(International Print/Online Journal)

SJIF IMPACT FACTOR: 5.565
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 5, Issue 2, Page No: 438-443
March-April 2022

IJMSCR

To evaluate Relationship of serum insulin with type 2 Diabetes

Dr Vanita sharma[1], Dr Shaheen[2] SR, Dr Shazia[3]
[1]Associate professor, [2]SR, [3]Lecturer
Department Physiology Government Medical College Jammu 180001

***Corresponding Author:**
Dr Shazia
Lecturer Physiology Government Medical college jammu

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

BACKGROUND: Diabetes mellitus is one of the most common diseases of current era which is characterized by hyperglycemia either due to insulin deficiency or insulin resistance or both. Type 2 DM is far more common than type 1 DM, accounting for 80 to 90 percent of all cases of DM. After getting permission from ethical committee IEC/pharma/thesis/2018/593

PURPOSE: To evaluate the relationship of serum insulin with type 2 diabetes mellitus.

METHODS: A case control study was conducted on 100 patients (50 patients with type 2 diabetes and 50 patients without diabetes). These patients were subjected to a thorough physical examination and body parameters were recorded. Also Serum insulin was estimated in both the groups. Venous sample was drawn for biochemical parameter i.e Serum Insulin estimated by using ChemiluminescentMicroparticle Immunoassay (CMIA) technology with flexible assay protocols, reffered to as Chemiflex.

RESULTS: Out of 50 subjects, it was found that 39 diabetic patients had increased serum insulin levels in comparison to that of controls and the difference was found to be statistically significant. Serum insulin was more than 12µU/ml in 78% type 2 diabetics and only 6% of non diabetics, however low level of serum insulin (less than 12µU/ml) was found in 11% of type 2 diabetics and 44% of non diabetics.

CONCLUSION: - Type-2 diabetic patients present with increased insulin levels which shows that type-2 diabetes mellitus is associated with insulin resistance.

Keywords: Hyperglycemia, mortality, morbidity, Chemiflex

Introduction

Diabetes mellitus is one of the most common diseases of current era which is characterized by hyperglycemia either due to insulin deficiency or insulin resistance or both. [1] The International Diabetes Federation (IDF) predicted that the number of people living with diabetes will rise from 366 million in 2011 to 552 million by 2030. [2] The prevalence of diabetes and its adverse health effects have risen more rapidly in South Asia than in any other region of the world. [3] Thirty years ago, the prevalence of diabetes in India based on the Indian Council of Medical Research (ICMR) multicentre survey was around two per cent in urban India and one per cent in rural India. In just three decades, these prevalence rates have increased to nine per cent in urban India and three to eight per cent in rural India, in adults over 20 years of age. With an increasing incidence worldwide, diabetes mellitus is a leading cause of mortality and morbidity. [4] Raised blood glucose concentration indicates the development of insulin resistance, which may ultimately lead to development of diabetes mellitus. [5]

American Diabetes Association (ADA) in 2000 gave recent etiological classification:

1. Type 1 diabetes: β cell destruction, usually leading to absolute insulin deficiency.
   A. Immune mediated
   B. Idiopathic
2. Type 2 diabetes (may range from permanently insulin resistance with relative insulin deficiency to predominantly insulin secretory defect with insulin resistance).
3. Other specific types of diabetes
4. Gestational diabetes mellitus (GDM)

Two features of the current classification of DM diverge from previous classifications. First, the terms IDDM and NIDDM are obsolete and replaced by Type 1 DM and Type 2 DM respectively. Second, the age is no longer used as criterion. Although type 1 DM most commonly develops before the age of 30, an autoimmune beta cell destructive process can develop at any age. In fact, it is estimated that 5-10% of individuals who develop DM after age 30 have type 1A DM. Likewise, although type 2 DM more typically develops with increasing age, it also occurs in children, particularly obese adolescents. Type 2 DM is far more common than type 1 DM, accounting for 80 to 90 percent of all cases of DM. [6]

CRITERIA FOR THE DIAGNOSIS OF DM

- In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose concentration >11.1 mmol/L (200mg/dl).
- Fasting Plasma glucose $\geq$ 7.0 mmol/L (126mg/dl). Fasting is defined as no caloric intake for at least 8 hours.
- Two hour plasma glucose $\geq$ 11.1 mmol/L (200mg/dl) during an oral glucose tolerance test (OGTT). The test should be performed using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water, not recommended for routine clinical use.
- HbA1C $\geq$ 6.5% .

