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ORIGINAL ARTICLE

Impact of Physical Activity on Fasting, Random Blood Sugar and HbA1C in Type – II Diabetic Patients

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Authors' Contributions
1 Conceived idea, manuscript initial drafting.
2 Study design, final drafting of manuscript.
3 Study supervisor and literature survey.
4 Statistical analysis and final interpretation of results.

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ABSTRACT

Objective: Aim of the study is to evaluate the impact of physical activities on fasting, random blood sugar and HbA1C on patients getting treatment with different systems of medicine.

***Methods*:** Prospective cross sectional study was conducted in outpatient facilities of Karachi from July 2017 to July 2018 with treatment duration of at least one year. 195 type – II Diabetic patients with confirm diagnosis enrolled in the study. Study has three arms of anti-diabetic treatment; herbal, homeopathic and allopathic. Outcome measures are Fasting Blood Sugar (FBS), Random Blood Sugar (RBS) and HbA1C with and without exercise.

Results: In exercise group, mean reduction of FBS in patients; Allopathic=138.31±46.11 mg/dl, homeopathic=100±00 mg/dl, herbal=121.11±19.64 mg/dl, combination=135.20±40.85 mg/dl. Mean reduction of RBS; Allopathic=186.25±58.77 mg/dl, homeopathic=140.00±00 mg/dl, herbal=198.88±49.60 mg/dl, combination=231.90±64.10 mg/dl. Mean reduction of HbA1C; Allopathic=7.53±1.97%, herbal=6.47±0.335%, combination=7.21±1.147%. In patients not doing exercise, mean reduction of FBS in patients; Allopathic=183.80±85.49 mg/dl, homeopathic=119.00±47.71 mg/dl, herbal=131.00±17.68 mg/dl, combination=134.37±49.88 mg/dl. Mean reduction of RBS; Allopathic=240.08±92.76 mg/dl, homeopathic=163.00±32.33 mg/dl, herbal=193.66±46.42 mg/dl, combination=212.67±87.21 mg/dl. Mean reduction of HbA1C; Allopathic=8.89±2.04%, homeopathic=6.40±00%, herbal=6.54±0.398%, combination=7.10±1.53%. FBS is significantly better controlled by allopathic system compare to homeopathic (p=0.004), herbal (p=0.0001), combination (p=0.0001). RBS is significantly better controlled by allopathic system compare to homeopathic (p=0.006), herbal (p=0.017). Homeopathic system significantly better control RBS compare to combination treatment (p=0.036).

Conclusion: Physical activities and exercises can provide better control on FBS, RBS HbA1C. Allopathic and combination systems of medicine have better glycemic control in type – II Diabetes Mellitus patients involve in physical activities.

Keywords: Exercise, Diabetes mellitus, blood sugar, HbA1C, glycemic control

INTRODUCTION

It is well known that exercise and physical activity have significant contribution in maintaining normal functions of body. Importance of physical activity increases when an individual is suffering from any chronic illness; hypertension, diabetes, hyperlipidemia, fibrinolysis, obesity or other form of cardiovascular disorder [1]. Definition of physical activity is demonstrated by one of the researcher as contraction of skeletal muscles which results in energy expenditure [2]. Definition of moderate physical activity is 3.0 to 5.9 metabolic equivalent units which is walking at a pace of 3 miles per hour [3]. It has been noted that diabetes and its complications are very much associated with slothful life style. Many researchers are agreed that physical activities have positive impact on body systems especially cardiovascular and metabolism, however, the magnitude of impact of physical activity is still a question mark and need further research about intensity, frequency and duration of physical activity [4]. In type – II Diabetes Mellitus patients, it is necessary to maintain disciplined life style by balanced and calculated calories of diet, exercises and drug doses. Physical activities keep diabetic patient active and make him feel well and strong. In addition, exercise also improve cardiac function, better control of blood glucose levels and prevents long term secondary complications [5, 6]. There are two main goals of diabetic therapy; to maintain blood glucose levels in the required ranges and reduce obesity, because chronic hyperglycemia leads to various complications including nephropathy, retinopathy, neuropathy, cardiomyopathy, and vasculopathy. Abdominal obesity is also related with insulin resistance, hyper insulinemia, hyperglycemia, dyslipidemia, and hypertension [7].

