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ANALYSIS OF INFLAMMATORY BIOMARKERS LEVELS IN INDIVIDUALS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

The purpose of this study was to compare the clinical features of type 2 diabetes patients with and without cardiovascular disease and stroke to those of similarly aged healthy controls. newline For this study, we used biochemical markers such as newline and LPL PvuII, as well as the MTHFR C677T gene polymorphism, to analyse blood and urine samples. The risk of cardiovascular disease and stroke appears to be elevated in T2DM newline patients due to elevated levels of HbA1c, newlines, homocysteine malondialdehyde, microalbuminuria, and lowered eGFR newline levels. Furthermore, the findings suggested that inflammation may have a role in the onset of CVD/stroke in diabetes patients. Risk assessment for diabetes complications requires the evaluation of biochemical markers in T2DM patients. Patients with T2DM may experience an increase in the prevalence of cardiovascular disease and new-onset stroke as a result of the global rise in the incidence of new-onset T2DM. newline Monitoring biochemical indicators in the blood and urine on a regular basis may be an important newline step in helping newline diabetic patients avoid or delay the development of cardiovascular disease. A lack of correlation between LPL PvuII and MTHFR newlineC677T gene polymorphism data and biochemical markers in T2DM newline patients may have resulted from the study's small sample size. It's possible that conclusive evidence won't be available until until large, randomised clinical studies of newer treatments are conducted.

Keywords: Immunology, Life Sciences, T2DM, CVD/Stroke

1.INTRODUCTION

Disordered metabolism and hyperglycemia are hallmarks of diabetes mellitus (DM), a complicated, multifactorial metabolic illness that affects people all over the world. [1] Cigarette smoking, alcohol consumption, a poor diet, being overweight, having vascular or cardiovascular disease, a lack of exercise, hormonal changes, and certain medications all increase the likelihood that a person will develop diabetes. Better health practises, like regular exercise and a healthy diet, can further reduce the likelihood of acquiring diabetes. [2] Major forms of DM include types 1 and 2. Insulin-dependent diabetes mellitus (IDDM) is a type of diabetes mellitus in which the pancreas is unable to produce insulin as a result of an autoimmune attack on the

cells that create the hormone. Non-insulin-dependent diabetes mellitus (NIDDM) is the adult-onset form of diabetes in which tissues and cells are resistant to the effects of insulin. In addition to the aforementioned hormonal anomalies, insulin action and secretion can also cause metabolic and genetic problems. While type 2 diabetes is more common in adults and tends to worsen with age, it has also been found to affect some children and adolescents who are overweight. [3] Diabetes mellitus has become one of the most common health problems around the globe during the past two decades. Worldwide, diabetes is the sixth biggest cause of death and disability, according to a recent assessment conducted by the World Health Organization (WHO) and the International Diabetes Federation (IDF). Through the Greek words "dia," meaning "through," and "baiein," meaning "sweet," we get the medical phrase "diabetes mellitus," meaning "to proceed." The disease leads to a loss of body weight that can be seen in the patient's urine. Even though it has been known for a long time that diabetic urine has an abnormally high content of sugar (see [4], the condition wasn't given the abbreviation DM (Diabetes Mellitus) until 1674, when a doctor named Willis coined the term (from the Greek word for nectar). Atherosclerosis and other cardiovascular diseases are more likely to develop in people with diabetes because of complications such as neuropathy, retinopathy, and kidney damage. [5] It is especially notable that this phenomenon is linked to an uptick in the production of oxygen species and a decrease in antioxidative safeguards. Pathophysiology of oxidative stress factors in diabetes Persistent hyperglycemia is the hallmark of diabetes mellitus (DM), a metabolic and multifunctional disease. [6] Diabetes mellitus (DM) has become increasingly common over the past two decades and will continue to pose a serious global health threat in the years to come. There were an estimated 425 million adults with diabetes in 2017, and that number is expected to rise to 592 million by 2035, according to a report by the International Diabetes Federation. With 109 million people in India alone suffering from diabetes, the disease is no longer limited to the wealthy world. Multiple factors contribute to the aetiology of diabetes mellitus, including insufficient insulin production, insulin resistance in target tissues, and the autoimmune destruction of pancreatic -cells. Type 1 diabetes, type 2 diabetes, gestational diabetes, and other forms of diabetes involving specific genetic flaws, metabolic, and mitochondrial abnormalities, as well as some diseases that affect glucose tolerance, are all classified differently based on their pathogenic pathways.[7] Microvascular problems, such as nephropathy or retinopathy, and macrovascular consequences, such as cardiovascular disease (CVD) and stroke, are possible outcomes of uncontrolled diabetes. But macrovascular problems are the leading cause of death in people with diabetes. 5 Recognizing the magnitude of the problem caused by diabetes and its complications, researchers began classifying people at risk for developing diabetes as having "prediabetes," an intermediate form of dysglycemia on a spectrum from normal to overt diabetes. [8]

