

ORIGINAL RESEARCH ARTICLE

Influence of diet and exercise adherence in diabetic cases and its impact on HbA1c

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ABSTRACT

In a current cross-sectional experimental study, it was observed that the impact of diet and exercise on healthy life adherence in mature diabetes cases and their influence on glycated hemoglobin (HbA1c, average glucose) The diabetic patients (male and female) were anatomized in relation to adherence and suggested a diet with exercise plans that control the adverse effect of producing less insulin. A sample of 30 subjects, 30–50 years old, were selected randomly from 3 major hospitals (Jinnah, Mayo, and Services) and some private laboratories. A group of normal control subjects (N = 10) was also selected for further comparison. The HbA1c test has been taken before and after the implementation of the 12-week diet and exercise plan. This study utilized a simple random sampling technique, and normality was checked through the Shapiro-Wilk test. The data was analyzed through SPSS-22, and a paired sample t-test was utilized for further comparison. The lower HbA1c values indicate a better diabetes operation. These results clearly depicted that it controlled the worse effects of sugar patients, which also emphasizes the significance of adherence in achieving optimal glycaemic control. The result also concluded that a balanced diet and a combination of exercises control the glycaemic patients efficiently and effectively.

Keywords: diabetes; adherence; glycaemic; HbA1c values

1. Introduction

One of the leading problem in disease in around the world is diabetes mellitus, which has become principal health problem in sports as well^[1-3]. Due to development in socio-economic factors, the daily routine, changes in dietary habits, aging and sedentary life style have manifested into significant rise in number of patients suffering from diabetes mellitus, hypertension, various musculoskeletal disorders resulted rise in obesity^[2,4-7]. Diabetes mellitus is a complex and habitual complaint defined by high blood sugar situations, and it poses considerable public health challenges around the world about 3000 years ago by the ancient Egyptians^[8]. Most probably, the Type 2 diabetes mellitus is considered to be one of the most

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common diseases globally and the threat of serious consequences increases the significance of applicable operation measures^[9]. Many studies work on dietary pattern that improved the glycaemic level and cardiovascular risk factors showed significance from other humans^[1,10]. Furthermore, physical activity not only improves the postural status but also acknowledges to disease awareness and behavior as well to attain better self-management of HbA1c^[11,12]. In the phase of rehabilitation most athletes do face the imbalance of HbA1c, but a comprehensive cardiovascular, resistance training and proper medicine helped to get the baseline values efficiently^[1,13,14]. Stretching also played an important role in improved the blood sugar consumption as it performed slow and controlled moments which impacted contact and relaxation on muscles results in consumption of blood sugar as a primary source thus, better performance in body functionality, In addition as it improved the body ability to work efficiently in daily activities and sports^[15,16]. In case of swear sports injuries the athletes HbA1c value increased as they are on bed rest and nor taking balance diet for a longer period of time resulted in overweight category and sometimes lead to obese^[3]. In rehabilitation phase which is also vitals segment of the recovery phase come over this imbalance phenomena^[13,16]. It was not only related to the subject disparity diet, but it also affected the pregnant women's metabolism as it prevented physical activity in a lighter mode^[17]. The other socioeconomic factors (e.g., income, education, employment status, and access to healthcare services) are all characteristics which have a substantial impact on diabetic cases' capability to follow suggested food and exercise routines, as highlighted by the WHO^[18]. A number of cross-sectional studies observed that an imbalance diet and periodontal health were inconsistent in diabetes persons^[19,20]. People in lower socioeconomic position constantly encounter challenges similar as a lack of access to nutritive foods, lower openings for physical exertion, and a lack of healthcare services^[21]. Diet and proper exercise adherence resulted in salutary and an exercise recommendation was estimated using the diabetic tone operation^[22]. The gyrated hemoglobin (HbA1c) values serve as an important index of long-term blood sugar control. Adherence to food and exertion recommendations in line with WHO's^[18], findings had a direct brunt on HbA1c situations, demonstrating a clear link between life choices and physiological consequences HbA1c situations^[1,21]. Glycated hemoglobin (HbA1c) situations were measured as a clinical index of long term glycaemic control^[23]. **Figures 1 and 2** show the physical activity and healthy food choices respectively.



