Original Article National Journal of Medical and Dental Research, April-June 2018: Volume-6, Issue-3, Page 391-401

TO STUDY THE CARDIOVASCULAR AND METABOLIC CHARACTERISTICS OF TYPE-II DIABETES

Jain Vikas[A], Jain Jyoti[B]

[A] - *Associate professor, Department of Physiology, Gajara Raja Medical College Gwalior (MP)*

[B] - *Associate Professor, Department of Biotechnology, Vijayaraje institute of science and management, Jhansi road, Gwalior (MP)*

Physiology

Article Submitted on: 09 May 2018
Article Accepted on: 14 May 2018

Corresponding Author

Dr Jyoti Jain,
Associate Professor,
Department of Biotechnology,
Vijayaraje institute of Science and Management,
Jhansi road, Gwalior (MP)
Mobile No - 0961704191
Email ID – jyoti_biotech2001@yahoo.co.in

Abstract:

Objectives – Present work aimed to study the cardiovascular / metabolic characteristic of type-2 diabetes and association with cardiovascular correlates of exercise.

Material And Method- The present study was conducted in Department of Physiology, GRMC Gwalior & Department Of Biotechnology, Vijayaraje Institute Of Science And Management, Gwalior (MP). The Biochemical investigations were done in the department of Biochemistry of these Institutions. Total of 60 T2DM patients were studied, all patients were examined clinically and systemic examination was done and confirmed by the investigations. All the data collected was statistically confirmed by faculty of SPM.

Results - in 60 T2 DM patients aged 40-50 years, 30 patients fell in the age range of 40-50 years with mean age 42.5+1.5 years and remaining 30 patients in age group >45-50years. (48.2+1.42 years.). 50% study population was categorized as normal weight and 50% as overweight, Based on waist circumference measurement abdominal obesity was exhibited by-82% of study population (wc=94.28+6.17cm). According to International diabetes federation (2005) 55% of the study-population categorized as having metabolic syndrome. The duration of disease in 60% of the subjects was < 7years and remaining 40% was more than 7years. Positive family history of diabetes mellitus, hypertension & obesity was found in 78%,45% & 51% of study-population respectively. Majority (63%) of study population were on oral anti-diabetics treatment and 37% were on combined (oral + insulin) therapy. 65% diagnosed cases of hypertension were on antihypertensive treatment (β-Blockers) None of the subjects were having any endocrinal disorder other than diabetes, musculoskeletal disorder and/Orthopaedic impairment. Study of cardiovascular risk factors distribution revealed that the major risk factors in subjects with metabolic syndrome were obesity (Generalized 79%, abdominal 100%), hypertension(100%) dyslipidemia (100%). Physical inactivity (74%) was also found in appreciable number of cases. In subjects without metabolic syndrome abdominal obesity was present in 75% cases, all other risk factors were present in very few cases. In the subjects aged more than forty-five years irrespective of gender, greater prevalence of coronary risk factors was observed. The main risk factors identified in the age group 40-45 years were abdominal obesity (77%) & smoking (53%) and in diabetic patient aged >45-50 years. (48.2+1.42years) were abdominal obesity (87%) hypertension (80%) & physical inactivity (80%). The present study showed that physical inactivity of any-type work related or leisure-time influences health adversely. Increasing trends were observed with increasing body mass index(>25Kg/m2) the prevalence of cardiovascular risk factors viz abdominal obesity (100%), hypertension (90%) metabolic syndrome, physical-inactivity & tobacco-use (67%)in both men & women found in the study population. Lowest prevalence of Hypertension & metabolic

syndrome was found in subjects of BMI category (<25 kglm2).

Conclusion- Diabetes mellitus is a unique endocrinal disorder, the poor control of which leads to complications involving nearly all the system of human body. It is estimated that large majority of patients with diabetes mellitus type-II or impaired glucose tolerance test have the metabolic syndrome. Presence of metabolic syndrome in these population is associated with higher prevalence of coronary vascular disease than found in patients without metabolic syndrome.