Among one of the above is required for diagnosis of diabetes mellitus, in the absence of unequivocal hyperosmolar state repeat testing is required.Type-2 diabetes mellitus is one of the leading causes of coronary artery disease, peripheral artery disease, end-stage renal disease and adult blindness. [1] Epidemiological studies have shown that asymptomatic hyperglycemia is a risk factor for coronary heart disease and cause of mortality. [7,8]

It is not that all insulin transduction pathways are resistant to the action of insulin. Those controlling cell growths are stimulated leading to atherosclerosis. There is endothelial dysfunction in insulin resistance. Nitric oxide in endothelium maintains a balance between blood flow and vasoconstriction. It is most potent vasodilator which inhibits vascular smooth muscle growth, cell adhesion and decreases oxidative stress. In insulin resistance and obesity ENO (Endothelial Nitric Oxide) synthase activity is reduced where as it is increased by exercise. [9]

To improve insulin sensitivity advise patient to reduce weight and exercise for 150 minutes/week. Even multiple short spans of exercise are as helpful as continous exercise. [10]

Confirmed prediabetic individuals are hyperinsulinemic and have a high cardiovascular morbidity. Prediabetic subjects have atherogenic pattern of risk factors caused by obesity, hyperglycemia and especially hyperinsulinemia. [11]

MATERIAL AND METHODS

One year case control study was undertaken with effect from November, 2018 to October, 2019, on 100 subjects, both males and females with age ranging between 35 to 70 years after getting approval from the institutional Ethics Committe vide No. IEC/GMC/2019/797. Subjects were selected from the patients attending the Medicine OPD of Government Medical College and Hospital, Jammu and from those who volunteer for the study. After obtaining a written consent from all the subjects participating in the study, a detailed physical examination was conducted along with measurements of blood pressure and pulse rate. Blood samples were drawn for estimation of biochemical parameters (serum insulin) which were carried out in the laboratory of Biochemistry Department of GMC, Jammu as per the laid down procedures.

The subjects were categorized into two groups:

1. Group I (Case group) comprised of 50 patients of type 2 diabetes.

Volume 5, Issue 2; March-April 2022; Page No 438-443

2. Group II (Control group) comprised of 50 healthy individuals who were non-diabetics.

Subjects with age greater than 70 years, patients with chronic kidney disease, liver disease, thyroid dysfunction, pregnant women, patients on Corticosteroid therapy, patients with hemosiderosis, patients with severe anemia were excluded from the study. A detailed history was taken regarding type-2 diabetes mellitus such as duration of disease, medication and personal history. Further these patients were subjected to a thorough physical examination and body parameters (including height, weight and body mass index), vitals (pulse rate and blood pressure) were recorded. Also Serum insulin was estimated in both the groups as per proforma. Venous sample was drawn under all aseptic precautions for biochemical parameter i.e Serum Insulin estimated by using Chemiluminescent Microparticle Immunoassay (CMIA) technology with flexible assay protocols, reffered to as Chemiflex. Reference range of serum insulin is upto 12µU/ml.

All the data was analyzed using the computer software Microsoft excel SPSS version 26. The qualitative data were reported as proportions while Mean ± SD were reported for quantitative variables. Unpaired student t-test was used to test the significance of demographic, physiological, biochemical parameters. Karl Pearson's correlation coefficient (r) was reported as point estimate. Association between Serum Insulin and Type-2 diabetes mellitus was evaluated by calculating crude odds ratio along with corresponding 95% Confidence interval and its statistical significance was assessed by the use of Chi Square test. A p value < 0.05 was taken as significant. All p values reported were two tailed.

RESULTS

Mean age of the patients was 46.74 ± 11.99 in the cases (Type 2 diabetics) and 47.74 ± 9.93 in controls (Non diabetics) shows that there was no significant difference in mean age and mean BMI among cases and controls (p = 0.42 and 0.79 respectively).

Table No. 1: Distribution of Physical parameters of study population

Characteristics	**Cases** **n = 50**	**Control** **n = 50**	**P value**
	Mean ± SD	Mean ± SD	
Systolic Blood Pressure (SBP)	119.4 ± 8.17	117.28 ± 7.90	0.19
Diastolic Blood Pressure (DBP)	75.8 ± 4.78	74.48 ± 3.94	0.14
Pulse Rate (PR)	75.68 ± 3.72	74.84 ± 3.65	0.26

Table 1 shows that there is no significant difference between cases and controls in respect of Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Pulse Rate (PR).

Table No.2: Distribution of Biochemical parameters of study population

	Cases	**Control**	**P value**
	Mean ± SD	**Mean ± SD**	
Blood Sugar (F)	178.96 ± 37.16	95.06 ± 12.68	<0.01
Serum Insulin	12.65 + 3.04	7.97 + 2.49	<0.01

Table 2 present mean blood sugar fasting and serum insulin of cases and controls and difference between them found statistically significant (p<0.001).

Volume 5, Issue 2; March-April 2022; Page No 438-443

Table No. 3: Correlation of serum insulin with type 2 diabetes mellitus.

