotherapeutic cost in the early stage of the disease, as well as minimizing the devastating complications of the disease. Type II diabetes and its prevention and treatment is a challenge for the future. The use of drugs therapy should be restricted only where dietary restrictions and exercise fail to achieve the desired goal. Even, in patients where drug therapy is the ultimate choice, life style modifications and dietary control are extremely fruitful and minimize the associated complications.

Keywords: Diabetes mellitus, pancreas, insulin, beta cells, exercise

1. Introduction

The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. The most important demographic change to diabetes prevalence across the world appears to be the increase in the proportion of people of more than 60 years of age, the number of people with diabetes is increasing due to population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity (Wild *et al.*, 2004). Diabetes mellitus is a chronic debilitating multi system metabolic disorder. It is characterized by increased glucose levels in blood and urine resulting from impaired or dysfunction of pancreatic Beta cells or resistance to insulin. Diabetes mellitus is broadly classified as Type I and Type II. The type II diabetes mellitus is the most common one and usually starts at later stages of life (over the age of 40 years). It is an extreme state of glucose intolerance, associates with elevated plasma levels of glucose both before and after its diagnosis and is associated with an increased risk of cancers of the liver, pancreas, colon, endometrium, kidney and breast (Strickler *et al.*, 2001; Czyzyk, and Szczepanik, 2000).

The disease is chronic with devastating consequences including both micro and macro vascular complications. Retinopathy, nephropathy, and neuropathy are the common micro -vasculopathies, and the later arises in the form of myocardial infarction or stroke (Ohkubo *et al.*, 1995). Long term complications of high blood glucose are: increased risk of cardiac arrest, stroke, kidney failure and amputation of some organs (Brian *et al.*, 2004). A number of risk factors are associated with the development of diabetes that includes obesity, acromegaly, Cushing's syndrome and a numerous endocrinological disorders (Jack 2004). Obesity has been found to be one of the major risk factor of the type II diabetes (CDC, 2004). Diet having high-fat contents (Lovejoy, 2002), low unsaturated fats (Bernard *et al.*, 2007-2009) and a sedentary lifestyle (Hu, 2003) contribute to the development of diabetes. Gestational diabetes mellitus occurs in women mainly during their third trimester of pregnancy. Although the condition usually resolves in the postpartum period, it is also associated with a higher risk of type II diabetes later in life (Buchanan and Kjos 1999). Gestational diabetes mellitus (GDM) affects 2-5 percent of pregnancies in the US (Coustan, 1995). It is the carbohydrate intolerance that begins or is first diagnosed during pregnancy (ACOG, 2001). Pregnancies complicated with are at increased risk for labor abnormalities as well as adverse neonatal outcomes such as macrosomia, hypoglycemia, stillbirth and neonatal intensive care unit admission (Langer *et al.*, 2005).

Diabetes enormously increases the risk of serious illnesses, causing hospitalization, including coronary artery diseases, cerebro-vascular and peripheral vascular disease, nephropathy, infection and lower extremity amputations. The management of diabetes in the hospital is generally considered secondary, in importance, compared with the condition that prompted admission. Recent studies have focused attention to the possibility that hyperglycemia in the hospital is not necessarily a benign condition and that aggressive treatment of diabetes and hyperglycemia result in reduced mortality and morbidity (Unpierrez *et al.*, 2002; Van Den Berghe *et al.*, 2001).

Type II diabetes mellitus, is commonly not diagnosed until complications appear, and

