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Research Article

**IMPACTS OF ALTERATIONS OF LEVEL OF  
GLYCOSYLATED HEMOGLOBIN IN DIABETICS  
ACCORDING TO PRESENCE OF CORONARY HEART  
DISEASE AND HYPERTENSION****Dr Sana Sajjad, Dr Iram Imtiaz, Dr Qamar Aslam**  
Sheikh Zayed Hospital Rahim Yar Khan**Article Received:** March 2020**Accepted:** April 2020**Published:** May 2020**Abstract:**

**Objective:** To examine the clinical impact of the alterations in the levels of glycosylated hemoglobin of diabetics on the Chronic Heart Disease and Hypertension.

**Methodology:** Division of total 196 patients carried out in two groups; control group comprising 96 patients without diabetes and patient group with 100 diabetics. The comparison of the biochemical indexes of the patients of both groups was carried out. Moreover, the division of the patients of the observation group was carried out in different sub-groups in accordance with the availability of hypertension and chronic heart disease and the comparison of the HbA1c level was carried out in various sub-groups.

**Results:** There was no significant difference in the levels of TC (Total Cholesterol), TG (Triglyceride) and LDL-C (Low-Density Lipoprotein Cholesterol) of the patients in both groups ( $P>0.050$ ). However, level of HDL-C (High Density Lipoprotein-Cholesterol) of the patients in observational group was much low as compared to the subjects of control group ( $P<0.050$ ). SBP and DBP (Systolic Blood Pressure and Diastolic Blood Pressure), FPG (Fasting Plasma Glucose), FI (Fasting Insulin) and values of hs-CRP (High-Sensitivity C - reactive protein) and level of HbA1c of patients in observational group were significantly high in comparison with the group of controls ( $P<0.050$ ). HbA1c level of the hypertension patients was much higher as compared to the patients without hypertension ( $P<0.050$ ). HbA1c level of the patients suffering from chronic heart disease was significantly higher as compared to the patients without chronic heart disease ( $P<0.050$ ). The results of the Pearson correlation analysis stated that HbA1c level of the patients in group of diabetics was in strong correlation with systolic and diastolic blood pressures and CRP level ( $P<0.050$ ).

**Conclusion:** HbA1c level of the patients suffering from diabetes was in a strong association with the blood pressure and CRP level. HbA1c level can predict the rate of occurrence of hypertension and chronic heart disease. Identification of the values of glycosylated hemoglobin is much vital in the screening of the patients present with hypertension and chronic heart disease.

**KEY WORDS:** Diabetics, Blood Pressure, Hba1c, Hypertension, Chronic Heart Disease, Systolic, Diastolic, Plasma, Fasting Plasma Glucose.

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**INTRODUCTION:**

With the innovative development in the standard of living, increasing prevalence of the chronic complications has become vital [1]. One of the most important disease is diabetes, which is much common in our country Pakistan [2]. Statistics have stated that the incidence rate of the diabetes in about 9.7% in the adult population [3], there are many complications of this disorder. The amount of the patients of diabetes with hypertension and chronic heart disease is increasing rapidly which seriously endangers the health of humans and it is the cause of serious health and economic burden. Many epidemiologic research works have stated that patients suffering from diabetes have many times higher risk of acquiring chronic heart diseases and diabetes itself is a very common factor of risk for chronic heart diseases [4,5]. Majority of the patients suffering from diabetes have impaired level of HbA1c which is thought to be an effective index for the monitoring of the therapeutic impacts of the drugs, short time for surgery and simple processes [6].

A research study stated that there was a close relation of the level of HbA1c with the cardiovascular as well as cerebrovascular complication [7]. Khaw in his research work discovered that there was 10% to 20% increases risk of cardiovascular diseases in the patients suffering from diabetes if there was increase in the level of HbA1c by 1.0% [8]. In this research work, level of HbA1c in the patients suffering from Type-2 diabetes mellitus with hypertension and chronic heart diseases were examined with the utilizing randomize controlled trial. The comparison of the HbA1c level of the patients present without or with cardiovascular disease was carried out. We observed the prevalence of cardiovascular diseases in diabetics under various HbA1c levels to explore levels of HbA1c in the prediction of the prevalence of chronic heart diseases in the patients suffering from diabetes. This current research aimed to provide a valid reference for the timely identification and prevention of associated chronic complications.

