IDENTIFICATION AND VALIDATION OF NOVEL BIOMARKERS FOR TYPE 2 DIABETES MELLITUS

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Abstract :

The two record normal forms of diabetes are type 2 and type 1. Around 5–8% of persons with diabetes have diabetes of type 1, which is characterised by beta cells in the pancreas that destroy themselves. Diabetes of type 2 (T2D) is the greatest mutual form of the disease and occurs when the body stops responding normally to insulin. Microvascular problems, such as retinopathy, nephropathy, and cardiomyopathy, are more likely in those with Type 2 and Type 1 diabetes compared to individuals with normal blood sugar stages. Diabetic nephropathy increases the chance of kidney failure in persons with both Diabetes of type 1 and type 2 diabetes (DN). Diabetic cardiomyopathy is characterised by diastolic dysfunction and cardiovascular remodelling (DC). Heart disease, stroke, and high blood pressure are not seen in diabetics. ([1] Diabetic retinopathy is among the greatest mutual microvascular outcomes of diabetes . About a third of people with diabetes may develop diabetic retinopathy; of those, about 10% will develop vision-threatening proliferative diabetic macular edoema (DME). Biomarkers may be used to monitor pathogenic processes, physiological procedures, or pharmacologic replies to healing interference. This paper aims to explore the identification and validation of novel biomarkers for T2DM.

Keywords: Immunology, life sciences, type 2 diabetes, cardiovascular disease, and stroke
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1 INTRODUCTION

Type 2 diabetes mellitus (T2DM) is the most prevalent form of diabetes and is characterized by insulin resistance in the body. Unlike type 1 diabetes, where the beta cells in the pancreas are destroyed, type 2 diabetes occurs when the body fails to respond adequately to insulin. Individuals with T2DM are at an increased risk of developing microvascular complications, including retinopathy, nephropathy, and cardiomyopathy, compared to individuals with normal blood sugar levels.

Diabetic nephropathy (DN) is a condition that affects both type 1 and type 2 diabetes, leading to an increased risk of kidney failure. Diabetic cardiomyopathy (DC) is characterized by abnormal diastolic function and cardiovascular remodeling. These complications significantly contribute to the morbidity and mortality associated with T2DM.

Diabetic retinopathy is another common microvascular complication of diabetes, affecting approximately one-third of individuals with the disease. Among those affected, about 10% will develop vision-threatening proliferative diabetic macular edema (DME). Early detection and monitoring of these complications are crucial for implementing appropriate therapeutic interventions.

Biomarkers have emerged as valuable tools for monitoring pathogenic processes, physiological mechanisms, and responses to therapeutic interventions. They provide objective measures that can aid in the identification, diagnosis, and prognosis of various diseases, including T2DM. By identifying and validating novel biomarkers specific to T2DM, we can improve our understanding of the disease pathogenesis, develop more effective diagnostic methods, and enhance treatment strategies.

This paper aims to explore the identification and validation of novel biomarkers for T2DM. By

conducting a comprehensive analysis of existing research and employing cutting-edge technologies, we seek to uncover potential biomarkers that can serve as reliable indicators of T2DM and its associated complications. The discovery and validation of such biomarkers hold great promise for improving early detection, risk assessment, and personalized treatment approaches for individuals with T2DM.

Importance of Biomarkers in Type 2 Diabetes Mellitus Research

Biomarkers as Indicators of Disease Pathogenesis: Biomarkers play a crucial role in understanding the underlying mechanisms of type 2 diabetes mellitus (T2DM). They provide valuable insights into the molecular pathways, cellular processes, and physiological changes associated with the development and progression of the disease. By identifying biomarkers that are indicative of disease pathogenesis, researchers can gain a better understanding of the complex interplay between genetic factors, environmental influences, and metabolic dysregulation in T2DM.

Biomarkers for Early Detection and Diagnosis: Early detection and diagnosis of T2DM are essential for initiating timely interventions and preventing complications. Biomarkers can serve as reliable indicators for identifying individuals at risk of developing T2DM or detecting the disease in its early stages. These biomarkers can be measured in blood, urine, or other bodily fluids, providing non-invasive and convenient diagnostic tools for healthcare practitioners.