Serum Insulin Mean ± SD	Blood sugar (F) Mean ± SD	Pearson's correlation coefficient (r)	P value
12.65 ± 3.04	178 ± 37.16	0.13	0.39

Table 3 shows that there is insignificant positive correlation between serum insulin and type 2 diabetes mellitus (r = 0.13, p = 0.39).

Table No. 4: Association of Serum Insulin with Type 2 diabetes mellitus

Serum Insulin	Cases n (%)	Control n (%)	Odds ratio (95% CI)	Significance	
				□2 - value	P- value
>12 µU/ml	39 (78)	3 (6)	55.55 (14.47-253.2)	53.2	<0.001
<12 µU/ml	11 (22)	47 (94)			
Total	50	50			

Table 4 shows the relationship between serum insulin and type 2 diabetes mellitus among the subjects. Risk of Type-2 diabetes mellitus is 55.55 times higher (OR = 55.55) among the subjects with raised serum insulin as compared to normal subjects. Association between them found statistically significant.

DISCUSSION

The present work was conducted in order to evaluate the relationship between insulin level and type-2 diabetes mellitus. Diabetes mellitus is a disease characterised by the 'too great emptying of urine' and finds its place in antiquity through Egyptian manuscripts dated back to 1500 B.C. [12] Diabetes mellitus is an important non-communicable chronic disease of global importance. It is characterized by hyperglycemia due to absolute or relative deficiency of insulin. [13] Type-2 diabetes mellitus is a predominant public health concern, affecting million of people worldwide. In urban India, type-2 diabetes mellitus is reaching epidemic proportions. The disease causes substantial morbidity and mortality as well as long term complications. Two third to three quarters of patients develop a disease complication which is going to rise further in the coming decade. [14]

The major long term complications of diabetes mellitus are currently thought to involve microangiopathic changes and non-enzymatic glycosylation of tissues proteins. [15] The degree of non-enzymatic glycosylation is directly related to the level of blood glucose. The early glycosylation products of collagen and other proteins in the interstitial tissues and blood vessel walls undergo slow chemical rearrangement to form irreversible advanced glycosylation end products (AGEs) which accumulate over the vessel wall. AGEs formation on proteins such as collagen causes cross links between polypeptides, this in turn may trap non-glycosylated plasma and interstitial proteins. Trapping of circulating low density lipoproteins (LDL) retards its efflux from the vessel wall and promote the deposition of cholesterol in the intima thus accelerating atherogenesis. AGEs may also affect structure and functions of capillaries. [16] Exposito K *et al*. [17] reported hyperglycemia induced vascular damage due to following mechanisms:

Volume 5, Issue 2; March-April 2022; Page No 438-443

- Polyol pathway (Sorbitol-aldose reductase pathway)
- Increased advanced glycation end product formation (AGE)
- Activation of protein kinase C pathway

It is increasingly recognized that iron influences glucose metabolism even in absence of significant iron overload. In general population, increased body iron stores are associated with the development of glucose intolerance; gestational diabetes and type-2 diabetes mellitus. [18] To be healthy our body needs to produce the right amount of insulin and respond to insulin appropriately. A confounding factor is that hyperglycemia and hyperinsulinemia in them can impair insulin secretion and insulin sensitivity. [8]

The body becomes more resistant to insulin with increasing duration of diabetes, so that insulin level is high or normal in the body but the available insulin is insufficient. [19] The other function of insulin is to prevent uncontrolled hydrolysis of triglyceride and limit gluconeogenesis, there by maintaining normal fasting blood glucose level. An increasing of serum glucose will induce pancreatic β-cell to increase insulin secretion for maintaining the homeostasis of normal blood glucose. The condition known as compensatory hyperinsulinemia. [20]

A significant increase in serum ferritin in diabetes mellitus as compared to control group was also observed by Raghavani PH, Sirajwala H in their study. [21] They also concluded that hyperferritinemia may be one of the causes for decreased insulin production and development of insulin resistance in diabetes mellitus.Insulin resistance contributes to the development of complications of diabetes through multiple pathways. [22]

In our study we found that diabetic patients had increased insulin levels in comparison to the non-diabetics ($p < 0.01$). Our findings were supported by a study conducted by Verma *et al* in Medical College Indore. [23] Similar results with statistically significant p value of <0.01 were reported in a study comparing serum insulin levels in type-2 diabetes mellitus patients and control group. [24]

However, this is a hospital based study and study population may not be the true representative of the target population. Therefore, population based studies with larger sample size are recommended for generalization of the findings of present study.

CONCLUSION

Type-2 diabetic patients present with increased insulin levels which shows that type-2 diabetes mellitus is associated with insulin resistance.

