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Prevalence Of Insulin Resistance In Type -2 Diabetes Mellitus Patients

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ABSTRACT

Insulin is a peptide hormone produced by the beta cells of pancreas. It plays a major role in the regulation of blood sugar level . Insulin promotes glycogenesis and inhibits glycogenolysis and lipolysis. This dysregulation of insulin hormone function can lead to insulin resistance. Insulin resistance is a condition in which the cells fail to respond to insulin resulting in impaired glucose uptake and hyperglycemia . Insulin resistance is of great significance nowadays , as it causes obesity , hypertension , dyslipidemia and cardiovascular diseases. The aim of the study is to estimate the prevalence of insulin resistance in the type 2 diabetes mellitus patients. And a cross sectional study was conducted among them. And insulin resistance is calculated by globally accepted standard HOMA –IR method. After 8 hours of fasting , type- 2 diabetes mellitus patients were subjected to fasting plasma insulin and fasting plasma blood glucose tests .

HOMA- IR is homeostasis model assessment for insulin resistance HOMA IR- (Fasting plasma insulin x fasting blood glucose) / 405 When the insulin resistance was calculated among the type - 2 diabetes mellitus patients by OMA – IR method, it was found to be high (insulin resistance ->1.9 to 2.9) .Where as in other individuals, insulin resistance was found to be normal (IR - < 1.4 . From the study , insulin resistance was found to be 65% among the diabetics and 35 % among the non- diabetics respectively . If the insulin resistance was detected at an earlier stage among the diabetics, complications like metabolic syndrome can be avoided. Patients can be given treatment accordingly. Thus morbidity and mortality among the diabetics will become less.

Keywords: *Insulin resistance, HOMA – IR, fasting plasma insulin, fasting blood glucose*

1. INTRODUCTION

Insulin resistance is the decreased biological response of the body to

insulin produced by the liver , muscle and adipose tissues[1-2] . It is of great importance in the recent times as it can lead to metabolic syndrome and further complications.

Insulin resistance is more common among type -2 diabetes mellitus patients. It causes impaired glucose utilization and compensatory increase in insulin production[3-4].Insulin sensitivity is reduced in these patients. There are two types of insulin resistance .Type –A insulin resistance that occurs due to defect in insulin receptor . Type –B insulin resistance is due to the insulin autoantibodies [5-6].

Insulin resistance occurs earlier before the onset of type - 2 diabetes mellitus in the individuals[7-8] .If the insulin resistance is detected at an earlier stage, diabetes mellitus ,obesity , dyslipidemia and hypertension and microvascular and macrovascular complications can be avoided[9-10].

2. MATERIALS AND METHODS

A cross sectional study was conducted in VMKV , Salem in 100 patients from August 2023 to November 2024.

Inclusion criteria : type - 2 diabetes mellitus patients

Exclusion criteria : 1.Patients who are on insulin

2.Patients on drugs like fluoroquinolones , hydroxychloroquine etc.

3.Pregnancy

4.Patients with wolfram syndrome etc.

5. Patients with impaired blood glucose

Insulin resistance is calculated by "Gold Standard" method hyperinsulinemic euglycemic glucose clamp technique which is practically not feasible. And insulin resistance is calculated by globally accepted standard HOMA –IR method. Also other methods like HOMA -2 ,QUICKI , ISI are available .

After 8 hours of fasting , type- 2 diabetes mellitus patients were subjected to fasting plasma insulin and fasting plasma blood glucose tests . Insulin resistance was calculated by HOMA – IR method.

HOMA - IR is homeostasis model assessment for insulin resistance

HOMA IR - (Fasting plasma insulin x fasting blood glucose) / 45

3. RESULTS

CHARACTERISTICS		**NO. OF PATIENTS**	**PERCENTAGE (%)**
AGE (in years)	< 40	10	10%
	41 - 50	20	20%
	51 - 60	50	50%
	61- 70	30	30%
	>71	10	10 %
SEX	FEMALES	60	60%
	MALES	40	40%
COMORBIDITIES	DIABETES	75	75%
	HYPERTENSION	50	50%
	CAD	30	30%
	CKD	10	10%

In this study , most of the patients were 51 – 60 years (50 %), 61 -70 years (30%) , 41-50 years (20%) ,> 70 years (10%) . Most of the patients were females (60%) and others were males (40%) .75 patients had diabetes (75%) and 25 patients had no