Dietary habits and exercises contributed significantly in reducing the incidences of type – II Diabetes Mellitus in individuals having metabolic disorder and abnormal blood glucose levels [8]. The another researcher found mixed type of results in glucose homeostasis of type – II Diabetes Mellitus patients when compared exercised and non-exercised groups [9]. Most of the studies prove that exercises and physical activities better control diabetes and also contribute in prevention of the diseases. It is also noted that incidence of chronic complications associated with type – II Diabetes Mellitus also reduce by exercises [5, 10].

Since most of the studies conducted on the impact of physical activity and exercise on control of FBS (Fasting Blood Sugar), RBS (Random Blood Sugar) and HbA1C in type – II Diabetes Mellitus patients of western countries, therefore, objective of current study is to evaluate the impact of physical activities on FBS, RBS and HbA1C in Pakistani patients suffering from type – II Diabetes Mellitus while on different systems of treatment.

MATERIALS AND METHODS

The cross sectional study conducted in the outpatient clinics at multiple medical centers, homeopathic clinics and Matabs of herbal practitioners (Hakeem) in Karachi to determine the impact of physical activity on diabetes control parameters in different system of medicines. The duration of study is from July 2017 to July 2018.

Treatment Duration:

At least one year from July 2017 to July 2018.

Data Collection:

Primary data was collected by pre-designed, structured questionnaires. Informed consent was taken from the patients before the interview. The first section of questionnaire was consisted of patient's demography. The second section consisted of a medical overview of the patients and existing co-morbid conditions like hypertension, nephropathy, duration, and laboratory tests like Fasting Blood Sugar (FBS), Random Blood Sugar (RBS). In this section patient's physical activity and exercise details are also collected. Physical activity means at least 150 minutes' aerobic activity per week. In last section, management of type – II Diabetes Mellitus included both therapeutic and non-therapeutic measures.

Ethics Committee Approval:

Study is approved by Institutional Bioethics Committee, University of Karachi (Project Reference No. IBC/KU/23) and Interactive Rsch & Development, registered with the U.S. Department of Health and Human Services (DHHS) Office for Human Research Protections (OHRP) with IRD-IRB#IRD_IRB_2017_03_018.

Sample Size:

Sample size of study was calculated by precision analysis technique [11]. 195 patients diagnosed with type – II Diabetes Mellitus were included in the study. These patients were divided into four groups based upon treatment type; Group 1 Allopathic medicine, Group 2 Homoeopathic medicine, Group 3 Herbal medicine and Group 4 Combination of any 2 or more of above mentioned medicine system.

Inclusion criteria:

Patients have confirmed diagnosis of type – II Diabetes Mellitus.

Exclusion criteria:

Pediatric and type – I diabetic populations, gestational diabetes, diabetes insipidus.

Data Analysis:

Collected data was processed on Statistical Package for Social Sciences (SPSS version 22) for analysis. Frequencies and proportions were computed for descriptive statistics.

RESULTS

Mean reduction, standard deviation, standard error, minimum and maximum reduction in FBS, RBS and HbA1C in patients with Physical activity in different treatment type. (Table **1**).

Table 1. FBS, RBS and HbA1C reduction in different treatment types with Physical Activity.

Physical Activity	Treatment Type/ System		Fasting Blood Sugar (FBS) in mg/dl	Random Blood Sugar (RBS) in mg/dl	HbA1C in %
With Physical Exercises	**Allopathic** (N=16)	Mean	138.31	186.25	7.53%
		Std. Deviation	46.11	58.77	1.97%
		Std. Error of Mean	11.52	14.69	0.493%
		Minimum	96.00	90.00	5.50%
		Maximum	251.00	293.00	12.60%
	Homoeopathic (N=1)	Mean	100.00	140.00	--
		Std. Deviation	--	--	--
		Std. Error of Mean	--	--	--
		Minimum	100.00	140.00	--
		Maximum	100.00	140.00	--
	Herbal (N=9)	Mean	121.11	198.88	6.47%
		Std. Deviation	19.64	49.60	0.335%
		Std. Error of Mean	6.54	16.53	0.1118%
		Minimum	90.00	140.00	6.00%
		Maximum	150.00	250.00	7.00%
	Combination (N=10)	Mean	135.20	231.90	7.21%
		Std. Deviation	40.85	64.10	1.147%
		Std. Error of Mean	12.92	20.27	0.468%
		Minimum	90.00	140.00	5.90%
		Maximum	200.00	350.00	8.50%
	Total Patients (N=36)	Mean	132.08	200.80	7.16%
		Std. Deviation	38.85	59.82	1.55%
		Std. Error of Mean	6.47	9.97	0.279%
		Minimum	90.00	90.00	5.50%
		Maximum	251.00	350.00	12.60%

