A Study of Biochemical Profile in Cases of Osteo-Arthritis

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ABSTRACT

Introduction: *Osteo-arthritis is the most frequent cause of musculoskeletal disability. It is a common disorder of synovial joints characterised by destruction of hyaline articular cartilage, and reactive bone changes.*
Aim: *To show the relation between Osteo-arthritis and metabolic syndrome.*
Materials and Methods: *The components of metabolic syndrome like waist circumference, blood pressure, total triglycerides, HDL cholesterol and fasting glucose were measured.*
Results: *HDL cholesterol levels between controls and cases were found to be highly significant.*
Conclusion: *The present study shows that there is increased association of adversely changed components of metabolic syndrome with osteo-arthritis.*

Key words: *Osteo-arthritis, metabolic syndrome, lipid profile, HDL, triglycerides.*

INTRODUCTION

Osteo-arthritis is the most frequent cause of musculoskeletal disability(1,2). It represents a major disease burden to the individual and society(3,4). The hands, spine, knees and hips are commonly affected. Osteo-arthritis is having well established link with obesity, which is associated with metabolic syndrome having effects on different systems of the body. It is a common disorder of synovial joints characterised by destruction of hyaline articular cartilage and reactive bone changes (5). The disorder is associated with joint pains and stiffness and radiological signs in the form of decreased joint space with subchondral bone density (6). Most individuals with this problem have no identifiable cause (7). The correlation between pain and degree of structural change is best at the hip then the knee, and is worst for hand and spinal epophyseal joints (8).

Biochemical alterations in the Osteo-arthritis: The proteoglycan content of Osteo-arthritic cartilage is reduced (9). Keratan sulphate is relatively decreased and chondroitin 4 sulphate is increased as compared to the normal state (10).

AIMS AND OBJECTIVES OF THE STUDY

The aim of the present study is to know whether the natural progression of the disease Osteo-arthritis is associated with metabolic syndrome. So the cases and controls were studied for assessment of metabolic syndrome.

MATERIALS AND METHODS

Patients attending Orthopaedic department, Govt general hospital, who were clinically and radio logically diagnosed to be suffering from Osteo-arthritis were taken as cases. They belonged to the age group of 43-80yrs. Among them 15 were male and 35 were female. Persons with previous history of injured joints were excluded. Age and gender matched 24 members without Osteo-arthritis were taken as controls.

1. Measurement of physical parameters(anthropometric measurements)
2. Measurement of systolic blood pressure
3. Estimation of total cholesterol
4. Estimation of triglycerides
5. Estimation HDL cholesterol
6. Estimation fasting glucose

Anthropometric Measurement: Physical parameters like height, weight and waist circumference were taken.
Measurement of blood pressure: Both systolic and diastolic blood pressure was measured by sphygmomanometer.
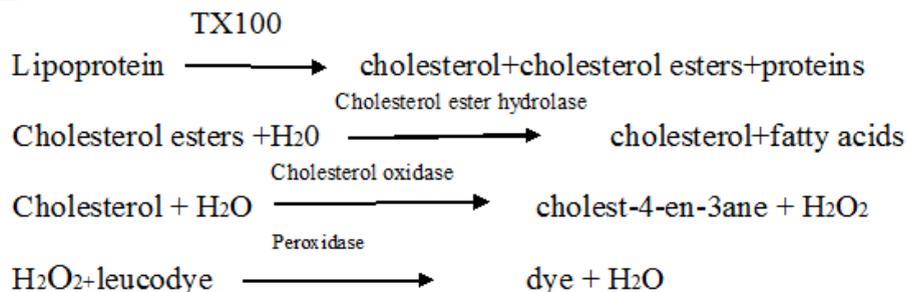
Estimation of total cholesterol:
Dry Tech (DT) Method: VITROS CHOLESTEROL DT slide method was performed using the: VITROS CHOLESTEROL DT SLIDE and VITROS chemistry products DT calibrate kit on VITROS DT 60/ DT 60 II CHEMISTRY SYSTEMS. VITROS CHOLESTEROL

DT SLIDE is multi layered analytical element cOsteo-arthritisted on a polyester support. The analysis was based on an enzymatic method as described by Spayed et al.

A drop of patients sample was deposited on the slide and evenly distributed by the spreading layer to underlying layers. The Triton X-100 surfactant in the spreading layers aids in dissociating cholesterol and cholesterol esters from lipoprotein complexes present in sample. Hydrolysis of cholesterol esters to cholesterol catalysed by cholesterol ester hydrolase.