Biomarkers for Risk Assessment and Prognosis: Biomarkers can assist in risk assessment and prognostication in T2DM patients. By identifying specific biomarkers associated with disease progression, healthcare professionals can stratify patients into different risk categories and tailor treatment plans accordingly. Additionally, biomarkers can provide valuable information about the likelihood of developing complications such as cardiovascular disease, diabetic nephropathy, or retinopathy, helping to guide patient management and improve long-term outcomes.

Biomarkers as Targets for Therapeutic Interventions: Biomarkers can serve as potential targets for therapeutic interventions in T2DM. Understanding the molecular pathways and cellular processes influenced by these biomarkers can aid in the development of novel therapies that specifically target the underlying mechanisms of the disease. Biomarker-guided interventions hold the promise of personalized treatment approaches, leading to improved patient outcomes and more effective management of T2DM.

Microvascular Complications Associated with Type 2 Diabetes Mellitus

Diabetic Nephropathy (DN): Diabetic nephropathy refers to kidney damage caused by diabetes. It is a significant microvascular complication of both type 1 and type 2 diabetes. Biomarkers associated with diabetic nephropathy can help identify individuals at high risk of developing kidney damage and monitor disease progression. Early detection of biomarkers indicative of renal dysfunction can enable timely interventions to prevent or slow down the progression of diabetic nephropathy.

Diabetic Cardiomyopathy (DC): Diabetic cardiomyopathy is characterized by structural and functional abnormalities in the heart muscle due to diabetes. Biomarkers associated with diabetic cardiomyopathy can provide insights into the pathophysiological changes occurring in the heart and aid in early detection, risk stratification, and monitoring of disease progression. These biomarkers may include indicators of cardiac remodeling, inflammation, oxidative stress, or altered myocardial metabolism.

Diabetic Retinopathy (DR): Diabetic retinopathy is a common microvascular complication of diabetes that affects the blood vessels in the retina, leading to vision impairment or blindness if left untreated. Biomarkers associated with diabetic retinopathy can help in early detection, monitoring disease progression, and identifying individuals at risk of developing vision-threatening complications. These biomarkers may involve factors related to vascular dysfunction, inflammation, angiogenesis, or oxidative stress in the retina.

2. MATERIALS AND METHOD

This prospective study was done on patients in and around Gurugram, Haryana and samples were processed at the tertiary care lab based at Gurugram-Haryana.

Samples

A total of 300 people took part in the study; 158 men and 142 women. The entire population was enlisted and then randomly split into one of three categories.

Group 1 consists of one hundred people (56 men and 44 women) who have a background of type 2 diabetes and cardiovascular disease/stroke.
Group 2 consists of 100 people (47 men and 53 women) who have type 2 diabetes but no other serious health problems.
One hundred people are included in Group 3, who are all in good health (55 males and 45 females).
Participants' age, gender, height, weight, waist-to-hip ratio, neck-to-neck ratio, systolic and diastolic blood pressure, duration of diabetes, smoking and drinking habits, level of physical activity, family history (FH), and quality of sleep were all recorded.

➢ **Group 1:**

Inclusion criteria:

- Participants in this study had to be between the ages of 30 and 60, and they had to have Type 2 diabetes (T2DM) and either stroke or cardiovascular disease (CVD/stroke).
- 12-lead ECG indicating angina or a previous MI
- Prior hospitalisation for a myocardial infarction (MI), whether fatal or not.
- Prior coronary artery bypass grafting (CABG) or percutaneous transluminal coronary angioplasty (PTCA) history Stroke

Criteria for exclusion

- Patients having a history of cardiovascular disease or stroke are at an increased risk of death from type 2 diabetes.

➢ **Group 2:**

Criteria for Inclusion

Patients with T2DM (FBS > 125 mg/dl) between the ages of 30 and 60.

Criteria for exclusion

The following is a list of complications that have been linked to type 2 diabetes, including those affecting the liver, kidneys, thyroid, lungs, and more.

➢ **Group 3:**

Male and female adults (30-60) in excellent health make up.