One third of adults had prediabetes, yet 90% were unaware of their condition, according to the Centers for Disease Control and Prevention. Improving quality of life

and gaining better control over diabetes require raising awareness and educating people about the disease and its management, complications, and risk factors. However, prompt diagnosis is hindered by the fact that the onset of symptoms, especially in type 2 diabetes mellitus (T2DM), might be years after the disease has already developed. Regular medical checkups have been shown to significantly reduce the relative risk of CVDs and all-cause mortality, thus highlighting the need for early detection. [9]

Several studies have shown that the progression of diabetes can be slowed or avoided if existing treatment procedures are followed early in the course of the disease, which would improve the efficacy of diabetic management to delay DM. Therefore, it is of utmost importance, for a successful intervention, to forecast and early identify high-risk patients before the development of prediabetes, that is, while the beta cells are relatively intact, as well as to immediately identify diabetic problems. However, timely management is useful in preventing progression to overt disease, but this situation remains difficult.

The pathophysiology of type 2 diabetes is characterised by inadequate insulin production by the pancreas and insulin resistance, particularly in skeletal muscle and the liver. Both genetic and environmental variables likely play a role in the development of type 2 diabetes. But our knowledge of the illness's origin is, at best, limited. Genetic predisposition seems to have a major role in the development of type 2 diabetes. Genome-wide association data has been the basis for a great deal of progress in genetics in the last few decades, leading to new insights into the genetics of disease and promising new methods of treatment for many conditions, including type 2 diabetes (T2D). Recent findings linking 400 genes together suggest that this disease may account for 18% of its risk. [10]

Rare mutations have a far less impact on passing on type 2 diabetes than common ones. Insulin resistance is linked to the development of type 2 diabetes (T2D). The terms "obesity pandemic" and "diabetes epidemic" are sometimes used interchangeably to describe the current worldwide obesity and diabetes crises since insulin resistance is mostly due to obesity. Risks of insulin resistance and type 2 diabetes are raised by inactivity and poor diet (T2D). Insulin resistance has been linked to a number of genetic variations. The majority of common gene variations have yet to be assigned defined functions. The capacity of metabolomics for predicting complications in Type 2 diabetes is limited by a number of factors. It is difficult to compare the outcomes of different metabolomics studies when there is no consensus on how to standardise metabolomics data. It may be impossible for some equipment to detect some metabolites, and the detection of others may necessitate some non-standard procedures or intensive statistical analysis. The biomarker panel employed in the diagnosis of type 2 diabetes had not before been identified using metabolomics (T2D).

2.MATERIALS AND METHOD

Place of Research

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

Here, we have a total of 300 participants, including 142 males and 158 females. Everyone who participated was divided into three groups based on their convenience. One hundred people (44 men and 56 women) with a background in T2DM and CVD/stroke make up Group 1.

100 people (53 men and 47 women) with type 2 diabetes but no other problems make up Group 2.

The third group consists of a hundred perfectly healthy people (45 males and 55 females).
Age, sex, height, weight, waist circumference (WC), hip circumference (HC), neck circumference (NC), systolic blood pressure (SBP), diastolic blood pressure (DBP), duration of diabetes, smoking status, alcohol consumption, level of physical activity, risk factors for cardiovascular disease (CVD), stroke risk factors, and quality of sleep were all collected from participants.

Group 1:

Inclusion criteria:

Both male and female patients with type 2 diabetes, cardiovascular disease, or stroke between the ages of 30 and 60 were enrolled in the trial.
A positive 12-lead electrocardiogram for previous MI or angina; a history of coronary artery bypass grafting (CABG) or percutaneous transluminal coronary angioplasty (PTCA); a history of stroke; a history of hospitalisation for either a fatal or nonfatal MI or an episode of angina; a history of coronary artery disease

Exclusion criteria:

Patients with type 2 diabetes who also have a history of cardiovascular disease or a stroke will not be considered.