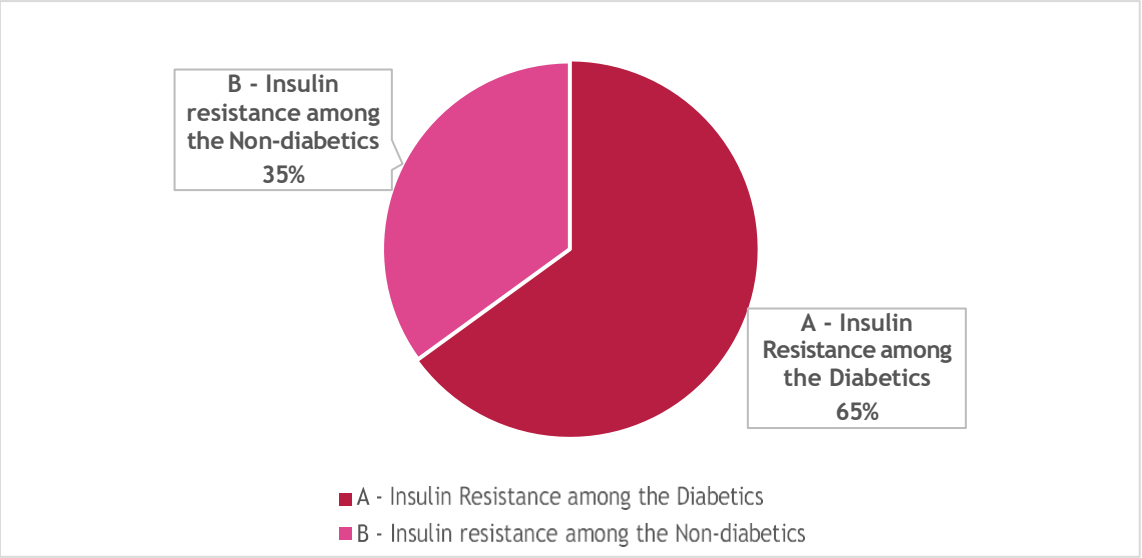
diabetes . 50 patients had hypertension (50%) and 50 patients had no hypertension . 30 patients had coronary artery disease (30%) and 70 patients had no coronary artery disease (CAD) .10 patients had chronic kidney disease (10%) and 90 patients had no chronic kidney disease (CKD).

4. PATIENTS AND CLINICAL FEATURES

	FREQUENCY	PERCENTAGE (%)
ACANTHOSIS NIGRICANS	15	15%
BURNING SENSATION OF FOOT	55	55%
CHEST PAIN , **PALPITATION,** **SYNCOPE**	40	40%
FUNDUS CHANGES- **(COTTON WOOL SPOTS ,MACULAR EDEMA , MICROANEURYSMS)**	25	25 %
OLIGURIA , **ANURIA,** **PEDAL EDEMA**	20	20 %
BMI (> 30)	60	60%

15 patients had acanthosis nigricans (15%) and 85 patients had no acanthosis nigricans and 55 patients had bilateral burning sensation of foot (55%) and 45 patients had no burning sensation of the foot. 40 patients presented with chest pain ,palpitation and syncope and 60 patients had no symptoms . Fundus examination showed that 25 patients present had cotton wool spots , macular edema , microaneurysms and dot and blot haemorrhages (25%) and 75 patients had no fundus changes . 20 patients had oliguria and pedal edema (20%) and

80 patients had no symptoms. 60 patients had BMI - > 30 (60%) and 40 patients had BMI - < 30 .When the insulin resistance was calculated with the fasting plasma glucose and fasting plasma insulin by HOMA –IR method , P value was found to be significant ($P < 0.05$) .



5. DISCUSSION

When the insulin resistance was calculated among the type - 2 diabetes mellitus patients by HOMA – IR method , it was found to be high (insulin resistance ->1.9 to 2.9) [11].Whereas in other individuals insulin resistance was found to be normal (IR - < 1.4) [12,13] . When the insulin resistance was done among the first degree relatives of diabetes mellitus patients , it was also found to be high (insulin resistance - > 1.9)

From the study , we can observe that the increased insulin resistance indicates decreased insulin sensitivity . Whereas decreased insulin resistance signifies increased insulin sensitivity[11-14].

Insulin resistance can lead to metabolic syndrome which constitutes obesity, diabetes ,hypertension , dyslipidemia and microvascular complications like retinopathy , neuropathy and nephropathy and macrovascular complications like cerebrovascular and coronary artery disease[15] .Insulin resistance can also cause Polycystic ovarian syndrome[16]. And it can also reduce the immunity in the individuals[15-16].