Figure 1. Physical activity.



Figure 2. Healthy food choices.

- **Objectives**

- (1) Check the effect of balance and appropriate diet effect on diabetic patients
- (2) To observe the influence of proper and comprehensive exercise plan on diabetic patients

- **Research question**

The balance diet and daily exercise impacted the value HbA1c (average glucose)

2. Methodology

The scholar explains the purpose of the study to the subjects and get the initial information and get the data of demographic variables N = 40 subjects.

Table 1 shows the mean \pm S.D. of demographic variables (age, weight, height and body mass index) BMI of the selected subjects from 3 major hospitals and laboratories of the Lahore.

Table 1. Demographic variables.

S. No	Mean \pm S.D.
Age (years)	39.43 \pm 2.13
Weight (Kg)	80.16 \pm 3.54
Height (cm)	156.45 \pm 3.17
BMI	33.1 \pm 2.10

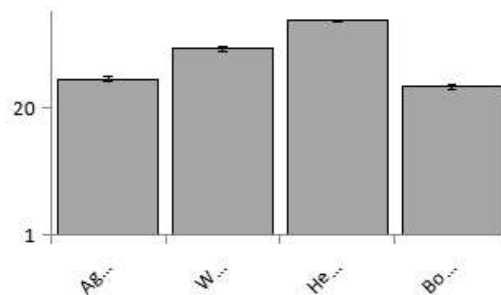


Figure 3. Demographic variable.

The **Table 1** and **Figure 3** shows mean \pm S.D. of demographic variables i.e., age (years, 39.43 \pm 2.13), weight (kilogram, 80.16 \pm 3.54), height (centimeters, 156.45 \pm 3.17), along with body mass index (33.1 \pm 2.10) of selected subjects from 3 different hospitals and laboratories.

In this retrospective study included 30 subjects of Type 2 diabetes cases aged 30–50 selected from 3 different hospitals (Junnah, Myo, and Services) and some private laboratories having confirmed diabetic issue checked through HbA1c test. The demographic variables also have been taken from the subjects. This experimental study is a cross-sectional study which assesses and checked the impact of diet and exercise effect on diabetes. A group of normal control (N = 10) also be selected for further comparison. The pretest values have been taken initially for baseline information. The result has been checked after 3 months before and after implementation of diet and exercises plan. Before post-test protocols implemented 6 male and 4 female left the study due to their personal problems and did not take part in the post-test activity. The normal control group performed their normal activities. The remaining 30 subjects executed the post-test protocols with same condition. Principle of progression, variation and specificity has been adopted through this research. The complete detailed program mentioned in the flow chart (**Figure 4** comprehensively). A comprehensive 12 weeks diabetic diet plan implemented balancing nutritive requirements and exercises plan

executed to check the effects of these factors on HbA1c. It is shown in **Table 2** and flow chart of the study is given below:

Table 2 shows the diet and exercise plan (12 weeks) of the HbA1c subjects (male and female) along with the 7th and 8th unloaded week.

Table 2. Diet plan (12-week plan for HbA1c subjects).