Group 2:

Inclusion criteria:

Men and women between the ages of 30 and 60 who have been diagnosed with type 2 diabetes (defined as a fasting blood sugar level of more than 125 mg/dl). **Exclusion criteria:**

Patients with type 2 diabetes who also have a history of liver, renal, thyroid, pulmonary, or other diseases are not eligible for this study.

Group 3 includes healthy males and females between the ages of 30 and 60.

Strategy for Gathering Information

The 10 mL of venous blood obtained from each individual while they were fasting was diluted into 2 mL, 3 mL, and 5 mL samples and placed in separate tubes. Within 30 minutes, the first 5 ml of blood is centrifuged without anticoagulant to separate plasma. Ethylenediaminetetraacetic acid (EDTA) was added to the second portion of the blood sample (2 ml) so that HbA1c and glucose levels could be calculated. [12] The remaining 3 millilitres of the blood sample, which contain the EDTA, are placed in the refrigerator at 2 to 4 degrees Celsius for future molecular research. Microalbuminuria was determined by collecting 25 ml of each subject's spontaneous pee in a sterile container. Polymorphisms in the lipoprotein lipase gene (LPL) in intron 6 at the PvuII site and the methyltetrahydrofolate reductase gene (MTHFR) in exon 4 at the C677T site were studied in 10 participants from group 2 (T2DM).

Statistical Analysis of Sequence Information

Codon Code Aligner Software (Codon Code Corporation, USA) was used to examine the DNA sequencing data files and identify mutations. Available for both Windows and Mac OS X, the codon code aligner can be used for sequence assembly, contig editing, and mutation identification.

3.RESULTS

Table 3.1 Characteristics of the study population

Characteristics	T2DM with CVD/Stroke (n=100)	T2DM (n=100)	Healthy control (n=100)
Age (year)	47.05	48.51	45.82
BMI (kg/m2)	25.9	26.2	24.5

SBP (mmHg)	134.8	127.3	114.5
NC (cm)	85.3	82.8	76.1
DBP (mmHg	36.3	38.0	36.6
WC (cm)	93.2	98.1	89.4
HC (cm)	100.6	104.4	100.6
FBS (mg/dl)	188.4	187.0	84.6
TC (mg/dl)	177.7	195.8	179.7
TGL (mg/dl)	201.7	210.4	140.2

Table 3.2 BMI with demographic features of T2DM patients

Characteristics	**Categories**	**N**	**Normal weight (n=21)**	**Overweight (n=18)**	**Obese (n=61)**
Smoking	No	85	20	13	52
	Yes	15	3	5	7
Alcohol consumption	No	81	18	14	49
	Yes	19	4	5	10
Physical activity	No	78	21	11	46
	Yes	22	2	7	13
Sleep quality	Interrupted	42	7	4	31
	Uninterrupted	58	15	15	28
Family history of diabetes	No	46	9	11	26
	Yes	54	13	8	33

Family history of Strokes	No	84	20	16	48
	Yes	16	3	2	11
Family history of CVD	No	88	19	14	55
	Yes	12	4	4	4
Hypertension	No	66	16	12	38
	Yes	34	5	8	21
Snoring	No	63	20	14	39
	Yes	37	2	5	30

Table 3.3 hsCRP and Hcy stratified by BMI intervals

Characteristics	**Categories**	**n**	**Normal weight (n=21)**	**Overweight (n=18)**	**Obese (n=61)**
HsCRP(mg/L)	Low risk	85	23	14	48
	Average risk	08	0	2	6
	High risk	07	0	3	4
Hcy (µmol/L)	Desirable	28	9	5	14
	Intermediate	33	10	6	17
	High	35	2	8	25
	Very high	04	0	0	4

