



Influence of Behavioral Risk Factors on Glycemic Biomarkers in the Early Detection of Diabetes mellitus

¹Dr. Puneet, ²Professor Subhash Manohar Choudhary

¹Scientist, ²Chief Executive Officer

^{1,2}Research and Development Cell, Swatantra Nirmal Foundation, Jaipur, Rajasthan.

²Research and Development Cell, Lagune Arogya Foundation, Gurugram, Haryana.

ABSTRACT

The aim of present study was to evaluate the risk factors for diabetic mellitus as compared to control participants. The Body parameters, dietary habits, glycosylated haemoglobin, fasting blood glucose levels were evaluated by weighing machine, glucometer machine and Quantia kit. The results were statistically significant of age, weight, BMI, Waist, Hip circumference, fasting blood glucose level and Glycosylated haemoglobin levels in Diabetic mellitus as compared to control participants. Due to the dietary habits and declining levels of physical exercise are the major causes of disease and some environmental factors have been thought to indicate a genetic susceptibility to obesity.

Keywords: Diabetic mellitus, Body mass Index, smoking, HbA1c.

I. INTRODUCTION

The prevalence of diabetes is a serious chronic illness and it is rising both nationally and internationally. Globally, it is an estimated that 387 million individuals suffer from diabetes; by 2035 and this figure is predicted to increase to 592 million [1,2] It is important to take into account that individuals with diabetes are stigmatized by their condition in light of the global diabetes epidemic. Insulin is secreted by the endocrine pancreas in response to the presence of sugar, a carbohydrate [1]. Almost all bodily tissue types, particularly the liver, muscles, and fat tissues, absorb and store sugar as a result of insulin. If blood levels are elevated and changes occur in the metabolism of fat, protein, and carbohydrates, it may be the result of ineffective insulin synthesis, release, or activity. Long-term harm, malfunction, and failure of several organs, including the heart, blood vessels, kidneys, eyes, and nerves, are linked to diabetes chronic hyperglycemia [3]. Blood glucose levels can also be used to categorize diabetes i.e. When fasting, plasma glucose levels are less than 110 mg/dL, and two hours after eating, they are less than 140 mg/dL, considered as normal. A fasting plasma glucose level between

110 and 126 mg/dL is regarded as impaired. Two hours after food, glucose levels might vary from 140 to 200 mg/Dl, considered as impaired glucose tolerance [4].

Obesity is often assessed based on physical characteristics. BMI, Waist-hip ratio, and Waist-height ratio are some of the physical indicators of obesity. Despite the availability of more advanced methodologies, anthropometric measures such as height, weight, waist-hip ratio (WHR), and Body Mass Index (BMI) have long been used to research genetic structure and forecast risk factors for a variety of complex disorders that affect human health. HbA1c (haemoglobin A1c) is a glucose-binding component of haemoglobin. Glycated, glycosylated haemoglobin, or glycohemoglobin are all terms used to describe HbA1c [5].

II. MATERIALS AND METHODS

Collection of Blood Samples

The sample size was calculated by Cats Power calculator, based on assumptions of an 8.8% diabetes prevalence in India and an odds ratio of 1.5 ($p \leq 0.05$, CI-95%). For the preliminary study, Diabetic mellitus (DM) were 25 patients, control were 25 participants were included. A questionnaire was created to collect important data from diabetes and controls. To reach the patients, a survey of clinic as well as laboratories were conducted.

The patients diagnosed with diabetes mellitus on the basis of glycosylated haemoglobin (A1C) $\geq 6.5\%$ and aged 35-75 years. Controls without history of any chronic disease were included in this study. The study eliminated participants with age <35 and >75 y and children were excluded from the study [6,7]. The Swatantra Nirmal Foundation committee of Jaipur were examined and approved the research proposal for this study and each participant provided written informed consent.