Reaction Sequence:

$$\text{Lipoprotein} \xrightarrow{\text{TX100}} \text{cholesterol+cholesterol esters+proteins}$$

$$\text{Cholesterol esters} + H_2O \xrightarrow{\text{Cholesterol ester hydrolase}} \text{cholesterol+fatty acids}$$

$$\text{Cholesterol} + H_2O \xrightarrow{\text{Cholesterol oxidase}} \text{cholest-4-en-3ane} + H_2O_2$$

$$H_2O_2 + \text{leucodye} \xrightarrow{\text{Peroxidase}} \text{dye} + H_2O$$
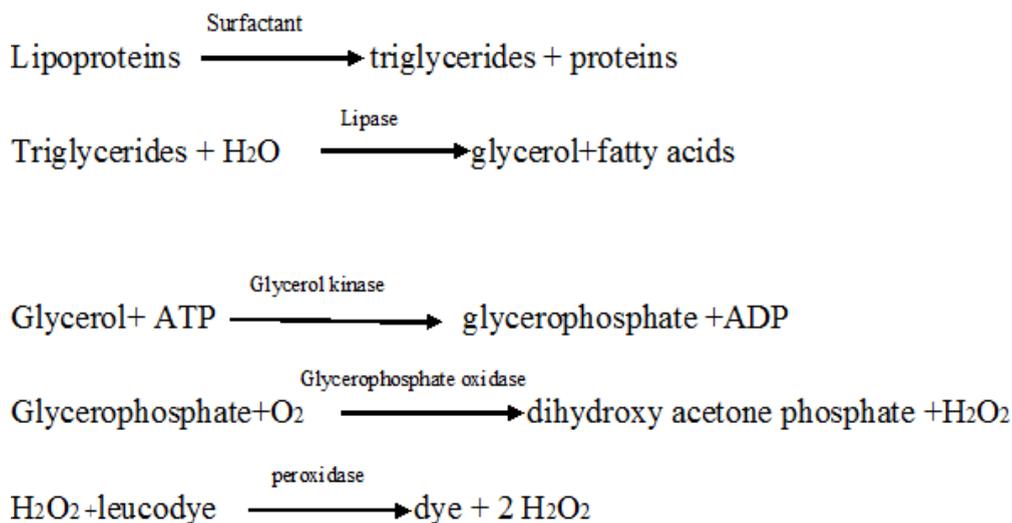
The density of dye formed proportional to cholesterol concentration present in the sample, and was measured by reflectance spectro photometry.

Reportable Range:

Conventional mg/dl
50-325

Estimation Total Triglycerides: VITROS TRIG DT SLIDE method was performed using the VITROS TRIG DT SLIDE and VITROS chemistry products DT calibrate kit on VITROS DT 60/DT 60 II chemistry systems. A drop of patient sample was deposited on the slide and evenly distributed by spreading layer to the underlying layers.

Reaction Sequence:

$$\text{Lipoproteins} \xrightarrow{\text{Surfactant}} \text{triglycerides} + \text{proteins}$$

$$\text{Triglycerides} + H_2O \xrightarrow{\text{Lipase}} \text{glycerol+fatty acids}$$

$$\text{Glycerol} + \text{ATP} \xrightarrow{\text{Glycerol kinase}} \text{glycerophosphate} + \text{ADP}$$

$$\text{Glycerophosphate} + O_2 \xrightarrow{\text{Glycerophosphate oxidase}} \text{dihydroxy acetone phosphate} + H_2O_2$$

