https://ijrps.com

ISSN: 0975-7538
Research Article

F2 Isoprostanes levels in Metabolic Syndrome

Sai Ravi Kiran B[2], Mohana Lakshmi T[1], Srikumar R[2], Prabhakar Reddy E*[2]

[1]Department of Microbiology, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry-605502, India
[2]Department of Biochemistry, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry-605502, India

ABSTRACT

Metabolic disorder is portrayed by a group of cardiovascular (CV) causing factors including raised triglycerides, lessened HDL cholesterol, central obesity, hypertension, expanded fasting glucose and hyper insulinemia. MDA is the steady final result of lipid peroxidation. F2 Isoprostanes has been implicates the role for OS in pathophysiology of diseases. Our aim is to evaluate the Oxidative stress in Metabolic syndrome by measuring F2 Isoprostanes, MDA levels. The study was conducted at SLIMS, Puducherry. The study included 200 MetS patients and 200 Controls. In comparison to controls, MDA was significantly higher in MetS ($p<0.001$). In MetS group, there was a significant increase in F2 Isoprostanes compared to controls ($p<0.001$). Increased MDA, F_2 Isoprostanes levels could be taken as an early marker of pathogenesis of MetS. The findings of the present study show that the individual components of MetS especially hyperglycemia, hyper triglyceridemia and obesity systolic blood pressure, diastolic blood pressure and BMR are related to OS. Markers of oxidative damage MDA and F2-isoprostanes and their relationship with self-reported chronic disease and metabolic syndrome as health indicators in a large adult sample. Present study's results confirm that plasma F2-isoprostanes are likewise associated with the vast majority of the settled hazard factors for the improvement of atherosclerosis, including systolic pulse, triglycerides, waist circumference, and LDL-cholesterol levels, free of socio statistic and way of life factors.

Keywords: F2-isoprostanes; Atherosclerosis; cholesterol, Oxidative stress; MDA (malondialdehyde)

INTRODUCTION

The metabolic disorder (MetS) is considered as the most vital general wellbeing danger of the 21stcentury, influencing between 10 and 15% of adult people around the world. Metabolic disorder is portrayed by a group of cardiovascular (CV) causing factors including raised triglycerides, lessened HDL cholesterol, central obesity, hypertension, expanded fasting glucose and hyper insulinemia (Taskinen MR.2007).

MetS is a condition of chronic low grade inflammation as a result of complex interchange amongst hereditary and ecological elements which instigate the few factors, for example, Insulin resistance, visceral adiposity, atherogenic dyslipidemia, endothelial dysfunction, hereditary susceptibility, hypertension, hyper coagulable state and chronic stress (H, Abel ED.2008, Nicolson GL.2007, Grundy SM, Brewer HB Jr, Cleeman JI, et al., 2004).

Metabolic Syndrome is otherwise called Insulin resistance disorder. This syndrome is a group of disorders like Insulin resistance, hyper insulinemia and impaired glucose intolerance. Insulin resistance gives off an impression of being the essential initial mediator of metabolic disorder.

Oxidative stress (OS) is an imbalance between the amount of pro-oxidant and antioxidant substances and play a role in pathophysiology of MetS Cardiovascular Diseases & Diabetes. Increased OS has assuming a focal part in MetS. In a healthy condition, ROS are kept up at an ideal level because of a harmony between their generation and disposal by enzymatic and non enzymatic antioxidants. In a pathological state, for example, the MetS, an expanded oxidant limit combined with diminished antioxidant capacity makes an uneven situation those outcomes in OS (V. Cavalca, F. Veglia, I. Squellerio et al., 2009). Expanded ROS levels showed amid OS effectually affect cells and tissues through expanded oxidation of carbohydrates, lipids, and proteins (H. Azumi, N. Inoue, Y. Ohashi et al., 2002). ROS have been appeared to assume a noteworthy part in the advancement and development of cardiovascular disorders. Also, OS has been recognized as a noteworthy component of micro and macro vascular complications in the Mets.

MDA (malondialdehyde) is the stable end product of lipid peroxidation and it's produced during the decomposition of polyunsaturated fatty acids and indicator of free radical damage.