6. CONCLUSION

If the insulin resistance is detected at an earlier stage , life style modifications can be brought in these patients Treatment can be done in a better way in the patients with the insulin sensitizers along with the anti – diabetic medications[16-20] . Thus obesity , hypertension , dyslipidemia and microvascular and macrovascular complications of insulin resistance can be avoided in these patients[21-24].

Considering insulin resistance as a focus in type-2 diabetes, there is scope for further research development in the above mentioned area by taking into account individual genetic profiles, life style factors, new drug targets, gene therapy and the role of gut microbiota in order to control the progression of the disease and effectively manage complications[25,26]

REFERENCES

[1] Seong J, Kang JY, Sun JS, Kim KW. Hypothalamic inflammation and obesity: a mechanistic review. Arch Pharm Res. 2019 May;42(5):383-392. [PubMed]

[2] Brown JC, Harhay MO, Harhay MN. The Value of Anthropometric Measures in Nutrition and Metabolism:

Comment on Anthropometrically Predicted Visceral Adipose Tissue and Blood-Based Biomarkers: A Cross-Sectional Analysis. NutrMetab Insights. 2019;12:1178638819831712. [PMC free article] [PubMed]

[3] Nolan CJ, Prentki M. Insulin resistance and insulin hypersecretion in the metabolic syndrome and type 2 diabetes: Time for a conceptual framework shift. Diab Vasc Dis Res. 2019 Mar;16(2):118-127. [PubMed]

[4] Deacon CF. Physiology and Pharmacology of DPP-4 in Glucose Homeostasis and the Treatment of Type 2 Diabetes. Front Endocrinol (Lausanne). 2019;10:80. [PMC free article] [PubMed]

[5] Thomas DD, Corkey BE, Istfan NW, Apovian CM. Hyperinsulinemia: An Early Indicator of Metabolic Dysfunction. J Endocr Soc. 2019 Sep 01;3(9):1727-1747. [PMC free article] [PubMed]

[6] Hossan T, Kundu S, Alam SS, Nagarajan S. Epigenetic Modifications Associated with the Pathogenesis of Type 2 Diabetes Mellitus. EndocrMetab Immune Disord Drug Targets. 2019;19(6):775-786. [PubMed]

[7] Bothou C, Beuschlein F, Spyroglou A. Links between aldosterone excess and metabolic complications: A comprehensive review. Diabetes Metab. 2020 Feb;46(1):1-7. [PubMed]

[8] Matthews DR, Hosker JP, Rudenski AS, Naylor BA, Treacher DF, Turner RC. Homeostasis model assessment: insulin resistance and beta-cell function from fasting plasma glucose and insulin concentrations in man. Diabetologia. 1985 Jul;28(7):412-9. [PubMed]

[9] Levy JC, Matthews DR, Hermans MP. Correct homeostasis model assessment (HOMA) evaluation uses the computer program. Diabetes Care. 1998 Dec;21(12):2191-2. [PubMed]Katz A, Nambi SS, Mather K, Baron AD, Follmann DA, Sullivan G, Quon MJ. Quantitative insulin sensitivity check index: a simple, accurate method for assessing insulin sensitivity in humans. J Clin Endocrinol Metab. 2000 Jul;85(7):2402-10. [PubMed]

[10] Kim-Dorner SJ, Deuster PA, Zeno SA, Remaley AT, Poth M. Should triglycerides and the triglycerides to high-density lipoprotein cholesterol ratio be used as surrogates for insulin resistance? Metabolism. 2010 Feb;59(2):299-304. [PubMed]

[11] Tobin GS, Cavaghan MK, Hoogwerf BJ, McGill JB. Addition of exenatide twice daily to basal insulin for the treatment of type 2 diabetes: clinical studies and practical approaches to therapy. Int J Clin Pract. 2012 Dec;66(12):1147-57. [PMC free article] [PubMed]

[12] Abdul-Ghani M, DeFronzo RA. Insulin Resistance and Hyperinsulinemia: the Egg and the Chicken. J Clin Endocrinol Metab. 2021 Mar 25;106(4):e1897-e1899. [PMC free article] [PubMed]

[13] Laursen TL, Hagemann CA, Wei C, Kazankov K, Thomsen KL, Knop FK, Grønbæk H. Bariatric surgery in patients with non-alcoholic fatty liver disease - from pathophysiology to clinical effects. World J Hepatol. 2019 Feb 27;11(2):138-149. [PMC free article] [PubMed]