approximately one-third of diabetics may be undiagnosed. Although the effectiveness of early identification of pre-diabetes and diabetes through mass testing of asymptomatic individuals has not been definitely proven (and rigorous trials to provide such proof are unlikely to occur), Pre-diabetes and diabetes meet established criteria for conditions in which early detection is appropriate (Engelgau *et al.*, 2000). The American diabetes association recommends that patients, with newly diagnosed type II diabetes, be treated with pharmacotherapy as well as lifestyle changes. The rationale for combination therapy is presumably that each form of treatment alone is imperfect. Life style changes are often inadequate because patients do not lose weight or regain weight or their diabetes worsens independent of weight (Nathan *et al.*, 2006). Pharmacotherapy also often fails with time (AADE, 2002), and some drugs have associated cardiovascular and other risks (Turner *et al.*, 1999; Goldfine, 2006). Effective management of people with type II diabetes must be based on support, education, motivation and empowerment of the person to understand, monitor and manage their own problems. Treatment should be aimed at curing the symptoms and minimizing the risk of long-term complications by maintaining optimal blood glucose level and minimizing the risk of cardiovascular diseases.

Type II diabetes is primarily due to lifestyle factors and genetics (Riserus *et al.*, 2009). In type II diabetics, Loss of pancreatic and duodenal homeobox-1 (PDX-1), a critical regulator of insulin promoter activity, has also been proposed as an important mechanism leading to Beta-cell dysfunction (Gual *et al.*, 2005). A strong genetic connection in type II diabetes has been observed. Near relatives (especially first degree) suffering from type II increases risks of developing diabetes substantially in individuals. In addition, there is also a mutation to the Islet Amyloid Polypeptide gene that results in an earlier onset, more severe form, of diabetes (Wild *et al.*, 1996; Cho, 2003). Exercise and life style modification plays significant role in the prevention of type II diabetes as well as in minimizing its complications (Bennion, 1979; Manson *et al.*, 1991; Yamoka *et al.*, 2005; Lindstrom *et al.*, 2006); Li *et al.*, 2008). Although exercise testing is proven to have prognostic value, studies examining the relationship between exercise, electrocardiography responses and coronary heart disease mortality risk in asymptomatic men with existing cardio vascular disease risk factors are inconsistent. Most of the studies have shown a positive association in high-risk subgroups (Laukknen *et al.*, 2001; Balady *et al.*, 2004; Bruce *et al.*, 1980; Rywik *et al.*, 2002). Exercise may be a therapeutic tool in a variety of patients with, or at risk for diabetes, but that like any therapy its effects must be thoroughly understood (Schnieder *et al.*,1990; Wasserman *et al.*, 1994; Devlin *et al.*, 1995). The disease is often managed by increasing exercise and dietary modification (Robins *et al.*, 2009). In a study conducted in Frontier province, it has been concluded that blood glucose level can be effectively controlled with diet, exercise besides the use of hypoglycemic drugs and insulin (Khan *et al.*, 1993-1994). The present study was conducted to see the correlation and effectiveness of the exercise and diet in the control of diabetes and minimizing the risks of associated complications in patients, in this area of the country, and to compare the results with studies already conducted.

Diabetes mellitus is a leading cause of morbidity and mortality in the world. The prevalence is on increase worldwide. Type II diabetes mellitus affects about 3-5 % of individuals in the

West, its incidence may double worldwide in the next 15 years (Haffner *et al.*, 1998). In the United States alone, an estimated 16 million individuals have diabetes mellitus, and in approximately one third of them are undiagnosed. A vast majority (90% to 95%) has type II diabetes, but many of these individuals also use exogenous insulin (Harris *et al.*, 1998). In United States, approximately 20.8 million people (7% of the population) are diabetic. The incidence rate of diabetes in the United States for 2005 was 1.5 million in people of age 20 years or older. Various trials have validated the need for strict glycemic control (Turner *et al.*, 1998) the Diabetes Control and Complications Trial Research Group 1993 and Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (Nathan et al., 2005). The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and is feared to be 4.4% in 2030. The current estimate of the disease is about 6.4% worldwide, and in the past two decades alone there has been a dramatic increase in type II diabetes (Shaw *et al.*, 2010).Diabetes is a fatal disease and is a growing global public health problem, which has affected 30 million people 10 years ago to about 135 million today. The mortality rate due to coronary artery disease is fourth in number in the world (Gerstein *et al.*, 2005-2009), in Pakistan 6.9 million people are affected by diabetes with the international Diabetes Federation estimating that this number will grow to 11.5million by 2025 (Jabbar, 2008). The prevalence of the disease has risen to 7th position in Pakistan, as it was 5th to 6th in number during the years 2005 and 2006 (Shera *et al.*, 2007).