* Corresponding Author
Email: drepebyreddy@yahoo.com
Contact: +91-9159186879
Received on: 15-08-2017
Revised on: 12-09-2017
Accepted on: 18-09-2017

F2 Isoprostanes represent one class of oxidized lipids formed invivo in humans. It is also known as 8-iso-PGF2α, are the sequence of prostaglandin F2α-simliar components manufactured by the free radical–catalyzed peroxidation of arachidonic acid autonomous of the cyclooxygenase (E. Niki, 2014).

F2 Isoprostanes has been implicates the role for OS in pathophysiology of a number of human condition and disease such as obesity, atherosclerosis, hypercholesterolemia, diabetes, cigarette smoking, rheumatoid arthritis and neurodegenerative disorders.

Objective of the Study

Our aim is to evaluate the Oxidative stress in metabolic syndrome by measuring F2 Isoprostanes, MDA levels.

MATERIALS AND METHODS

The present study was conducted at SLIMS, Puducherry. The study included 200 MetS patients and 200 Controls. F2 Isoprostanes, MDA estimated by 5 ml of venous blood samples were taken from patients and controls and these samples were collected overnight fasting of 12 hrs. Collected samples centrifuged under 2000 rpm for 20 min and after centrifugation of samples (plasma) used to assess the F2 Isoprostanes, MDA levels. MDA estimated as TBARS (Thiobarbituric acid reactive substance) by UV Spectrophotometer. F2 Isoprostanes measured ELISA using cayman chemical-enzyme immunoassay kit. FBS, lipid profile assessed by using standard method using commercial kits.

The diagnosis of metabolic syndrome was based waist, body mass index, waist-hip ratio, systolic and diastolic blood pressure, Blood glucose levels.

NCEP ATP III 2001 Criteria for Metabolic Syndrome
The agenda of ATP III was to recognize the people with long term risk of cardiovascular disorders (CVD's) who merited clinical way of life mediation to lessen chance.

Existence of three of the below mentioned five elements is required for conclusion of metabolic disorder. Central obesity: Abdominal waist circumference: Men >102 cm, women >88 cm. Fasting plasma glucose >110mg/dl or identified type 2 diabetes mellitus (T2DM). Fasting plasma triglyceride >150 mg/dl or medication. Fasting plasma HDL cholesterol: Men <40 mg/dl, women <50 mg/dl or medication. Blood pressure ≥120/80 mmHg or medication (((Adult Treatment Panel III). JAMA2001).

Statistical analysis

All results were summarized as mean ± SEM. The statistical analysis was done using SPSS software 11.5 version (SPSS, Inc., Chicago)., and the comparison between patients and control was done by using ANOVA. A p value < 0.05 were considered as statistically significant. The p value was kept of <0.001 is comparatively highly significant.

RESULTS AND DISCUSSION

FBS, lipid profile significantly increased in the studied subjects such that DM ($p<0.05$) and MetS ($p<0.05$) were observed, when compared with control group. Increase FBS, lipid profile were observed, when compared with MetS group. FBS, lipid profile were done rule out the DM, MetS patients.

In comparison to controls, MDA was significantly higher in MetS and it correlate with Srinivas Rao et al study (Srinivasa Rao PVLN, Daksihnamuthy KV,et al.,2009). This results suggest Type II DM patients have increased. ROS generation incited higher oxidative harm in the circulation and furthermore have lessened antioxidant protective mechanisms (Martín-Gallán P,2003).

Hyperglycemia condition can instigate OS by a few systems, for example, glucose autoxidation, polyol pathway, AGE development and PKCβ1/2 kinase. Under the state of expanded oxidative stress brings about the exhaustion of the local antioxidants, which causes a lessening in the antioxidant status in the body. This is in agreement with previous reports of increased MDA levels in patients with MetS compared to controls. In present study specify that, increased production of ROS leads damage and dysfunction despite the fact that ordinary rate of ROS generation is required for life. DM is a disorder characterized by persistent hyperglycemia due to insulin resistance. Insulin is a pleiotropic hormone which signals a number of cellular processes such as glucoregulation, lipid metabolism, and protein synthesis in multiple tissues. In patients with DM, these actions of insulin are reduced (Moller DE, Flier JS.1991).