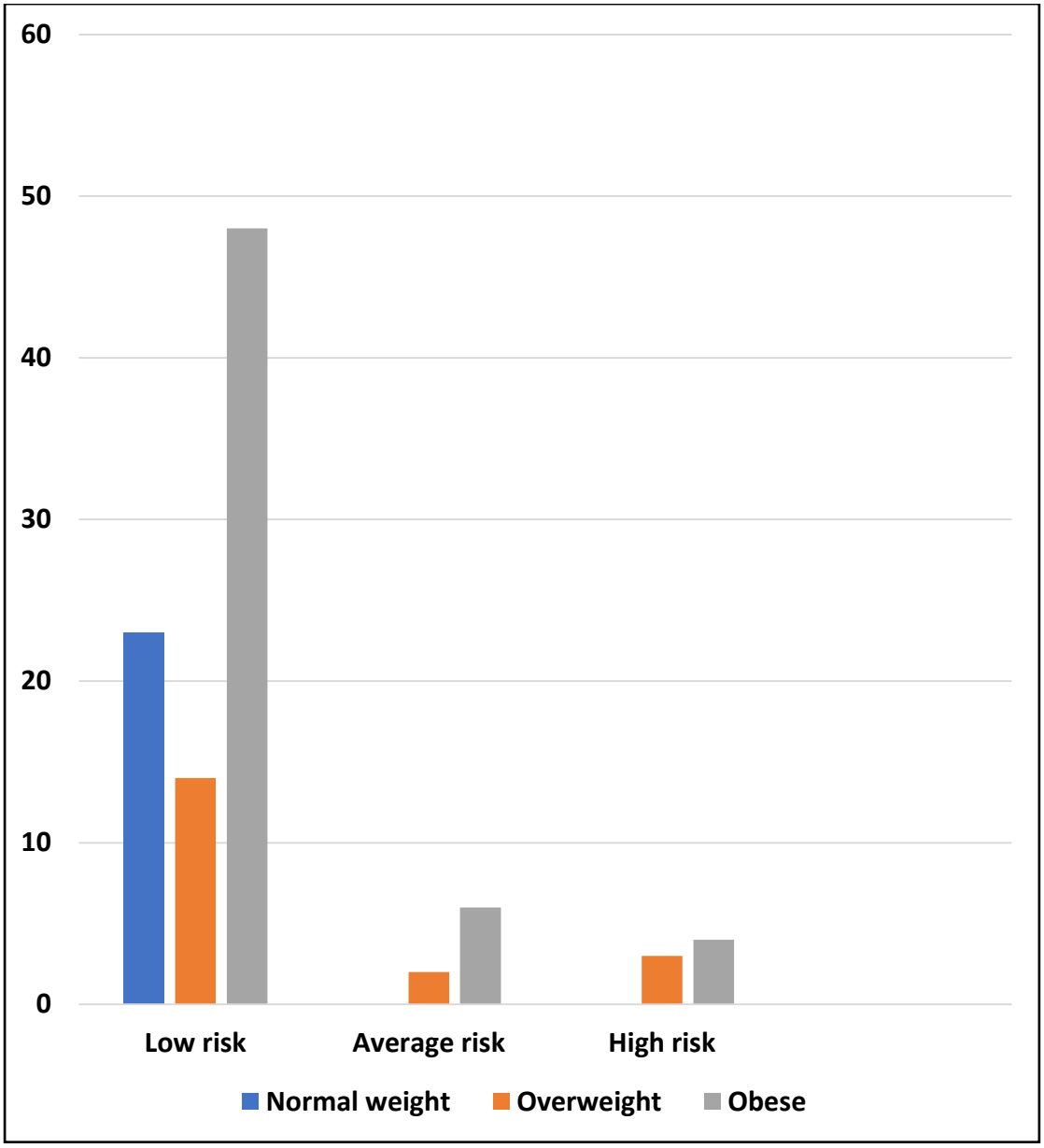

Fig 3.1 hsCRP stratified by BMI intervals

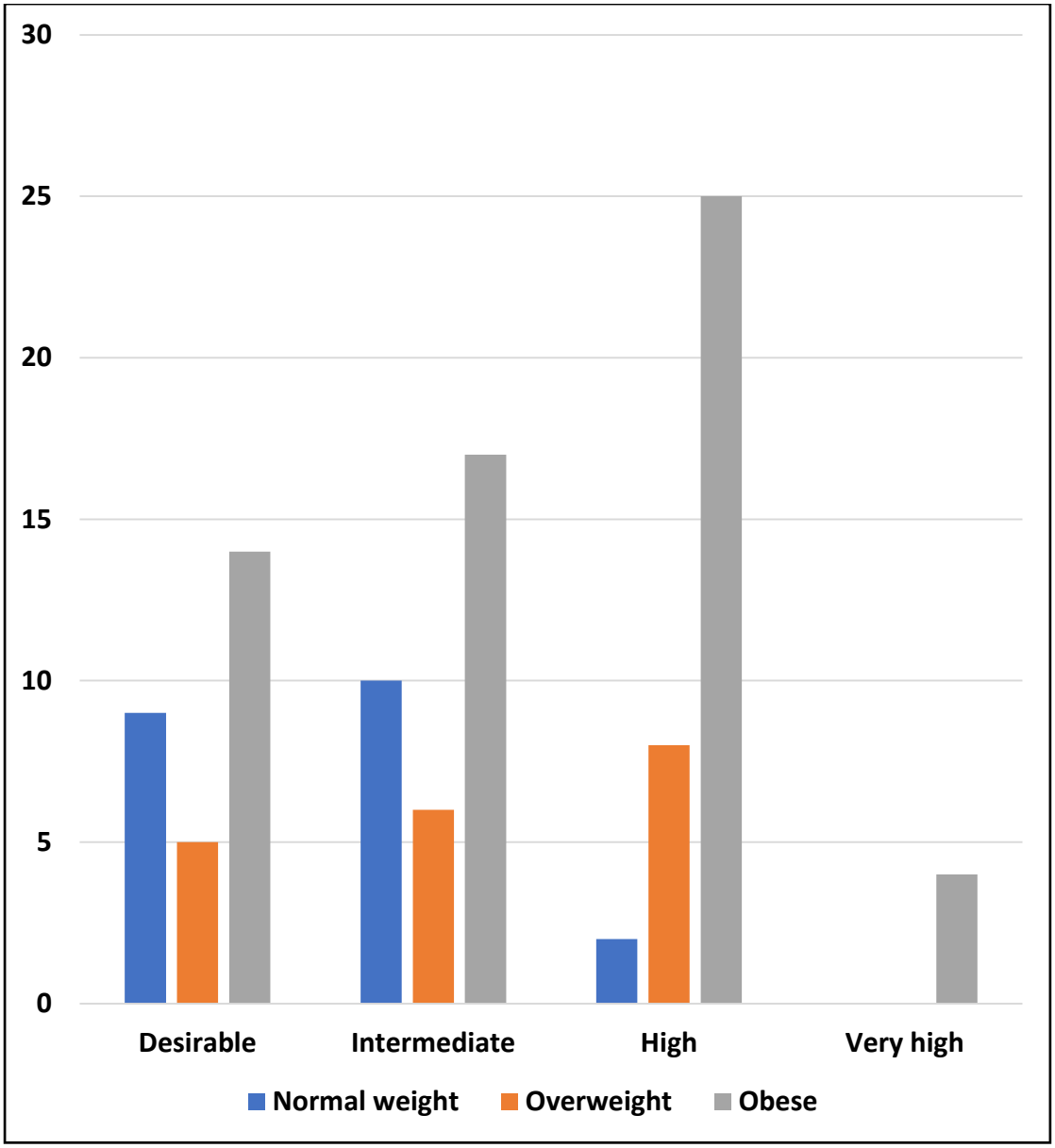

Fig 3.2 Hcy stratified by BMI intervals

4.DISCUSSIONS

There are two main types of diabetes mellitus: type 2 (T2DM) and type 1 (T1DM). Between 5 and 8 percent of all instances of DM are attributable to T1DM, which is characterised by pancreatic beta cells that destroy themselves. [13] Unfortunately, the majority of people with DM suffer from T2DM, which develops when insulin-sensitive organs like the liver, skeletal muscles, and adipose tissue become non-responsive to insulin. Common microvascular consequences of diabetes include nephropathy, retinopathy, and cardiomyopathy. [14] Thirty percent of people with type 1 diabetes (T1DM) and between twenty percent to thirty percent of people with

type 2 diabetes (T2DM) develop diabetic nephropathy (DN), the leading cause of renal failure. The heart undergoes remodelling and diastolic failure in diabetic cardiomyopathy (DC). Moreover, those with DM do not show any signs of cardiovascular disease or high blood pressure. Patients with type 2 diabetes who have high levels of Hcy are more likely to be obese than to be overweight or of normal weight, and all individuals with very high levels of Hcy are obese; there are no such patients in the normal weight or overweight categories. There was a statistically significant increase (p0.05) in the mean SBP, DBP, and hsCRP values. first the overweight, then the obese, and finally the average-weight people. [15]