	Week (1–2)	Week (3–4)	Week (5–6)	Week (7–8)	Week (9–10)	Week (11–12)
Breakfast 7–8 a.m.	low-fat yogurt, brown chuck, eggs without yolk	whole grain cereals with low-fat milk, brown chuck with egg without yolk	oatmeal with sliced bananas, brown chuck with vegetable omelette	unloading week	low-fat yogurt, brown chuck, eggs without yolk	whole grain cereals with low-fat milk, brown chuck with egg without yolk
Mid-day meal 11–12 p.m.	apple small serving of almonds	fresh fruit salad pineapple	small peach grapefruit		apple small serving of almonds	fresh fruit salad, pineapple
Lunch 2–3 p.m.	chickpea salad, grilled craven with salad, whole grain roti	grilled fish with salad, whole grain roti, chickpea salad	brown rice with craven inside, whole grain roti, chickpea salad		chickpea salad, grilled craven with salad, whole grain roti	grilled fish with salad, whole grain roti, chickpea salad
Evening meal 5–6 p.m.	interlaced biscuits with tea, pineapple clumps	fresh fruit juice (flavorless), fresh orange slices, mixed unsalted nuts	mixed unsalted nuts, tea with canderels, mixed unsalted nuts		interlaced biscuits with tea, pineapple clumps	fresh fruit juice(flavorless), fresh orange slices, mixed unsalted nuts
Dinner 8–9 p.m.	lentil soup with mixed vegetables stir dinner mutton with broccoli	ignited fish with sautéed spinach, ignited craven with sweet potato	grilled funk inside with slide salad, steamed leafy sap		lentil soup with mixed vegetables, stir dinner mutton with broccoli	ignited fish with sautéed spinach, ignited craven with sweet potato
Exercise plan (12-week plan for HbA1c)						
Morning session	light walk with 50%–70% intensity full body stretching	body weight exercises upper body stretching	brist walk with 50%–70% intensity	unloading week	body weight exercise and brist walk	walk with 80% intensity pool recovery session
Evening session	pool session mobilization exercises	rest	full body stretching		low impact cardio exercises full body stretching	jogging 15 min with 60% intensity

Note: Warm-up and warm-down after every session, each session consisted up to 45 min.

Figure 4 shows the detailed activity throughout the study along with control group values as well.

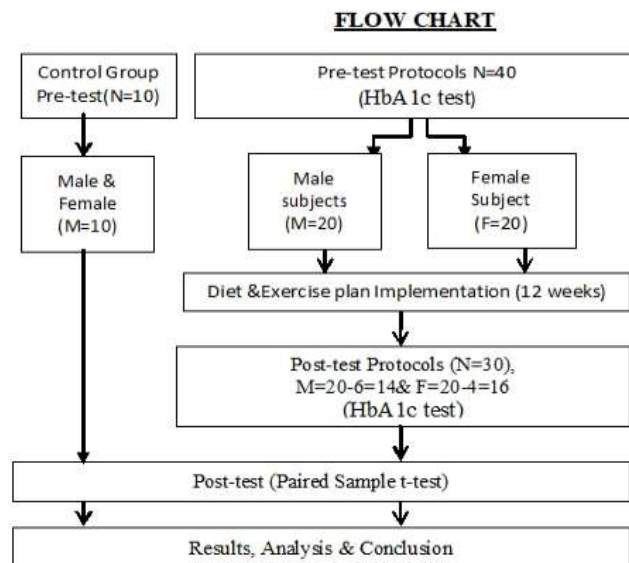


Figure 4. Activity flow chart.

3. Data analysis

The HbA1c is a Glycosylated Hemoglobin value which is calculated in gram/deciliter. Its low, normal, pre-diabetes and diabetic values have been shown in the following **Table 3** given below:

Table 3. Glycosylated hemoglobin.

S. No	Glycosylated hemoglobin values (mg/dl)	Opinion
1	Less than < 4	Low
2	Range 4–5.7	Normal
3	Range 5.7–6.3	Pre-diabetes
4	6.4 < and above	Diabetes

Table 3 shows the different values of HbA1c values along with their range.

The selected subjects were passed through 12 weeks diet and exercises plan and post-test has been taken with the same protocols. The results have been showed in **Table 4**. **Table 4** shows the pre-test and post-test values (N = 30) analyzed by paired sample t-test of male and female diabetic patients data along with difference in HbA1c values and percentage improvement.

Table 4. HbA1c values, difference and improvement (%).