Biomarkers of Diabetes mellitus

There are several risk factors for the progression of Diabetes mellitus disease i.e. Some physical appearance parameters like height (cm), weight (kg), Body mass Index (BMI) in kg/m^2 , waist circumference (WC) in cm, Hip circumference (HC) in cm. Height, WC and HC were measured by measuring tape. Weight was measured by weighing machine. BMI was calculated by online BMI calculator as well as height divided by weight. Some Dietary parameters like Smoking, Tobacco use, Alcohol content, vegetarian and non-vegetarian and sedentary lifestyle. These were all noted by taking consent form of patients and control group. Some Biomarkers to diagnose disease like Fasting Blood Glucose (FBG), HbA1c (Glycosylated haemoglobin). FBG was measured by glucometer machine and HbA1c was measured by Quantia kit [6,7].

Statistical analysis

The data were normally distributed so the independent sample t-test was used to determine the Mean $\pm$ SD and p-value. The chi square test was used to examine the category variables by Statistical package for social sciences (SPSS IBM version 22) software. The Statistical significance was determined to exist when the $p < 0.05$.

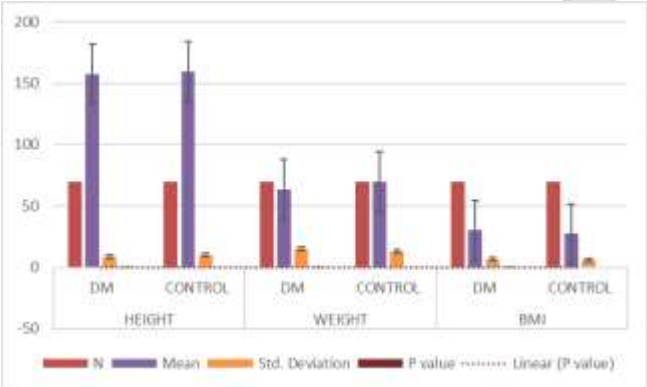
III. RESULTS AND DISCUSSION

The Mean $\pm$ SD and p-value were measured by independent t test because data were normally distributed as shown in Table1 and Figure 1. The other categorical parameters were measured by chi square test as shown in Figure 2. The Mean $\pm$ SD of height of Diabetic mellitus patients and control were 157.6372 ± 8.78562 and it is not statistically significant i.e. $p=0.24$. The Mean $\pm$ SD of weight of Diabetic mellitus patients and control were 63.3529 ± 14.95373 and it is a statistically significant i.e. $p=0.04$. The Mean $\pm$ SD of BMI of Diabetic mellitus patients and control were 30.3257 ± 6.73349 and it is a statistically significant i.e. $p=0.02$. The Mean $\pm$ SD of WC of Diabetic mellitus patients and control were 37.6143 ± 4.43730 and it is a statistically significant i.e. $p=0.03$. The Mean $\pm$ SD of HC of Diabetic mellitus patients and control were 40.1429 ± 4.65408 and it is a statistically significant i.e. $p=0.04$. The Mean $\pm$ SD of waist-hip ratio (WHR) of Diabetic mellitus patients and control were $.9379 \pm .4721$ and it is not a statistically significant i.e. $p=0.17$. The Mean $\pm$ SD of FBG of Diabetic mellitus patients and control were 126.3571 ± 76.76296 and it is a statistically significant i.e. $p=0.03$. The Mean $\pm$ SD of HbA1c of Diabetic mellitus patients and control were 7.5240 ± 3.59581 and it is a statistically significant i.e. $p=0.02$. The Mean $\pm$ SD of age of Diabetic mellitus patients and control were 52.6714 ± 10.95276 and it is a statistically significant i.e. $p=0.04$. Investigations by Sheriff DS et al. yielded similar results. The rise in BMI might be attributed to insulin resistance, the primary cause of type 2 diabetes. Cell membrane insulin sensitivity is markedly reduced. Consequently, the vital process by which insulin facilitates the passage of glucose through the cell wall and its conversion into energy is severely disrupted. High blood sugar levels that are then transported to the liver are the result of excess glucose continuing to circulate in the bloodstream. After arriving, the sugar is converted to fat and transported by the bloodstream throughout the body. Increased weight and obesity are the results of this process [7,8].