Therefore, there is an expansion in free unsaturated fattyacids which advance oxidative stress, endothelial dysfunction, vascular damage, and atheroma formation. The clinical outcomes are increased BP, HDL concealment, and high triglycerides (TGL) moreover, DM is related with macro vascular (myocardial localized necrosis, stroke) and micro vascular (retinopathy, neuropathy, renal disorder) issues which interfere with blood and supplement conveyance to various tissues all through the body (Hotel RH, Hollywood CA., 2011).

DM is a vital factor in MetS and is profoundly prescient of CVD chance. In 1999 the San Antonia Heart Study found that insulin resistant patients had a more prominent rate of hypertension and dyslipidemia than non-insulin-safe patients. Other epidemiological studies have built up a comparable connection amongst hyperglycemia and CVD which embroils the significance of DM as a risk factor for cardiovascular mortality.

In MetS group, there was a significant increase in F2 Isoprostanes compared to controls ($p<0.001$). This study's results confirm that plasma F2-isoprostanes are additionally connected with the greater part of the well-established risk factors for the development of atherosclerosis, including waist circumference, systolic

Table 1: MDA, F2 Isoprostanes levels in metabolic syndrome

S.No.	Parameters	MetS(n-200) Mean± SEM	Controls(n-200)Mean±SEM	p Value
1	MDA (µmol/lit)	5.73± 0.98	0.07± 0.01	p<0.001
2	F2 Isoprostanes (pg/ml)	363.0±62.38	122.50±4.08	p<0.001
3	FBS(mg/dl)	156.55±4.82	106.12±1.68	p<0.001
4	Cholesterol (mg/dl)	245± 30.51	188.5 ±27.3	p<0.001
5	TGL (mg/dl)	243±28.62	169.2±28.4	P<0.001
6	HDL (mg/dl)	30± 5.52	50± 8.25	p<0.001
7	LDL (mg/dl)	123.8±31.4	68.3±13.2	P<0.002

blood pressure, triglycerides, and LDL-cholesterol levels independent of socio demographic and lifestyle factors. After a glucose load in type II diabetes is related with an intense increment in plasma convergences of F2 isoprostane (Cameron AJ, Shaw JE, Zimmet PZ.2004). This compounds demonstrate elevated free radical mediated generation from arachidonic acid in membrane and lipoprotein phospholipids. This provides delicate and guide proof to a connection between acute or chronic hyperglycemia and free radical damage in type II diabetes (Sampson MJ, Gopaul N, et al., 2002).

Our findings indicate that the markers of free radical induced injury i.e. MDA and F_2 Isoprostanes and decline in antioxidant defenses may appear early in type 2 DM, before the development of secondary complications. There is hyperglycemia induced OS associated with a depleted antioxidant status which sets the stage for further disease progression. Antioxidants are essential for the avoidance of MetS and its implications (Mancini A, Leo F, et al., 2017). So more is research is needed to differentiate the effects of major serum antioxidant on MetS.

Increased MDA, F_2 Isoprostanes levels could be taken as an early marker of pathogenesis of type 2 DM. The findings of the present study show that the individual components of MetS especially hyperglycemia, hyper triglyceridemia and obesity systolic blood pressure, diastolic blood pressure and BMR are related to OS.

CONCLUSION

Markers of oxidative damage MDA and F2-isoprostanes and their relationship with self-reported chronic disease and metabolic syndrome as health indicators in a large adult sample. Present study's results confirm that plasma F2-isoprostanes are additionally connected with the vast majority of the well-established risk factors for the development of atherosclerosis, including waist circumference, systolic blood pressure, triglycerides, and LDL-cholesterol levels, independent of socio demographic and lifestyle factors. As low HDL-cholesterol levels are a well-established risk factor for CVD, an association in the opposite direction would be expected. Plasma F2-isoprostanes were also positively associated with HDL-cholesterol. Biomarkers of oxidative stress, F2-isoprostanes and oxidized LDL, were emphatically connected with occurrence of T2DM.