2. Objectives of the Study

The study was mainly focused to;

1. See the effects of different treatments on randomly selected type II diabetics.
2. To observe the effect of dietary, exercise or clinical therapies on the subjects group under study.

3. Materials and Methods

3.1 Population

This study was conducted on four hundred and twenty (420) human subjects with type II diabetes. Informed consent was taken from each subject prior to the start of the study. The study subjects were divided in to six (06) groups, each having seventy (70) subjects.

3.2 Sampling and Sampling Technique

Type II diabetics who attended medical outpatient department of Saidu Teaching Hospital, Saidu Sharif, Swat with the following inclusion criteria were included in the study. Relevant basic information with name, sex, age, history of disease, treatment regimen, weight, family history etc. were recorded on the predesigned Performa.

3.2.1 Inclusion Criteria

1. Both sexes of age between 35-50 years suffering from Type II diabetes mellitus.

3.2.2 Exclusion Criteria

2. Pregnant ladies.
3. Age less than 35 and more than 50 years.
4. Patients with cardiac problems.
5. Smokers and Alcoholics.

3.3 Research Design

This is a hospital based randomized control study, conducted on patients with Type II diabetes. The study was carried out in the Department of Medicine, Saidu Teaching Hospital in collaboration with the Department of Biochemistry and Department of Pathology, Saidu Medical College Swat. The duration of the subject medication, diet and exercise therapy was of nine months period.

3.4 Research Instrument

Blood (random) and urinary glucose levels were analyzed before study in control group, after three months and lastly after six months duration.

3.4.1 Exercise Protocol

Brisk walk for five days in a week with a minimum distance of not less than about three kilometers per day for more than thirty minutes up to three hours, without rest during walk and excessive sweating, was advised to the subject in the exercise group and also with medication.

3.4.2 Diet Protocol

Patients were advised and monitored for avoiding diet having refined and noncomplex carbohydrates (honey, sugar, banana, sweet meat, glucose, gurh, ice cream and soft drinks, etc:). Patients were also advised and educated not to take sugar in the form of sweets, soft drinks and high carbohydrate diets, having high glycemic index. While coming for the investigations, he/she was directed to avoid taking reducing substances, i.e., vitamin C. etc. which interferes in the assay method. Food frequency questionnaires, i.e., daily food and usage of various foods consumptions, etc. weekly food intakes and monthly intakes of various foods were recorded from the subjects. The subjects were divided in to the following six groups:

1. Control group, 2. Exercise group

3. Diet group. (Total of 70 diabetic subjects consuming the prepared menu of food according to international criteria advised/day/week). The proforma of FFQ was filled for every volunteered subject.

a). Breakfast: Morning black tea: One cup 250 ml + black tea leaf + 40 ml milk with no cream and no sugar. One loaf 150 gram (whole grain).

b). Midday meal: One cup tea (green/black) or one cup of self-made juice of seasonal fruits/vegetables with one slice of non-sweet biscuits/toast.

c). Lunch/Dinner food: One loaf/rice of about 200-250 gram of whole grain flour/rice cooked and boiled in water+ chicken breast about 100 gram soaked, boiled, cooked in oil one spoonful (vegetable) and tasted with local flavoring agents and salt.

d) Mid-evening meal: 4 PM-4.30 PM: one cup/glass of 250 ml black/green tea or one apple/other seasonal fruits available in the areas of moderate size or some other seasonal fruits. Vegetable juice of the locality.

e) Evening meal/Supper: Two loafs/rice of about 200-250 grams whole grain food + meat+ oil according to the taste and customs+ salt for taste.

e) Night foods: One cup rice water with oil for taste + onion +garlic small and tomatoes. One glass of skimmed milk/Dahi before sleeping. (Soup of seasonal vegetables).