5.CONCLUSIONS

Diabetes mellitus (DM) is a metabolic illness with negative health and economic consequences, and its prevalence is rapidly increasing around the world. Several windows of opportunity for preventing and treating diabetes exist during the lengthy asymptomatic stage. Early detection of diabetes (including prediabetes) is crucial in avoiding complications, according to a number of studies. The detection of DM at an early stage is crucial, and the identification of novel biomarkers can help with both that and the understanding of pathogenesis processes. MiRNAs have emerged as promising techniques for identifying DM among a number of indicators. These molecules are pivotal in a number of biological pathways that contribute to the development of DM. Extensive research in this area has revealed that miRNAs show promise as a biomarker for diagnosing diabetes in patients.

REFERENCES

1. Feng, X.-T., Tang, S.-Y., “Anti-diabetic effects of Zhuoduqing formula, a Chinese herbal decoction, on a rat model of Diabetes of type 2”, African Journal of Traditional, Complementary, and Alternative Medicines, Vol 14,Issue (3),page 42,2017.
2. Inagaki-Ohara, K., & Yoshimura, A. “SOCS, inflammation, and metabolism”. Journal of Molecular Biochemistry, Vol 3,Issue (3), Page 234-265,2014.
3. Irudayaraj, S. S., Stalin, A., Sunil, C., “Antioxidant, antilipidemic and antidiabetic effects of ficusin with their effects on GLUT4 translocation and PPARγ expression in type 2 diabetic rats”, Chemico-Biological Interactions, Vol 256,Issue (1),Page 85–93,2016
4. JeBailey, L., Wanono, O., Niu, W., “Ceramideand oxidant-induced insulin resistance involve loss of insulin-dependent Rac-activation and actin remodeling in muscle cells”, Diabetes, Vol 56,Issue (2), Page 394–403,2007
5. Jorgensen, S. B., Palanivel, R., Galic, S. “Deletion of skeletal muscle SOCS3 prevents insulin resistance in obesity”. Diabetes, Vol 62, Issue (1),Page 56–64,2013.
6. Kabirifar, R., Ghoreshi, A. “Curcumin, quercetin and atorvastatin protected against the hepatic fibrosis by activating AMP-activated protein kinase”. Journal of Functional Foods,Vol 40, Issue (1),Page 341–348,2018.

7. Osellame LD, Blacker TS, "Cellular And Molecular Mechanisms Of Mitochondrial Function". Best Practice & Research Clinical Endocrinology & Metabolism. Vol 26, Issue (6), page 711-23,2012.
8. Aouacheri O, Saka S, Krim M, "The Investigation Of The Oxidative Stress-Related Parameters In Diabetes of type 2 Mellitus". Canadian Journal Of Diabetes. Vol 39, Issue (1), page 44-9,2015.
9. Sarkhail P, Rahmanipour S, "Antidiabetic Effect Of Phlomis Anisodonta: Effects On Hepatic Cells Lipid Peroxidation And Antioxidant Enzymes In Experimental Diabetes". Pharmacological Research. Vol 56, Issue (3), Page 261-6,2007.
10. Pazdro R, Burgess JR. "The Role Of Vitamin E And Oxidative Stress In Diabetes Complications". Mechanisms Of Ageing And Development.;Vol 131, issue (4), page 276-86,2010.
11. Bora P, "Adipose tissue-derived stromal vascular fraction in regenerative medicine: a brief review on biology and translation". Stem Cell Research & Therapy. Vol 8, issue (1), page 145-149,2017
12. Das HK, et al. "Prevalence of diabetes and prediabetes in 15 states of India: results from the ICMR INDIAB population-based cross-sectional study". The Lancet Diabetes & Endocrinology ,Vol 5, issue (1), Page 585-596,2017
13. Mohan G. "Oxidative Stress: An effective prognostic tool for an early detection of cardiovascular disease in menopausal women". Biochemistry Research International, Vol 12, issue (1), Page 1-7,2016
14. Yuchao Z, "A possible synergistic effect of MTHFR C677T polymorphism on homocysteine level variations increased risk for ischemic stroke". Medicine (Baltimore) 2017; Vol 96, issue (1), Page 93-100,2017
15. Akalin A, "Relation of plasma homocysteine levels to atherosclerotic vascular disease and inflammation markers in type 2 diabetic patients". Eur J Endocrinol, Vol 158, issue (1), Page 47-52,2008.