Subjects N = 30	HbA1c mean \pm S.D.	Difference in values	% Improvement
Pre-test	6.88 \pm 0.36	0.8	12%
Post-test	6.08 \pm 0.31		

The data collected from HbA1c has been analyzed through paired sample t-test. The **Table 3** and **Figure 5** showed the results of HbA1c pre-test value 6.88 ± 0.36 and post-test value 6.08 ± 0.31 , with the difference improvement at 0.8 along with 12% after the completed of 3 months implementation of diet and exercise comprehensive program with the help of bar graph. The subjects not only showed improvement in this body functionality state but it also helped them to perform better in different working areas. The results also concluded that it stopped the adhesive effects of the diabetes patients.

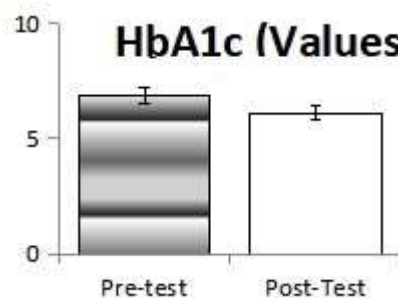


Figure 5. Bar graph (HbA1c).

4. Discussion

The results of the HbA1c revealed that a balance diet and appropriate exercise improved the functionality of insulin in the body and thus cut down the value of HbA1c. The results resembled with Li et al.^[2] and Gill et al.^[7]. The study extracted that after avow grievance to athlete and stuck such problem as he did not take care of his diet and perform proper exercises sessions can be compared with Gill et al.^[13] and

Gill et al.^[16]. In addition, the rehabilitation phase sometimes started within few hours after acute injuries. The study also depicted that rehab plan started as soon as possible after free from pain and swelling as it resulted in a risk of overweight situations, sometimes lead to obese person which lead to produce problem like HbA1c as the finding was similar with Abbas et al.^[3]. The cardiovascular training also improved the performance as it reduces the HbA1c values by consuming the blood sugar level consistently; the outcome was overlap with Chen and Carbone^[22]. The present study highlighted that by performing physical activity we can decrease blood sugar level. The results appeared to be similar to the finding of Habib and Durrani^[11] and Christensen et al.^[12] and Shaji^[14]. Moreover, the study improved the glycaemic level and cardiovascular risk factors as it overlap with the findings of Qi et al.^[1], Whiteley et al.^[10] and Xu et al.^[21], as it decrease the of risk cardiovascular injuries efficiently. The study also revealed that static and dynamic stretching is helpful in cut down the HbA1c level. The results are compared with Gill et al.^[16] as they worked on static and dynamic stretching, but this study is about reduction of HbA1c due to blood glucose consumption through stretching. The research also helpful for pregnant women in controlling the HbA1c as it used to restrict the blood sugar level at that stage, and result was similar with the finding of Boath et al.^[17].

In future there is a space that a proper diet plan along with vigorous exercises will not only control the HbA1c value but also improve or get rid of health issues which created problems for other diseases like Cardiovascular disorder, Stomach upset and respiratory issues.

5. Conclusion

The study concluded that proper exercise and a balanced diet not only support the related person but also help to cut down on health issues and enhance performance. The results showed that a proper 12-week plan not only cut down the HbA1c value but also improved the health issues, e.g., cardiovascular issues and stomach issues. Diabetes mellitus is one of the most widespread diseases in the new era and has stabilized through a balanced diet and regular exercise. This study supports the issue with facts and figures. This study supports the issues with facts and figures. Moreover, the study revealed that devotion to diet and exercise resulted in better performance not only in social but also in physical performance as well.

Author contributions

Conceptualization, MM and MSAG; methodology, MSAG, IN and MU; software, MSAG, HS and MI; validation, MSAG, RA and AS; formal analysis, MSAG and AL; investigation, MSAG and SA; resources, MSAG and MM; data curation, MSAG; writing—original draft preparation, MSAG, MM and SA; funding acquisition, MM. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declared no conflict of interest.

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