**MATERIAL AND METHODS:**

This retrospective research work was carried out on 196 patients suffering from endocrine diseases from March 2018 to December 2019. The division of these patients carried out into 2 groups; control group and observational group in accordance with the presence of diabetes. All the patients of observation group were fulfilling the diagnostic criteria described by WHO [9]. All the patients who were suffering from infectious diseases, current hypoglycemia, inefficiency in kidney function, and cardiovascular and cerebrovascular diseases were not included in this research work.

There were 100 patients in the observation group, including 43 females and 57 males. The average age of these patients was  $57.68 \pm 6.33$  years and average BMI (Body Mass Index) was  $27.88 \pm 5.54 \text{ kg/m}^2$ . There were 96 patients in the group of controls, including 43 females and 53 males. The average age of these patients was  $58.13 \pm 6.96$  years and average BMI was  $24.12 \pm 4.30 \text{ kg/m}^2$ . We found no significant disparity in the age, gender, weight and height of the patients of both groups. We obtained the written consent from the patients after describing them the main purpose of this research work. Ethical committee of the Hospital gave the permission to conduct this research work.

We obtained the venous blood from all the patients in fasting condition. The separation of the serum was carried out and the detection of the lipids in blood was carried out with the utilization of the Backman automatic biochemical analyzer. Various blood lipid indexes comprised Total Cholesterol, Triglyceride, HDL-C and LDL-C. We detected the level of blood glucose. The measurement of the level of HbA1c was also carried out in accordance with the international instructions. We also performed the oral glucose tolerance insulin release test on every patient according to international guidelines of WHO. For the diagnosis of hypertension, we measured the blood pressure with the utilization of the mercury sphygmomanometer. We used the standard of WHO for its diagnosis. The diagnosis of the chronic heart disease carried out with the utilization of the coronary arteriography in accordance with the criterion that minimum 1 vascular luminal stenosis exceeded 50.0%. We used SPSS V.20 for statistical analysis of collected information. Kolmogorov-Smirnov test was in use for measuring the normative data. We expressed the categorical data in averages and standard deviations. T test was in use for the comparison of data between both groups. We expressed the numerical data in rates. We used the Pearson test for the correlation analysis. P value of less than 0.050 was significant.

**RESULTS:**

Comparison of the indexes of blood lipid among both groups stated that values of LDL-C, Total Cholesterol and Triglyceride of the patients both groups were not significant difference statistically ( $P > 0.050$ ); the HDL-C level of the patients in observational group was significantly lower as compared to the patients of control group ( $P < 0.050$ ); Systolic and diastolic blood pressure of the subjects of observation group were much high as compared to the group of controls ( $P < 0.050$ ). Levels of Fasting Plasma Glucose and Fasting Insulin of the patients in observational group were much high in comparison with the subjects of

control group ( $P < 0.050$ ). Levels of hs-CRP and HbA1c of the observation group were much high as compared to the patients present in control

group ( $P < 0.050$ ). The summary of these details is present in Table-1.

**Table-I: Comparison of Biochemical Indexes Between the Two Groups**

Group	Observation group (n=100)	Control group (n=96)	t	P value
SBP (mmHg)	132.12±14.37	116.99±9.66	7.679	<0.05
DBP (mmHg)	81.62±10.89	75.87±9.76	6.971	<0.05
TC (mmol/L)	4.71±1.23	4.56±1.04	1.043	>0.05
TG (mmol/L)	1.06±0.30	0.81±0.24	1.127	>0.05
LDL-C (mmol/L)	2.80±0.92	2.64±0.83	1.268	>0.05
HDL-C (mmol/L)	0.82±0.30	1.11±0.37	2.453	<0.05
FPG (mmol /L)	7.97±1.12	5.13±0.99	3.014	<0.05
FINS (mIU/L)	5.83±1.54	4.42±0.26	2.827	<0.05
hs-CRP (mg/L)	11.42±2.97	4.14±1.32	4.618	<0.05
HbA1c (%)	7.29±2.11	5.57±1.55	3.731	<0.05