4. Diet + exercise group. (The above mentioned protocol of exercise and diet followed under the international and national guidelines).

5. Insulin + diet + exercise group: (Measures of the already prescribed therapy with protocols of diet and exercise followed) and

6. Insulin+ oral hypoglycemic drugs + exercise group: (Protocols of exercise with other therapy advised followed).

3.5 Analysis of Data

The data analysis thus obtained was tabulated and analyzed statistically for any significant change using SPSS version 16.

4. Results and Discussion

This study was conducted on type II diabetic individuals for about nine months at tertiary care hospitals of Swat, which is attended by patients from various districts of all Malakand division as well as from Kohistan and FATA areas of Gilgit etc. Four hundred and twenty volunteered individuals, with informed consent of both sexes, were registered for this study with the ages between 35-50 years. Those subjects were included in the study that were not suffering from any cardiac problems and have no history of smoking.

These subjects were divided in the groups of exercise, diet, diet and exercise, insulin diet and exercise and insulin oral hypoglycemic drugs and exercise. Serum glucose estimations (random) and urinary glucose levels were determined. The patients, already diagnosed and had the present blood glucose level of more than 200mg/dl were taken for the study. Smoker diabetics were excluded from the study, as smoking aggravates the complications of diabetes. During the initial stage, these individuals were allowed to use and take routine oral hypoglycemic medication as well as insulin injections as advised by their physicians. For exercise and diet groups, as per instructions, the volunteers were given the guidelines, health educations, literatures and pamphlets etc. The date recorded at initial period, after three

months and finally after six months on formats on the appendix tables. At initial stage of the data recording the measurements of random blood sugar and urine sugar levels were very high as the values were always more than 200 mg/dl and colored precipitate (green, yellow, red and brick red precipitate), were observed in the urine of some subjects.

After the passage of time and adopting the guidelines and schedules of health educations in exercise and dietary groups, addition and combination with therapy of oral hypoglycemic drugs, the results recorded of random blood sugar and urine sugar were more encouraging in terms of controlling blood glucose level as compared with control group. The data of the groups thus obtained was tabulated as in tables following the text. Exercise and dietary methods, when adopted by the type II diabetics during this study, were not only beneficial in terms of cure but also minimized the burden on the health and economy of the subjects. The results obtained showed highly beneficial effects after combinations of dietary and exercise measures with oral medications.

Table 1

Groups	**Blood sugar Mean ± SD**			**Urine sugar Mean ± SD**		
	Zero month	3 months	6 months	Zero month	3 months	6 months
Control*	248.38 4.6	258.43 2.4	252.64 3.6	86.4 2.3	91.2 5.2	83 4.5
Exercise*	207.87 3.24	159.00 4.24	157.1 2.17	85 4.56	25.71 4.00	5.71 1.90
P value	0.05	0.05	≤ 0.05	0.05	0.05	≤0.05

* n= 70, SD stands for standard deviation

The high level values of blood and urinary sugar at the initial phase of collecting the data from volunteered subjects in the 2nd group of exercise showing higher levels than control subjects. After three months, in the exercise group, the values of blood and urine sugar levels were reduced up to some extent but are still higher than control subjects. The values decreased after six months in the subjects recorded as the data collected in the 1st group of exercise. The results showed a significant change as compared with control subjects.

Table 2

Groups	**Blood sugar**			**Urine sugar**		
	Zero month	3 months	6 months	Zero month	3 months	6 months
Control*	248.38 4.6	258.43 2.4	252.64 3.6	86.4 2.3	91.2 5.2	83 4.5
Diet*	203.0 5.1	159.90 3.3	158.24 2.70	75 6.0	13.6 2.7	8.6 2.3
P value	0.05	0.05	0.05	≤0.05	0.05	≤0.05

* n= 70, SD stands for standard deviation

The high level values of blood and urinary sugar at the initial phase of collecting the data from volunteered subjects in the 3rd group of diet showing higher levels than control subjects. In 3rd group of diet the values of blood and urine sugar levels decreased after three months up to some extent in the recorded and consented/volunteered subjects. But the values were higher than the control subjects. The values of blood and urine sugar levels decreased after six months duration in the data collected subjects. Values recorded were less than the control subjects.