REFRENCES

1. Rawat N, Mathur N, Harikrishnan R, Choudhary J, Rawat K, Mathur M. A study of correlation of serum ferritin with glycated haemoglobin in diabetes melllitus type 2 patients: A case control study. Asian Pac j Health Sci 2016;3(4):83-8
2. Neve B, Fernandez-Zapico ME, Ashkenazi-Katalan V, Dina C, Hamid YH, Joly E. Role of transcription factor KLF11 and its diabetes associated gene variants in pancreatic beta cell function. Proc Natl Acad Sci USA 2005;102(13):4807-12
3. Ghaffar A, Reddy KS, Singhi M. Burden of noncommunicable diseases in South Asia. Brit Med J 2004;328(7443):807-10
4. Patil LS, Giraddi T, Chinagi D, Ugaragol P, Kolluru B. A study on relation between serum ferritin and glycated hemoglobin in type 2 diabetes mellitus. Inter J Curr Res 2017;9(8):55849-53
5. Reaven G.M. Role of insulin resistance in human disease.Diabetes 1988;37:1595-607
6. Guyton, A. C and Hall, J.E. Insulin, Glucagon and Diabetes Mellitus. Text Book of Medical Physiology 10th edition: 895; 2001 W. B. Saunders Company, Philadelphia.
7. Shaw JE, Hodge AM, de Courten M, Chiston P, Zimmet PZ. Isolated post-challenge hyperglycemia confirmed as a risk factor for mortality. Diabetologia 1999;42:1050-4
8. Singer DE, Nathan DM, Anderson KM, Wilson PW, Evans JC. Association of HbA1c with prevalent cardivascular disease in the original cohort of the Framingham Heart Study. Diabetes 1992;41(2):202-8

Volume 5, Issue 2; March-April 2022; Page No 438-443

9. Steinberg HO, Charker H, Leaming R, Johnson A, Brechtel G, Bara AD. Obesity/ Insulin resistance is associated with endothelial dysfunction, implication for the syndrome of insulin resistance. J Clin Incest 1996;97:2601-10
10. Jakicic J.M, Winters C, Lan W, Wing R.R Effect of intermittent exercise and home exercise equipment on adherence, weight loss and fitness in women, a randomized trial. JAMA 1999;282:1554-60
11. Haffner SM, Stern MP, Hazuda HP, Mitchel BD, Peterson JK. Cardiovascular risk factors in confirmed prediabetic individuals: Does the clock of coronary artery disease start ticking before the onset of clinical diabetes? JAMA 1990;263(21):2893-8
12. Maccracken J, Hoel D. From ants to analogues: Puzzles and promises in diabetes management. Postgrad Med 1997;101:138-40.143-5,149-50
13. Sreejo, Samuel E, Kesavachandran C, Shashidhar S. Pulmonary function in patients with diabetes mellitus. IJPP 2003;47(1):87-93
14. Bloomgarden ZT. The 1st World Conference on the Insulin resistant syndrome. Endoc Pract 2003;9(3):240-50
15. Sandler M. Is the lung a "target organ" in diabetes mellitus? Arch Intern Med 1990; 150(7):1385-8
16. Kumar, V, Cotran, R. S, Robbins, S. L. Robbin's Basic Pathology, 7th edition. Harcourt (India) Private limited, New Delhi. 2003;647
17. Exposito K, Nappo F, Marfello R. Inflammatory cytokines concentrations are actually increased by hyperglycemia in human. Circulations 2002;106:2067-72
18. Fernandez-Real JM Bermejo A and Ricart W: Cross talk between iron metabolism and diabetes. Diabetes Care 2002;51(8):2345-8
19. Mathews, D., Hosker, J, Naylor, B. Insulin resistance and beta cell functioning from fasting plasma glucose and insulin concentration in man. Diabetologia. 1985;28:412-9
20. Wilcox, Gisela. Insulin and Insulin Resistance. Clin Biochem Rev 2005;26:19-39
21. Raghavani PH, Sirajwala H. Serum ferritin level in patients with Type-2 diabetes mellitus IJBAR 2014;5:6
22. Lebovitz HE. Rationale for use and role of thiazolidinediones in Type-2 diabetes. American Journal of Cardiology 2002;90(5A):34G-41G
23. Verma M, Paneri S, Badi P, Raman G. P. Effect of increasing duration of Diabetes mellitus Type-2 on glycated haemoglobin insulin sensitivity. Intl J Clin Biochem 2006;21(1):142-6
24. Tangvarasittichai S, Poonsub P, Tangvarasittichai O. Association of serum lipoprotein ratio with insulin resistance in Type-2 diabetes mellitus. Indian J Med Res 2010;641-8.

Volume 5, Issue 2; March-April 2022; Page No 438-443