$$H_2O_2 + \text{leucodye} \xrightarrow{\text{peroxidase}} \text{dye} + 2H_2O_2$$
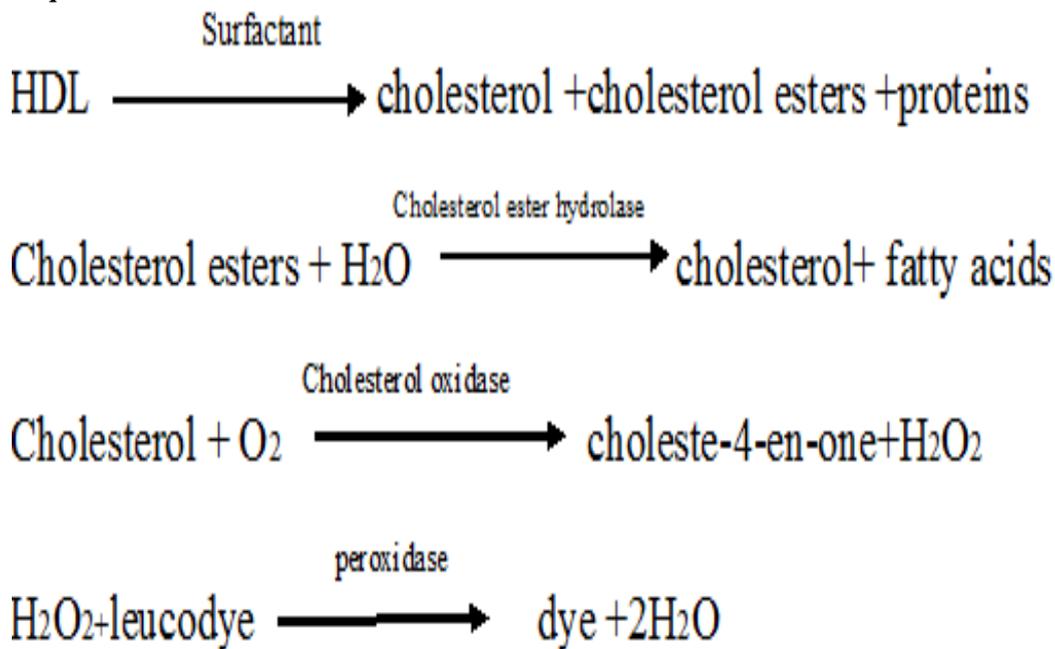
The density of dye formed was proportional to the triglycerides concentration present in the sample and was measured by reflectance spectro photometry.

Reportable range for TRIG DT
Conventional mg/dl
15-400

HDL cholesterol estimation by Dry Tech (DT) method: HDL separated by precipitation of LDL and VLDL using dextrin sulphate and magnesium chloride provided in VITRO DT micro HDL tool. The HDL lipoprotein remains in the liquid portion of the tube after centrifugation. The liquid portion was called supernatant and was the portion analysed. The non HDL fraction form a pellet on the bottom of the tube and discarded. A drop of pre treated patients sample was deposited on the sample.

Reaction sequence:

$$HDL \xrightarrow{\text{Surfactant}} cholesterol + cholesterol\ esters + proteins$$

$$Cholesterol\ esters + H_2O \xrightarrow{\text{Cholesterol ester hydrolase}} cholesterol + fatty\ acids$$

$$Cholesterol + O_2 \xrightarrow{\text{Cholesterol oxidase}} choleste\text{-}4\text{-}en\text{-}one + H_2O_2$$

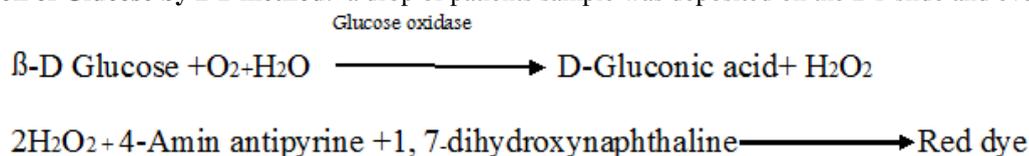$$H_2O_2 + leucodye \xrightarrow{\text{peroxidase}} dye + 2H_2O$$

The density of dye formed was proportional to HDL cholesterol concentration present in pre-treated sample and was measured by reflectance spectrophotometry.

Reference interval for HDL

	Conventional units
Low	<40
High	>60

Estimation of Glucose by DT method: a drop of patients sample was deposited on the DT slide and even.

$$\text{ß-D Glucose} + O_2 + H_2O \xrightarrow{\text{Glucose oxidase}} \text{D-Gluconic acid} + H_2O_2$$

$$2H_2O_2 + 4\text{-Amin antipyrine} + 1,7\text{-dihydroxynaphthaline} \longrightarrow Red\ dye$$