[14] Pennings N, Jaber J, Ahiawodzi P. Ten-year weight gain is associated with elevated fasting insulin levels and precedes glucose elevation. Diabetes Metab Res Rev. 2018 May;34(4):e2986. [PubMed]

[15] Church TJ, Haines ST. Treatment Approach to Patients With Severe Insulin Resistance. Clin Diabetes. 2016 Apr;34(2):97-104. [PMC free article] [PubMed]

[16] Diamanti-Kandarakis E, Dunaif A. Insulin resistance and the polycystic ovary syndrome revisited: an update on mechanisms and implications. Endocr Rev. 2012 Dec;33(6):981-1030. [PMC free article] [PubMed]

[17] Engin A. The Definition and Prevalence of Obesity and Metabolic Syndrome. Adv Exp Med Biol. 2017;960:1-17. [PubMed]

[18] Tanase DM, Gosav EM, Costea CF, Ciocoiu M, Lacatusu CM, Maranduca MA, Ouatu A, Floria M. The Intricate Relationship between Type 2 Diabetes Mellitus (T2DM), Insulin Resistance (IR), and Nonalcoholic Fatty Liver Disease (NAFLD). J Diabetes Res. 2020;2020:3920196. [PMC free article] [PubMed]

[19] Nellaiappan K, Preeti K, Khatri DK, Singh SB. Diabetic Complications: An Update on Pathobiology and Therapeutic Strategies. Curr Diabetes Rev. 2022;18(1):e030821192146. [PubMed]

[20] Reaven GM. The metabolic syndrome: is this diagnosis necessary? Am J Clin Nutr. 2006 Jun;83(6):1237-47. [PubMed]

[21] McCormick N, O'Connor MJ, Yokose C, Merriman TR, Mount DB, Leong A, Choi HK. Assessing the Causal Relationships Between Insulin Resistance and Hyperuricemia and Gout Using Bidirectional Mendelian Randomization. Arthritis Rheumatol. 2021 Nov;73(11):2096-2104. [PMC free article] [PubMed]

[22] Deshpande AD, Harris-Hayes M, Schootman M. Epidemiology of diabetes and diabetes-related complications. Phys Ther. 2008 Nov;88(11):1254-64. [PMC free article] [PubMed]

[23] Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, Nathan DM., Diabetes

Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med. 2002 Feb 07;346(6):393-403. [PMC free article] [PubMed]

[24] Samuel VT, Shulman GI. The pathogenesis of insulin resistance: integrating signaling pathways and substrate flux. J Clin Invest. 2016 Jan;126(1):12-22. [PMC free article] [PubMed]

[25] Perreault L, Pan Q, Schroeder EB, Kalyani RR, Bray GA, Dagogo-Jack S, White NH, Goldberg RB, Kahn SE, Knowler WC, Mathioudakis N, Dabelea D., Diabetes Prevention Program Research Group. Regression From Prediabetes to Normal Glucose Regulation and Prevalence of Microvascular Disease in the Diabetes Prevention Program Outcomes Study (DPPOS). Diabetes Care. 2019 Sep;42(9):1809-1815. [PMC free article] [PubMed]

[26] Ogawa W, Araki E, Ishigaki Y, Hirota Y, Maegawa H, Yamauchi T, Yorifuji T, Katagiri H. New classification and diagnostic criteria for insulin resistance syndrome. Endocr J. 2022 Feb 28;69(2):107-113. [PubMed]

[27] Park YW, Zhu S, Palaniappan L, Heshka S, Carnethon MR, Heymsfield SB. The metabolic syndrome: prevalence and associated risk factor findings in the US population from the Third National Health and Nutrition Examination Survey, 1988-1994. Arch Intern Med. 2003 Feb 24;163(4):427-36. [PMC free article] [PubMed]

[28] Parcha V, Heindl B, Kalra R, Li P, Gower B, Arora G, Arora P. Insulin Resistance and Cardiometabolic Risk Profile Among Nondiabetic American Young Adults: Insights From NHANES. J Clin Endocrinol Metab. 2022 Jan 01;107(1):e25-e37. [PMC free article] [PubMed]

[29] Petersen MC, Shulman GI. Mechanisms of Insulin Action and Insulin Resistance. Physiol Rev. 2018 Oct 01;98(4):2133-2223. [PMC free article]

[30] Legro RS, Finegood D, Dunaif A. A fasting glucose to insulin ratio is a useful measure of insulin sensitivity in women with polycystic ovary syndrome. J Clin Endocrinol Metab. 1998 Aug;83(8):2694-8. [PubMed]