Mean reduction, standard deviation, standard error, minimum and maximum reduction in FBS, RBS and HbA1C in patients without Physical activity in different treatment type. (Table **2**).

Table 2. FBS, RBS and HbA1C reduction in different treatment types without Physical Activity.

Physical Activity	Treatment Type/ System		Fasting Blood Sugar (FBS) in mg/dL	Random Blood Sugar (RBS) in mg/dL	HbA1C in %
No Physical Exercise	**Allopathic** (N=78)	Mean	183.80	240.08	8.89%
		Std. Deviation	85.49	92.76	2.04%
		Std. Error of Mean	9.68	10.43	0.230%
		Minimum	70.00	82.00	5.10%
		Maximum	408.00	470.00	14.40%
	Homoeopathic (N=10)	Mean	119.00	163.00	6.40%
		Std. Deviation	47.71	32.33	--
		Std. Error of Mean	15.08	10.22	--
		Minimum	90.00	120.00	6.40%
		Maximum	250.00	230.00	6.40%
	Herbal (N=30)	Mean	131.00	193.66	6.54%
		Std. Deviation	17.68	46.42	0.398%
		Std. Error of Mean	3.22	8.47	0.072%
		Minimum	90.00	120.00	5.90%
		Maximum	150.00	250.00	7.00%
	Combination (N=40)	Mean	134.37	212.67	7.10%
		Std. Deviation	49.88	87.21	1.53%
		Std. Error of Mean	7.88	13.79	0.32%
		Minimum	70.00	100.00	5.80%
		Maximum	316.00	505.00	12.10%
	Total Patients (N=159)	Mean	157.16	219.58	8.03%
		Std. Deviation	71.41	84.45	2.00%
		Std. Error of Mean	5.68	6.69	0.173%
		Minimum	70.00	82.00	5.10%
		Maximum	408.00	505.00	14.40%

Comparison of different treatment options with and without physical activity for the reduction of FBS and RBS. (Table **3**). No significance was observed in treatment type versus HbA1C reduction.

Table 3. Comparison of different treatments for FBS and RBS reduction.

Dependent Variable	Treatment Type/ System	Treatment Type/ System	Mean Difference	Significance (p-value)
Fasting Blood Sugar (FBS) in mg/dl	Allopathic	Homoeopathic	58.79110	0.004
		Herbal	47.34588	0.0001
		Combination	41.52383	0.0001
	Homoeopathic			
		Herbal	-11.44522	0.599
		Combination	-17.26727	0.416
	Herbal			
		Combination	-5.82205	0.669
Random Blood Sugar (RBS) in mg/dl	Allopathic	Homoeopathic	70.11196	0.006
		Herbal	36.14926	0.017
		Combination	14.50105	0.294
	Homoeopathic			
		Herbal	-33.96270	0.209
		Combination	-55.61091	0.036
	Herbal			
		Combination	-21.64821	0.201

MATERIALS AND METHODS

Physical activities and exercises are essential for health. Many researchers are agreed upon positive impact of physical activities on body systems especially cardiovascular and metabolism [12]. In addition of dietary management and pharmacological intervention, exercise is a cornerstone for Diabetes Mellitus management [13]. Despite this fact, very few patients in current study were engaged in physical activity. Counseling of patients for physical activity may improve health related outcome. According to literature, counseling of medium intensity physical activity improved on an average 38 minutes rise in physical activity per week [14]. From the study it is noted that among all patients (N=195) of type – II Diabetes Mellitus, only 18.46% (N-36) have physical activities and exercises in their daily routine. 17.02% (N=16) patients in allopathic system, 9.09% (N=01) patients in homeopathic system, 76.92% (N=30) patients in herbal system and 80% (N=40) patients in combination treatment have physical activities and exercises in their daily routine (Table **1**). Interestingly patients in herbal and combination treatment are involved more in physical activities and exercise.