Reportable range for GLUCOSE DT

Conventional mg/dl
20-450

Reference interval for GLU DT

Fasting plasma glucose levels in adults
74-110mg/dl

RESULTS

Measurement of waist circumference: It is one of the components in assessing metabolic syndrome. In female controls and Osteo-arthritis cases there was significant rise in measurement. 4 female controls out of 12 (33.3%) are having WC ≥88cm, where as 20 female Osteo-arthritis cases out of 35(57.1%) are having ≥88cm. There is no significant difference in male patients.
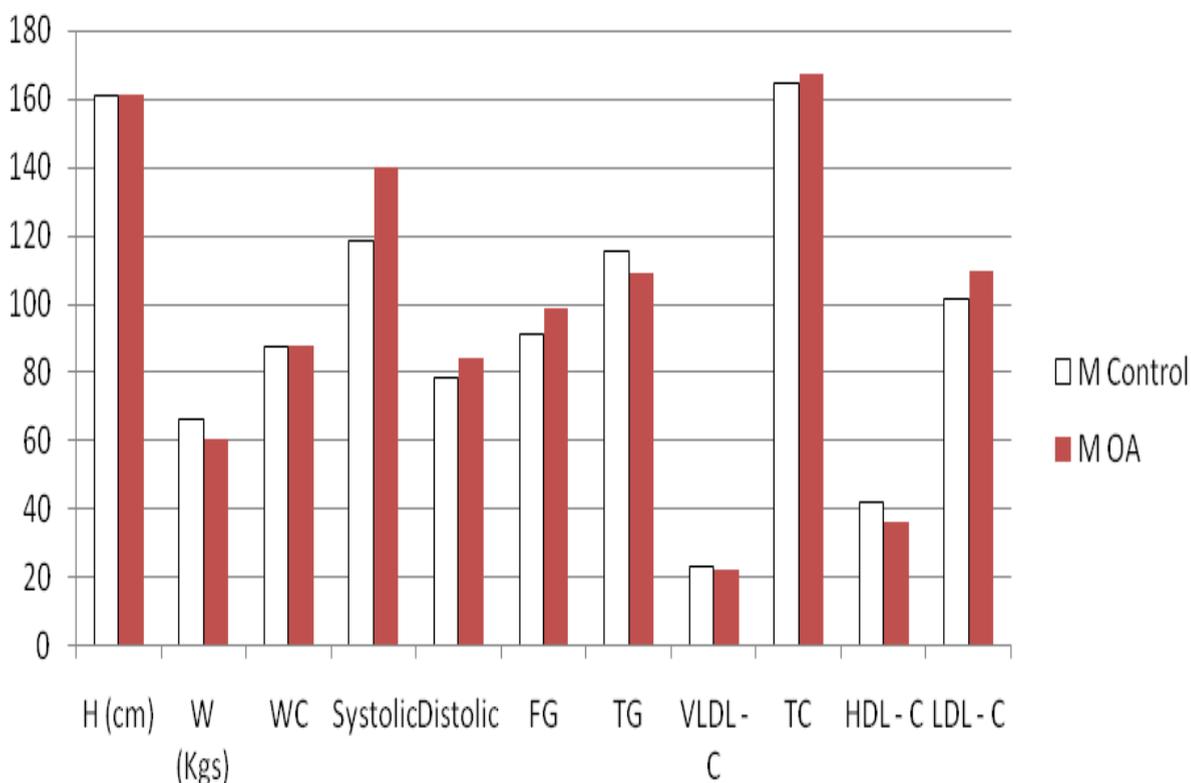
Measurement of systolic blood pressure: Systolic blood pressure was measured among male controls and Osteo-arthritis cases, and there was statistical rise in measurement. Out of 12 male controls 3 (25%) are having systolic BP >130mm of Hg, where as10 male Osteo-arthritis cases out of 15(66.7%) are having > 130mm of Hg. In female controls and Osteo-arthritis cases there was highly significant rise in systolic measurement. Out of 12 female controls one (8.3%) is having systolic BP >130mm Hg; whereas 31 female Osteo-arthritis cases out of 35(88.6%) are having >130mm Hg. There is no significant difference in the diastolic blood pressure.

Measurement of total Triglycerides: Serum triglycerides were measured and there was no significant difference between controls and cases.

Serum HDL cholesterol measurement: There was a significant decrease in HDL level between controls and cases. 4 male controls out of 12(33.3%) were having serum HDL cholesterol < 40mg/dl, where as all male cases (100%) showed < 40mg/dl. Among female controls 5 out of 12(41.7%) are having serum HDL <40mg/dl, whereas 30(85.7%) cases showed < 40mg/dl.