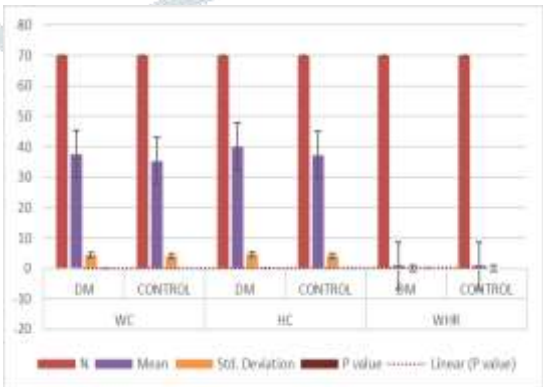
The Categorical variables i.e. Smoking, Tobacco use, Alcohol content, vegetarian were categorized in 'NO' and 'Yes' variables. Sedentary lifestyles were categorized into three variables i.e. Low, Moderate and High physical exercise as shown in Figure 2. The correlation of smoking status of Diabetic mellitus as compared to control participants were 30 in number and it is not statistically significant i.e. $p=0.14$. The correlation of Tobacco use status of Diabetic mellitus as compared to control participants were 20 in number and it is a statistically significant i.e. $p=0.02$. The correlation of alcoholic content of Diabetic mellitus as compared to control participants were 36 in number and it is not statistically significant i.e. $p=0.03$. The correlation of vegetarian status of Diabetic mellitus as compared to control participants were 68 in number and it is not statistically significant i.e. $p=0.12$. The correlation of sedentary lifestyle of Diabetic mellitus as compared to control participants were 65 moderate in number and it is statistically significant i.e. $p=0.35$. Dietary habits and declining levels of physical exercise have an impact on the BMI and WHR calculation. These environmental factors have been thought to indicate a genetic susceptibility to obesity, especially in individuals with metabolic genotypes [8].

Table1: The Mean, standard deviation and p value of Diabetic mellitus as compared to control.

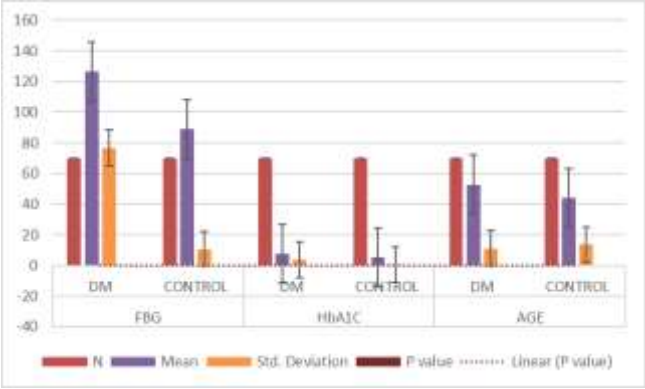
GROUPS		N	Mean	Std. Deviation	P value
HEIGHT	DM	70	157.6372	8.78562	0.24
	CONTROL	70	159.5000	9.87613	
WEIGHT	DM	70	63.3529	14.95373	0.04
	CONTROL	70	69.6143	12.84500	
BMI	DM	70	30.3257	6.73349	0.02
	CONTROL	70	27.5101	5.77986	
WC	DM	70	37.6143	4.43730	0.03
	CONTROL	70	35.3143	4.03083	
HC	DM	70	40.1429	4.65408	0.04
	CONTROL	70	37.3143	4.03083	
WHR	DM	70	.9379	.04721	0.17
	CONTROL	70	.9457	.00632	
FBG	DM	70	126.3571	76.76296	0.03
	CONTROL	70	88.7429	10.70647	
HbA1C	DM	70	7.5240	3.59581	0.02
	CONTROL	70	5.3171	.65959	
AGE	DM	70	52.6714	10.95276	0.04
	CONTROL	70	44.0571	13.61466	



A)



B)