Present study found that metabolic syndrome had higher levels of Oxidative stress is associated with an increase in insulin resistance and endothelial dysfunction. Many studies reported higher quality of oxidative stress markers in Hypertension patients and metabolic syndrome patients. These findings are consistent with previous studies demonstrating that hypertension and metabolic syndrome are independently associated with increased oxidative stress and inflammatory disease.

The present study results further suggest that supplementation may be used as preventive and management strategies for the cardiovascular complications of MetS and DM.

Conflict of Interest: Nil

REFERENCES

Cameron AJ, Shaw JE, Zimmet PZ. The metabolic syndrome: prevalence in worldwide populations. Endocrinol Metab ClinNAm 2004; 33:351-75.

E. Niki, "Biomarkers of lipid peroxidation in clinical material," Biochimica et Biophysica Acta, vol. 1840,no. 2, pp. 809–817, 2014.

Executive Summary of the Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). JAMA2001*;* 285*:* 2486–2497.

Grundy SM, Brewer HB Jr, Cleeman JI, et al: Definition of metabolic syndrome. Report of the National Heart, Lung, and Blood Institute/American Heart Association conference on scientific issues related to definition. Arterioscler Thromb Vasc Biol 24: e13-e18, 2004.

H, Abel ED. Molecular mechanisms for myocardial mitochondrial dysfunction in the metabolic syndrome. 2008 Clin Sci (Lond). 114 (3):195–210.

H. Azumi, N. Inoue, Y. Ohashi et al., "Superoxide generation in directional coronary atherectomy specimens of patients with angina pectoris: important role of NAD(P)H oxidase," Arteriosclerosis, Thrombosis, and Vascular Biology, vol. 22, no.11, pp. 1838–1844, 2002.

Hotel RH, Hollywood CA. 9th Annual World Congress on Insulin Resistance, Diabetes & Cardiovascular Disease (WCIRDC). Endocrine Practice. 2011 Nov; 17(6):1A.

Mancini A, Leo F, Di Segni C, Raimondo S. Relationship Between Hormonal Milieu and Oxidative Stress in Childhood Obesity: A Physiopathological Basis for Antioxidant Treatment and Prevention of Cardiovascular Risk. Anti-Obesity Drug Discovery and Development. 2017 Jun 9; 3:149.

Martín-Gallán P, Carrascosa A, Gussinyé M, DomínguezCBiomarkers of diabetes-associated oxidative stress and antioxidant status in young diabetic patients with or without subclinical complications.FreeRadicBiol Med. 2003 Jun 15; 34(12):1563-74.

Moller DE, Flier JS. Insulin resistance—mechanisms, syndromes, and implications. New England Journal of Medicine. 1991 Sep 26;325(13):938-48.

Nicolson GL. Metabolic syndrome and mitochondrial function: molecular replacement and antioxidant supplements to prevent membrane peroxidation and restore mitochondrial function. J Cell Biochem. 2007; 100(6):1352–69.

S. S.Davies and L. J. Roberts II, "F2-isoprostanes as an indicator and risk factor for coronary heart disease," Free Radical Biologyand Medicine, vol. 50, no. 5, pp. 559–566, 2011.

Sampson MJ, Gopaul N, Davies IR, Hughes DA, Carrier MJ. Plasma F2 isoprostanes. Diabetes care. 2002 Mar 1; 25(3):537-41.

Srinivasa Rao PVLN, Daksihnamuthy KV, Sai baba KSS, Ragavan MSS, Vijay bhaskar M, Sreekrishna V, Ambbekar JG, Jayaseelan L.Oxidative stress in hemodialysis- intradialytic changes. Redox report. 2001; 6(5): 303-309.)

Taskinen MR. Is metabolic syndrome the main threat to human health in the twenty-first century 2007 Arterioscler Thromb Vasc Biol; 27: 2275.

V. Cavalca, F. Veglia, I. Squellerio et al., "Glutathione, vitamin E and oxidative stress in coronary artery disease: relevance of age and gender," European Journal of Clinical Investigation, vol. 39, no. 4, pp. 267–272, 2009.