Measurement of serum fasting glucose levels: There was a significant rise in the measurement of blood glucose levels in Osteo-arthritis patients on comparing with male and female controls. All male controls are having serum fasting glucose levels <110mg/dl, Whereas 2 Osteo-arthritis cases out of 15(13.4%) are having >110 mg/dl. On comparison female controls and Osteo-arthritis cases there was significant increase in FBS measurement in Osteo-arthritis cases. All female controls are having serum fasting glucose <110 mg/dl, where as 10 Osteo-arthritis cases out of 35are having >110 mg/dl.

COMPARISON OF MALE CONTROLS VS OSTEO-ARTHRITIS

COMPARISION OF MALE CONTROLS Vs OSTEO-ARTHRITIS

Male Controls	H (cm)	W (kg)	WC	Systolic	diastolic	FG	TG	VLDL-C	TC	HDL-C	LDL-C
Average	161.3	66.33	87.5	118.3	78.33	91.08	115.8	23.25	164.8	42.08	101.8
SD±	6.874	7.967	7.129	7.862	5.6	6.34	36.5	10.42	26.52	4.792	23.63
Male OSTEO-ARTHRITIS cases Average	161.3	60.2	87.6	140	83.67	98.67	119.1	21.93	167.2	35.93	109.3
SD±	4.906	8.318	7.9	28.52	11.39	20.74	40.29	8.09	30.2	1.11	27.16
P value			>0.05	<0.05	>0.05	>0.05	>0.05	>0.05	>0.05	<0.05	>0.05
Significance			NS	S	NS	NS	NS	NS	NS	HS	NS

COMPARISION OF FEMALE CONTROLS Vs OSTEO-ARTHRITIS

Female Controls	H(cm)	W(kg)	WC	Systolic	diastolic	FG	TG	VLDL-C	TC	HDL-C	LDL-C
Average	152.1	55.58	81.67	118.3	75	89.08	92.17	18.67	163	39.92	103.6
SD±	4.262	10.89	6.392	9.439	5.222	8.026	35.57	7.176	24.7	2.453	23.65
Female OSTEO-ARTHRITIS cases average	149	60.14	89	158.9	90.71	105.5	151.5	30.4	204	36.9	137
SD±	5.065	12.18	10.24	33.98	10.09	20.11	64.11	12.74	43.63	2.92	39.39
P value			<0.05	<0.01	<0.01	<0.05	>0.05	>0.05	<0.01	<0.01	<0.05
Significance			S	HS	HS	S	NS	NS	HS	HS	S