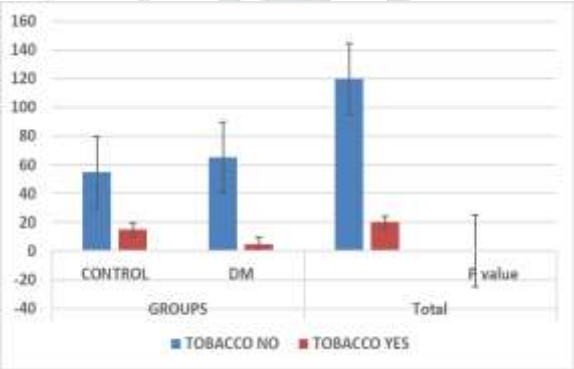
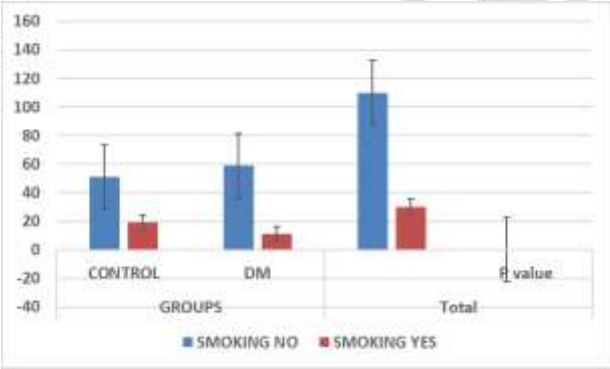


C)

Fig. 1. The Graphical representation between the Body parameters and Biomarkers of Diabetic mellitus as compared to control. DM represented Diabetic mellitus, BMI represented Body Mass Index, WC represented Waist circumference, HC represented Hip circumference and WHR represented Waist-Hip ratio. Lines represented the Error Bars.

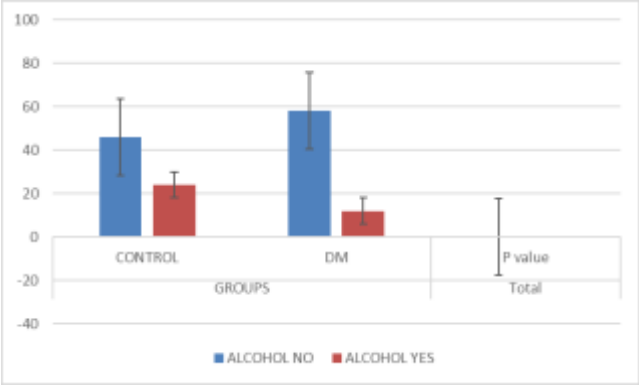
Table 2. The Dietary Parameters and p value between Diabetic mellitus as compared to control.

		SMOKING		Total	TOBACCO		Total	ALCOHOL		Total
		NO	YES		NO	YES		NO	YES	
GROUPS	CONTROL	51	19	70	55	15	70	46	24	70
	DM	59	11	70	65	5	70	58	12	70
Total		110	30	140	120	20	140	104	36	140
P value		0.149			0.028			0.033		



A)

B)

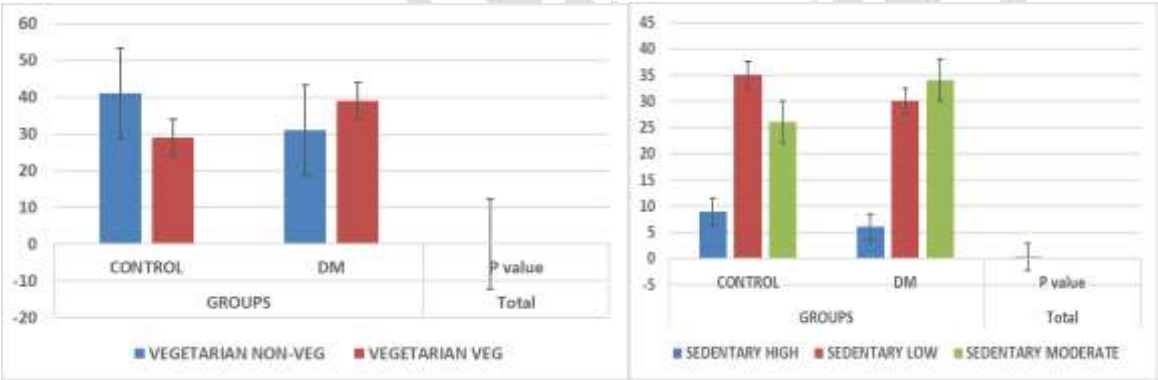


C)