3. ANALYSIS OF TRIGLYCERIDES

Reagents

- Glycerol Kinase and 50 mmol/l PIPES Buffer (pH = 7.0) in a PIPES Buffer (pH = 7.0).
- b4 aminoantipyrine -1.5 mmol/l
- The ATP concentration is 2.85 mmol/l while the magnesium concentration is 60 mmol/l.
- Lipoprotein lipase at a concentration of 25 U/ml
- Peroxidase (15.0 U/ml)
- At least 6 U/ml of Glycerol 3-phosphate Oxidase is present.
- TOOS (Total Organic Oxidative Stress): 0.48 mmol/l

Procedure

Tranasia Biomedical Ltd., India, manufactured the commercial Erba kit for the estimation of the concentration of TG in serum. Glycerol and free greasy acids are out from triglycerides by the lipase enzyme. Glycerolkinase uses adenosine triphosphate (ATP) to phosphorylate the glycerol, resulting in adenosine diphosphate and glycerol 3-phosphate. Glycerol 3-Phosphate is the product of the corrosion of Glycerol 3-Phosphate by (GPO) Glycerol Phosphate Oxidase. A peroxidase enzyme (Trinder reaction) is present when H_2O_2 combines with 4-chlorophenol and 4-aminoantipyrine to generate a red colour. [7] Triglyceride content is directly related to the color's absorption.

4. RESULT AND DISCUSSION

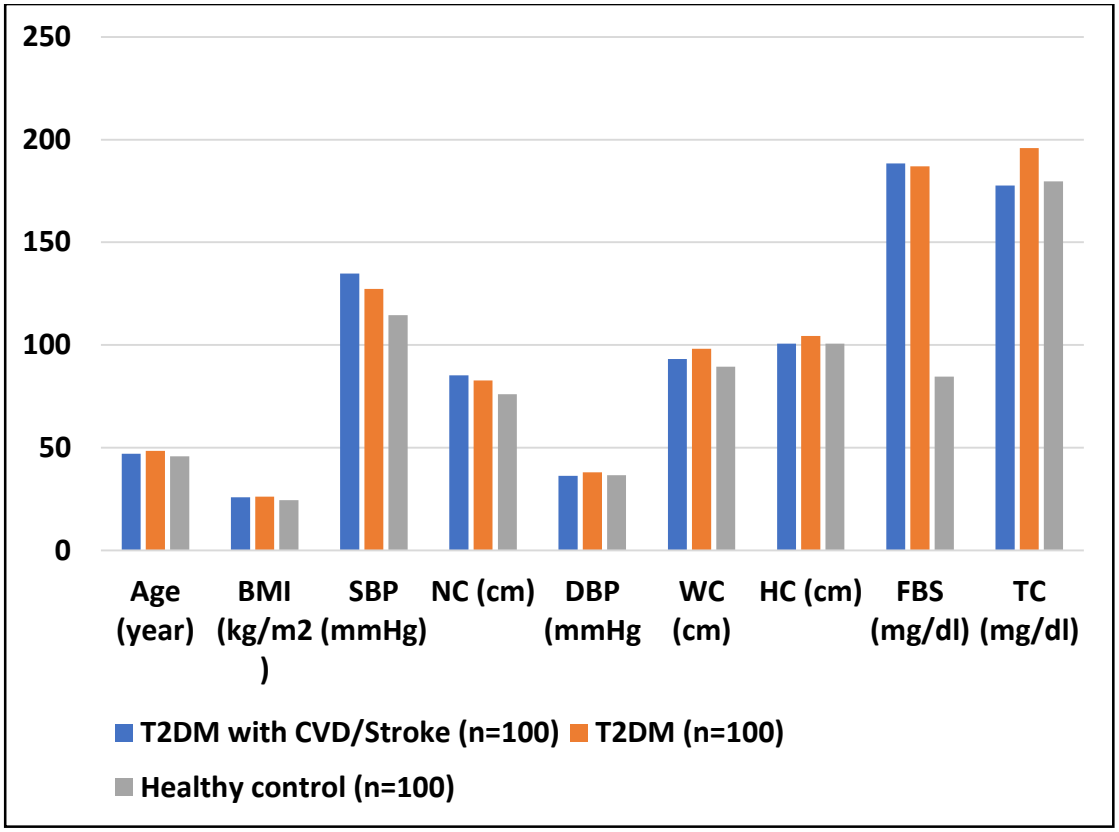

Fig 1:Physical features of the learning people

Table 1: HDL-C of T2DM patients stratified by eGFR intervals.