Table 3

Groups	**Blood sugar**			**Urine sugar**		
	Zero month	3 months	6 months	Zero month	3 months	6 months
Control*	248.38	258.43	252.64	86.4	91.2	83
	4.6	2.4	3.6	2.3	5.2	4.5
Diet+	201.9	159.90	157.80	72.9	20	12.10
Exercise*	4.7	3.3	2.70	5.4	2.90	2.6
P value	0.05	0.05	≤0.05	0.05	0.05	≤0.05

* n= 70, SD stands for standard deviation

The high level values of blood and urinary sugar at the initial phase of collecting the data from volunteered subjects in the 4th group of diet+ exercise showing higher levels than control subjects. The values of blood and urine sugar levels after three months decreased but the values of blood and urine sugar were higher than the control subjects. The values decreased up to some extent after six months.

Table 4

Groups	**Blood sugar**			**Urine sugar**		
	Zero month	3 months	6 months	Zero month	3 months	6 months
Control*	248.38	258.43	252.64	86.4	91.2	83
	4.6	2.4	3.6	2.3	5.2	4.5
Insulin+ diet+	230.7	159.90	156.9	104.3	14.3	9.3
Exercise*	6.6	3.3	2.9	6.7	2.70	2.6
P value	0.05	0.05	≤0.05	0.05	0.05	≤0.05

* n= 70, SD stands for standard deviation

The high level values of blood and urinary sugar at the initial phase of collecting the data from volunteered subjects in the 5th group of insulin+ diet+ exercise showing higher levels than control subjects. The values of blood and urine sugar levels decreased up to some extent after three and six than the control subjects. The values of blood and urine sugar levels decreased in the fifth group in the recorded and volunteered subjects, the values recorded were lesser than the control subject.

Table 5

Group	Blood sugar			Urine sugar		
Control*	Zero month	3 months	6 months	Zero month	3 months	6 months
Insulin+ oral hypoglycemic drugs+ Exercise*	248.38 4.6	258.43 2.4	252.64 3.6	86.4 2.3	91.2 5.2	83 4.5
P value	257.80 4.90 0.05	163.2 3.20 0.05	154.6 3.3 ≤0.05	132.9 5.0 0.05	15.70 3.10 0.05	9.3 2.3 ≤ 0.05

* n= 70, SD stands for standard deviation

The high level values of blood and urinary sugar at the initial phase of collecting the data from volunteered subjects in the sixth group of insulin+ oral hypoglycemic drugs+ exercise showing higher levels than control subjects. The values of blood and urine sugar levels decreased up to some extent after three months in the recorded and volunteered subjects, but the values recorded were higher than the control subjects. The recorded data of subjects showing reduction in blood and urine sugar levels after six months period effectively in the volunteered subjects in the six numbers of subjects.

5. Conclusion

Diabetes mellitus type-II is a life threatening metabolic syndrome. It increase the risks of serious illness. Type-II diabetes mellitus is commonly not diagnosed until complication appear and approximately one-third of diabetes may be undiagnosed. The prevalence of the disease has raised each year in Pakistan. The present study was aimed that how to minimize the complication associated with this disease. It is being concluded from the present study that exercise and diet play important role to minimize the risk associated with this fatal disease. Significant improvement on the health of individual in the diet and exercise was observed in exercise, diet and diet plus exercise group. It is concluded that low calorie intake with regular exercise not only reduce the economic burden of the diabetics but also minimize the associated long term fatal pathologies. The disease is a growing health concern which needs lifelong treatment. Life style modification with changes in dietary habits and exercise therapy would reduce the economic burden in term of chemotherapeutic cost in the early stage of the disease, as well as minimizing the devastating complications of the disease.

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