Fig. 2. The Graphical representation of Dietary parameters of Diabetic mellitus as compared to control. A) Smoking status of Diabetic disease as compared to control. B) Tobacco status of Diabetic disease as compared to control. C) Alcoholic status of Diabetic disease as compared to control. Lines represented the Error Bars.

Table 3: The Dietary Parameters of Vegetarian and Sedentary Lifestyle and p value between Diabetic mellitus as compared to control.

		VEGETARIAN		Total	SEDENTARY			Total
		NON-VEG	VEG		HIGH	LOW	MODERATE	
GROUPS	CONTROL	41	29	70	9	35	26	70
	DM	31	39	70	6	30	34	70
Total		72	68	140	15	65	60	140
P value		0.128			0.359			



A)

B)

Fig. 3. The Graphical representation of Dietary parameters of Diabetic mellitus as compared to control. A) Vegetarian and Non-Vegetarian status of Diabetic disease as compared to control. B) Sedentary lifestyle i.e. Low, Medium and High of Diabetic disease as compared to control. Lines represented the Error Bars.

IV. CONCLUSION

Diabetic mellitus disease is increasing day by day globally. In our study, age, height, BMI, waist circumference, hip circumference showed the positive correlation in Diabetes as compared to control participants. FBG and HbA1c are biomarkers of diabetes and it was also found to be positive and statistically significant in Diabetes as compared to control. Low, medium and high sedentary lifestyle, alcoholism and Tobacco takers was found to be the positive effect in Diabetes as compared to Control. The poor dietary and sedentary lifestyle may alter the insulin levels in the body and prone to diabetic mellitus disease. There was not found any correlation of gender, smoking, vegetarian content in the participants.

V. CONFLICT OF INTEREST

There was no conflict of Interest.

VI. AUTHORS CONTRIBUTIONS

The manuscript preparation and experimentation was done by Dr. Puneet. The proof reading of manuscript was done by Professor S.M. Choudhary sir.

VII. REFERENCES

1. Hanif Mughal, M. Spices: A Review on Diabetes Mellitus. J. Emerg. Technol. Innov. Res. www.jetir.org 11, 477–483 (2024).
2. Wild S, Roglic G, Green A, Sicree R, King H (2004). Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. Diabetes Care 27: 1047-53.
3. Mohan, H. & Mohan, S. Diabetes Mellitus and its Complications. J. Emerg. Technol. Innov. Res. 11, d663–d667 (2024).
4. Singh, S. (2011). The Genetics of Type 2 Diabetes Mellitus: A Review. Journal of Scientific Research. Baranas Hindu University, Varanasi, 55, 35–48.
5. Sheriff DS, Sachu P, Elshaari F. HDL, apo B/apo A1 ratio, Diabetes Mellitus and Cardiovascular Disease. Intech. Text B. 2013(8):171-201. Doi: <http://dx.doi.org/10.5772/56476>.
6. Kumar, S. et al. Relation Between HbA1c and Lipid Profile Among Prediabetics, Diabetics, and Non-diabetics: A Hospital-Based Cross-Sectional Analysis. Cureus 14, (2022).
7. Puneet, Upadhyay, A. K., Kaur, M. & Singh, R. D. Assessment of Haptoglobin 2-2 Genotype in Type 2 Diabetes and Cardiovascular Patients in North Indian Population: A Case-control Study. J. Clin. Diagnostic Res. 17, 6–10 (2023).
8. Riaz S, Alam SS. Obesity as risk factor and study of obesity related proteins in diabetes mellitus. African Journal of Biotechnology. 2009;8(5):737-44.