In the observation group, 63 patients were present with hypertension and prevalence rate of hypertension was 63%. HbA1c level of the diabetics with hypertension was  $9.38 \pm 3.11\%$ , whereas in the diabetics' patients without hypertension, it was  $5.97 \pm 2.01\%$ . We found that the level of HbA1c in the diabetic patients with hypertension was much high and this difference was statistically significant ( $t=6.3840$ ,  $P < 0.050$ ). There were 55 patients in the observation group, who were suffering from chronic heart disease and the prevalence rate of chronic heart disease was 55%. HbA1c level of the diabetics with chronic heart disease was  $8.67 \pm 2.77\%$ , whereas this level was in the diabetics without chronic heart disease was  $5.61 \pm 1.94\%$ . This result showed that the HbA1c level in the diabetics with chronic heart disease was much higher than the diabetics without chronic heart disease and this findings was also significant statistically ( $t=7.5960$ ,  $P < 0.050$ ). Pearson correlation analysis showed that the HbA1c level of the diabetics was present with strong association with the systolic and diastolic blood pressure and hs-CRP ( $P < 0.050$ ) as presented in Table-2.

**Table-II: Analysis on the Factors Associated with HbA1c of Patients with Diabetes**

Statistical value	SBP	DBP	hs-CRP
r value	0.781	0.786	0.714
P value	< 0.05	< 0.05	< 0.05

## DISCUSSION:

HbA1c level is associated with the life of Red Blood Cells and mean level of glucose in this particular period. This level is a suitable index for the determination of the degree of glucose control in blood [10]. The significance of the determination of HbA1c has already reached a consensus in treatment field of diabetes and WHO has prescribed the level of HbA1c as the gold standard for the monitoring of the diabetes [11]. In comparison with the OGTT (Oral Glucose Tolerance Test), the identification of the level of HbA1c is very simple with high level of specificity and sensitivity in the diagnosis of the diabetes. This research work showed that the level of HbA1c was present with association with the macro-vascular diseases such as chronic heart disease and hypertension as described by research work conducted in past [12,13]. The findings of this research work stated that systolic and diastolic blood pressure of the diabetics were high as compared to the patient without diabetes which is

also comparable with the findings of research work conducted by Zhou [14]. Pearson correlation analysis highlighted that level of HbA1c of the diabetes patients was present with relation to Systolic Blood Pressure and Diastolic Blood Pressure and HbA1c level of diabetes patients with hypertension was much higher than the patients without hypertension, which is innovative point of this research work; the content of this feature was seldom briefed in previous research studies [15,16]. Above-mentioned results stated that HbA1c level was present with strong association with blood pressure. There are two reasons behind this fact. First cause is that hypertension damages the endothelial function. Second cause is that insulin accelerated reabsorption of sodium and water in distal renal tubule, which induce rise in the volume of blood [17, 18].

Some research work showed that one of the most important reason for the induction of the chronic heart disease is level of HbA1c [19].

Cardiovascular disease particularly chronic heart disease is the outcome of atherosclerosis because of hypercholesterolemia and hyperlipidemia. There are also findings about that the high level of HbA1c is the main contributor to the atherosclerosis [20]. HbA1c level reflects the control level of glucose in blood of the patients [21]. Moreover, HbA1c has the ability to decline the capacity of deformation of erythrocyte through enhancing the viscosity of erythrocyte and decreasing the fluidity and furthermore, reduces the rate of dissociation oxygenated hemoglobin, which is also vital factor for tissue hypoxia [22]. Therefore, the rise in the level of HbA1c also increases the risk of atherosclerosis. Farrag AAM in his research work found that resistance to insulin was frequent in the diabetes patients and furthermore, there was increase in the content of HbA1c, which could directly influence the metabolism of the myocardial cell energy, worsen hemodynamic disorder and induce chronic heart disease [23]. Pearson correlation analysis showed that level of HbA1c of the diabetes patients was present with association with the hs-CRP level and this finding is similar with the result of the study conducted by Ametov [24]. There are some limitations of this research work as there was very small sample size and all the samples were from a single center. There is need of multi-center research works on large sample sizes for the consolidation of the findings of this research work.

### CONCLUSION:

HbA1c level of the diabetic patients has positive correlation with the Systolic Blood Pressure, Diastolic Blood Pressure and CRP level. The identification of the level of HbA1c can predict the prevalence of hypertension and chronic heart disease. There should be strict measures on the monitoring of level of HbA1c in clinics. Patients suffering from diabetes with high HbA1c level should pay more attention towards screening and prevention of chronic heart disease and hypertension.

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