COMPARISON OF FEMALE CONTROLS VS OSTEO-ARTHRITIS
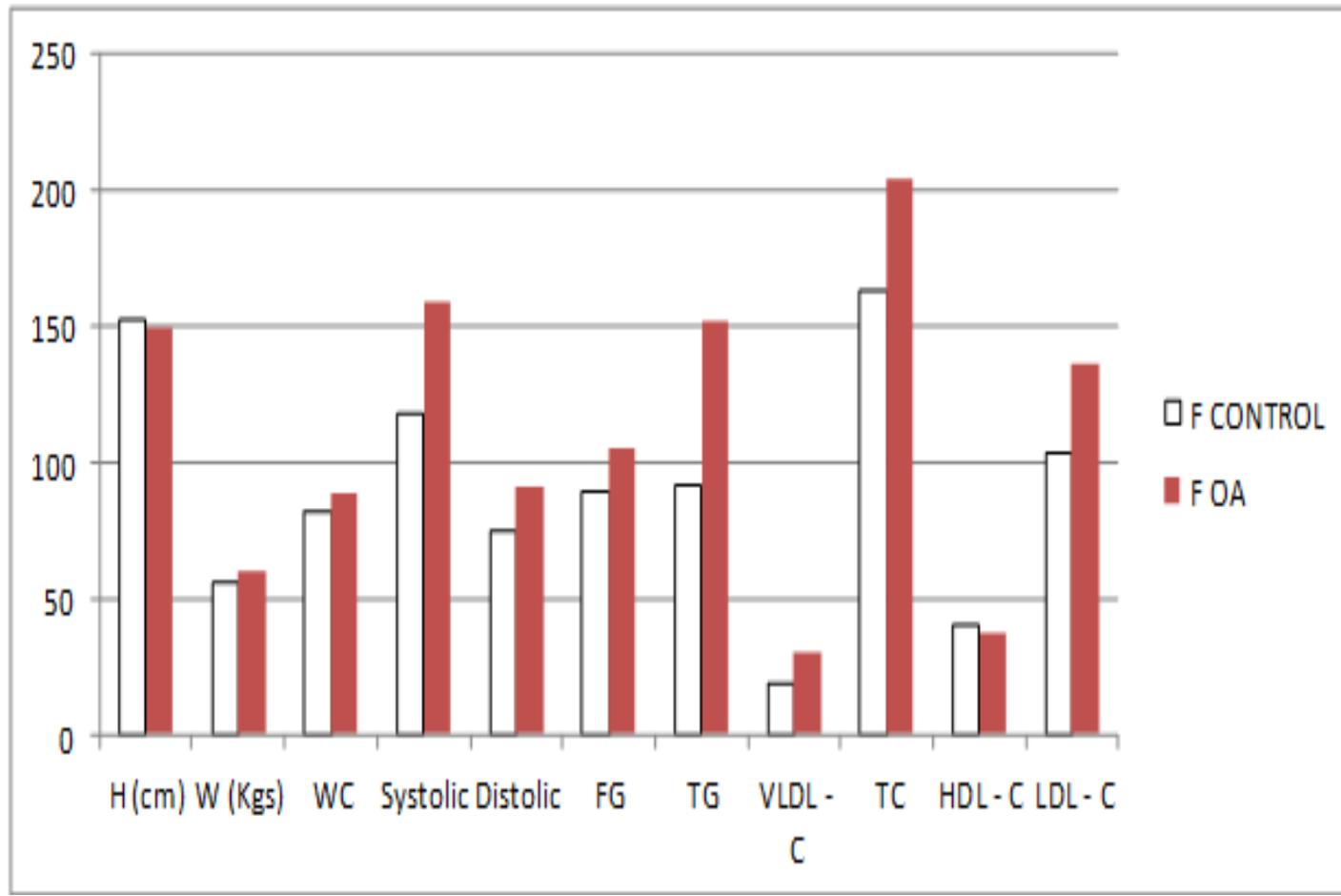
DISCUSSION

Osteo-arthritis is a degenerative disease of joints of unknown aetiology. It is the most prevalent form of arthritis effecting approximately 10-12% of World population. In the present study of "Biochemical profile in cases of Osteo-arthritis" there is statistically significant increase in waist circumference in female osteo-arthritis cases which is in concurrence with the established fact that over weight and obesity are predisposing risk factors for osteo-arthritis (11,12). The systolic blood pressure is an important component of metabolic syndrome, which is also a predisposing risk factor of osteo-arthritis (13,14). Its increase in both male osteo-arthritis cases is statistically significant, where as it is highly significant in female osteo-arthritis cases. The rest pain of the osteo-arthritis cases may be due to rised intra-osseous pressure (IOP), which may be aggravated by rise in systolic blood pressure (15,16). Serum total cholesterol is a component of metabolic syndrome which is frequently associated with overweight and obesity. In this study there is no statistical difference in male controls Vs osteo-arthritis cases, but in female controls Vs osteo-arthritis cases there is a statistical significance. The serum HDL cholesterol is also an important component of metabolic syndrome, which is also a predisposing risk factor of osteo-arthritis. In the present study there is highly significant decrease in the HDL levels in both male and female (17,18). Serum fasting glucose levels are significantly rised in osteo-arthritis cases on comparison with controls, showing diabetics are more susceptible to osteo-arthritis (19).

SUMMARY AND CONCLUSION

The primary generalised Osteo-arthritis can be proposed as a metabolic disorder in which systemic factors induce changes in cartilage and bones. Its prevalence is more in aged people as the wear and tear is more with aging. In the present study 15 male Osteo-arthritis cases 35 female Osteo-arthritis cases were studied between ages 43-80 years against 12 age matched controls in each sex for the components of metabolic syndrome. There is increased association of adversely changed components of metabolic syndrome with Osteo-arthritis in the present study. This association of metabolic syndrome can aggravate the pathogenesis of Osteo-arthritis. Osteo-arthritis may be affected at an earlier age in persons with metabolic syndrome than controls. If metabolic syndrome is detected in early adulthood, when reversibility is possible, the Osteo-arthritis can be prevented or postponed.

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