racteristics	mal	d decrease	d moderate	d severe
-C (mg/dl)				

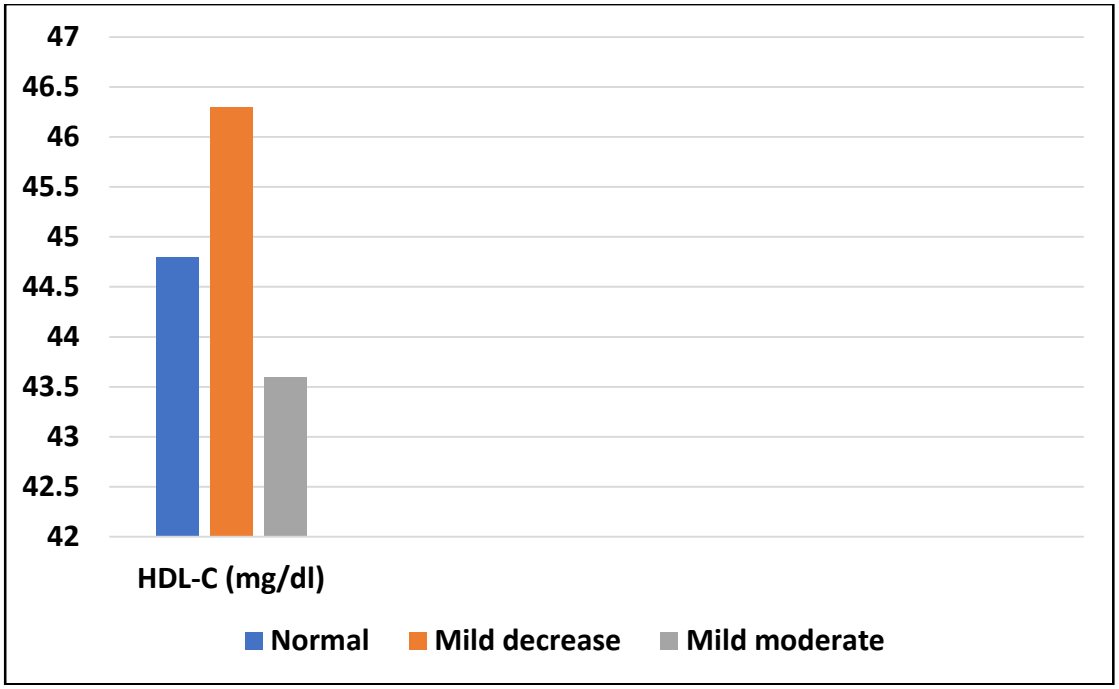

Fig 2: HDL-C of T2DM patients stratified by eGFR intervals

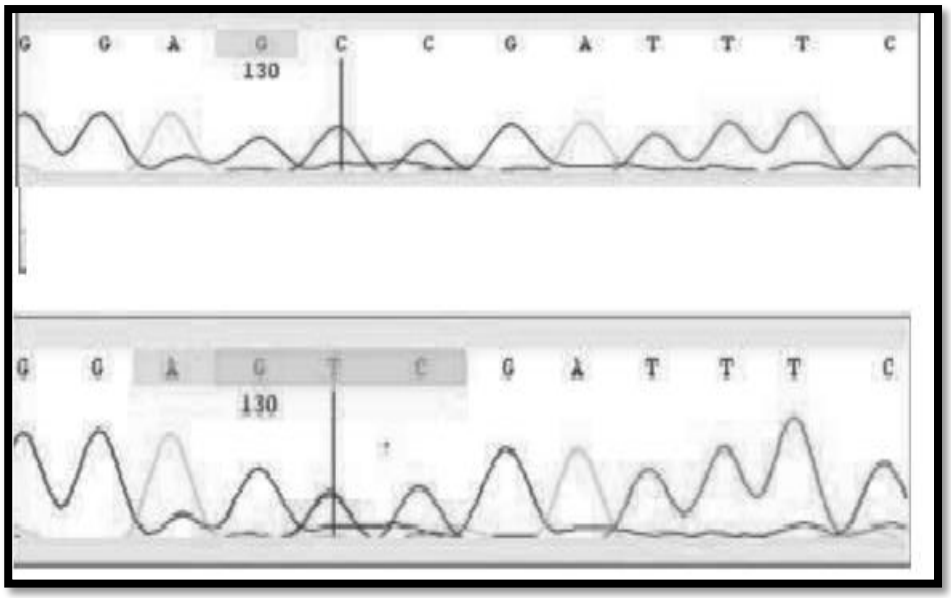

Fig 3: Electropherogram of no mutation and mutation screened in MTHFR gene

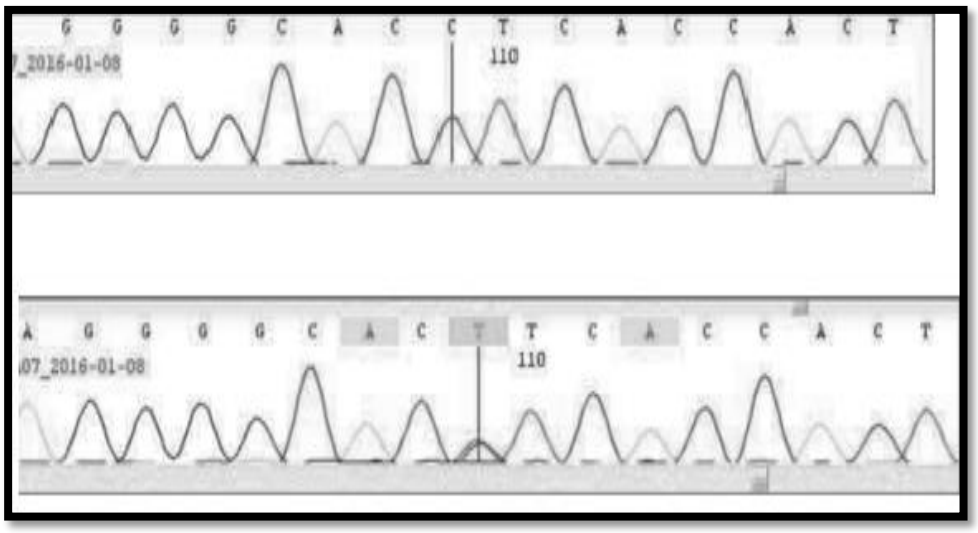

Fig 4: Electropherogram of no mutation and mutation screened in LPL gene

Collectively, the three cohorts in this study represented 300 participants. A entire of 100 people with Diabetes of type 2 make up Group 1, with an average age of 73. The second cohort consists of one hundred persons who have been identified with Diabetes of type 2 Mellitus (T2DM). The third group, made up of 100 healthy individuals, had the oldest median age of the three at 45.82. Extra clinical data was collected from each study participant in Groups 1, 2, and 3. Distinct differences existed between patients with T2DM and CVD and strong panels (p 0.05). (CVD). Affected role with T2DM have inferior DBP and SBP than T2DM affected role with CVD/stroke, but both are considerably advanced than in well switch members (p 0.05).

p 0.05.Likened to affected role with stroke or CVD, those with T2DM had advanced HDL-C, eGFR, and (eGFR) glomerular filtration rate but lower eGFR and HDL-C than healthy controls (p 0.05).

The identification and validation of novel biomarkers for type 2 diabetes mellitus hold significant potential for advancing our understanding of the disease, enabling early detection, risk assessment, and personalized treatment strategies. The integration of omics technologies, advanced computational approaches, and large-scale cohort studies are crucial for uncovering robust and reliable biomarkers. Further research is needed to validate these biomarkers in independent cohorts and translate them into clinical practice, thereby improving patient outcomes and paving the way for personalized management of type 2 diabetes mellitus.

5. CONCLUSION

In conclusion, the study of biomarkers associated with T2DM is crucial for enhancing our understanding of the disease and its complications. The identification and validation of novel biomarkers can provide valuable insights into the underlying mechanisms of T2DM and contribute to the development of improved diagnostic tools and targeted therapeutic interventions. Through this research, we aim to make significant contributions towards the advancement of T2DM management and patient care.

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