Findings of meta-analysis and systematic review of 47 randomized clinical trials reveals that 62.9% type – II Diabetes Mellitus patients have significant reduction

of HbA1C when structured training and exercise program were implemented [15]. Another meta-analysis demonstrated 0.6% reduction of HbA1C when patients are engaged in aerobic exercises and resistance training [16]. Due to this reason, current study also focused on the impact of physical activity on HbA1C, fasting and random blood sugar in patients getting treatment by different system of medicine. Current study confirmed the findings of previous studies that patients on the treatment of their type – II Diabetes Mellitus by allopathic or homeopathic system of medicine have better reduction of mean FBS, RBS and HbA1C if they have physical activity and exercises in their daily routine (Table **1**). However, interestingly no effect is observed of physical activity and exercises in reduction of FBS, RBS and HbA1C if patients are getting treatment of type – II Diabetes Mellitus by Herbal system or combination of these systems of medicine (Table **1**). When data was evaluated regardless of system of medicine, It has been noted that there is a difference in the magnitudes of FBS, RBS and HbA1C in both group of patients who does exercises and who does not exercise (Table **1** and Table **2**).

One of the literature suggest that education and training of diabetic patient results in better outcome and quality of life [17]. Patients of type II Diabetes Mellitus interrupt their sitting time and involve themselves in mild to moderate type of walking to lower their glucose levels [18, 19]. Similarly, current study also focused on the impact of physical activities on FBS and RBS with different system of medicines. When allopathic system of medicine was compared with homeopathic system of medicine, the mean difference in FBS was noted 58.79 mg/dl and this difference is significant (p=0.004) (Table **3**). Similar significant results were noted when allopathic system was compared with herbal system with mean difference 47.34 mg/dl (p=0.0001) and combination treatment with mean difference 41.52 mg/dl (p=0.0001) (Table **3**). These findings of current study suggest that Allopathic system of medicine is superior in reducing FBS compare to all other systems of medicine.

In comparison of homeopathic system with herbal system and combination system, no significance was noted with mean difference of FBS to herbal system -11.44 (p=0.599) and combination -17.26 (p=0.416) (Table **3**). Herbal system is also found to be non-significant to combination system for reducing FBS with a mean value of 5.82 mg/dl (p=0.669) (Table **3**).

In the similar way, RBS data of patients who does physical activity and exercises also compared in different system of medicines. Those patients who do exercises have significantly better reduction of RBS with allopathic system of medicine compares to homeopathic and herbal systems. Differences in mean reduction for allopathic versus homeopathic was 7.11 mg/dl (p=0.006) and allopathic versus herbal was 36.14 mg/dl (p=0.017) (Table **3**). When allopathic system was compared with combination treatment for RBS reduction, there was no significance difference noted with mean difference of 14.50 mg/dl (p=0.294) (Table **3**).

In comparison of homeopathic and herbal systems, mean difference in RBS reduction was -33.96 (p=0.209) and no significant difference was observed. However, results are in the favor of combination treatment compare to homeopathic system with mean difference in RBS reduction of -55.61 (p=0.036) and combination treatment is significantly better versus homeopathic system of medicine. Other studies supported these findings and clearly stated that integration of other system of medicine may have potential solution in health care system improvement [20, 21]. Study further reveals no significant difference of RBS reduction in comparison of herbal system of medicine with combination treatment, in this comparison mean difference in RBS reduction is -21.64 (p=0.201) (Table **3**). In the current study, data of HbA1C found to be non-significant in multiple comparisons of different system of medicines. Due to this reason it is recommended that when target of clinician is to reduce patient's HbA1C or FBS, any system of medicine can be used which is economical. This recommendation is supported by Adler NE et al. by emphasizing the use of alternative medicine in low socio-economic class [22].

CONCLUSION

Allopathic systems of medicine have better glycemic control in type – II Diabetes Mellitus patients involve in physical activities. However, alternative system also shows no significance difference in FBS and HbA1C reduction compare to allopathic system i.e. why it is suggested to use these systems in low socio-

economic class, as cost of allopathic treatment is high. Moreover, physical activities and exercises can provide better control on FBS, RBS HbA1C and can prevent form long term diabetes related complications.

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