Key Words – T2DM, Metabolic Syndrome , Coronary Artery Disease

Introduction

Diabetes represents a spectrum of metabolic disorder which has become a major health challenge, world-wide. Diabetes is characterized by a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects of insulin secretion, insulin action or both[1]. The metabolic dysregulation associated with diabetes mellitus causes secondary pathophysiologic changes in multiple organ systems that impose a tremendous burden on the individuals with diabetes and on the health care system. Often the hyperglycemia sufficient to cause pathological and functional changes is present for a long time before the diagnosis is made.The prevalence of diabetes mellitus has reached epidemic proportions. International diabetic federation estimated about 246 million diabetics worldwide in the year 2007 with the prevalence rates of 6% among the adults of 20-79 age groups[2]. According to World health organization (WHO), more than 180 million people worldwide have diabetes and by the year 2030, this number is likely to become more than double[3]. In 2005, an estimated 1.1 million people died from diabetes. This would actually underestimate the true burden of diabetes. Although people may live for years with diabetes, their underlying cause of death is recorded as heart disease or kidney failure. An alternative estimate, taking into account deaths, in which diabetes was a contributory condition, suggests that approximately 2.9 million deaths are attributable to diabetes[3]. WHO predicts that developing countries will bear the brunt of this epidemic in the 21st century, with 80% of all new cases of diabetes expected to appear in the developing countries by 2025. In India alone, diabetes is expected to increase from 40.6 million in 2006 to 79.4 millions by 2030.[4] The onset of the disease in urban Indian adults is about a decade earlier than their western counterparts and the prevalence of type 2 diabetes mellitus is 4-6 times higher in urban than in rural areas[4]. Type 2 diabetes mellitus constitutes about 85-95% of all the diabetes in developed countries accounting for an even higher percentage in developing countries[2]. it is beyond doubt that India actually has the highest number of diabetics in the world and Government of India has rightly launched the national programme for control of diabetes, cardiovascular diseases and stroke in January 2008.[2] It may seem strange that developing world which is often associated with hunger and inadequate nutrition for children, is now experiencing an epidemic of type 2 diabetes, a disease related to wealth and unhealthy life style. This can be explained on the basis of high degree of urbanization in the countries like India that have made people adapt the life style from the industrial countries It is also a fact that some people genetically have a higher risk of developing diabetes and combined with great changes in lifestyle this risk has turned to reality for the people in these countries. The risk factors peculiar for developing diabetes among Indians include high familial aggregation, central obesity, insulin resistance and urbanization leading to lifestyle changes[2]. Sedentary Iife is one of the most significant factors associated with diabetes in this population.The risk of heart diseases and stroke increase, causing 50 % of deaths in' the people with diabetes[3]. Because of the severe pathologies complicating the clinical course of diabetes, one can easily speculate on huge economic and psychosocial impact of diabetes on individuals, families and health care systems. Patients with type-2 diabetes are at increased risk of coronary heart disease and stroke, which are the most common cause of death and disability and excess health care cost in diabetics. It is estimated that the large majority (~75%) of patients with type-2 diabetes or impaired glucose tolerance have the metabolic syndrome. Metabolic syndrome is the constellation of risk factors acting synergistically and one or all of which may share a common etiology. Aggregation of cardiovascular risk factors including hyper insulinemia, systemic hypertension elevated serum cholesterol and triglyceride level, reduced HDL cholesterol as well as glucose tolerance comprised the syndrome. There fore identifying the metabolic

abnormalities to prevent morbidity and mortality in type-2 diabetic patients due to cardiovascular disease is urgent need.

Material and methods

The present study was conducted in Department of Physiology,GRMCGwalior&DepartmentofBiotechnology, Vijayaraje institute of science and management, Gwalior (mp).The Biochemical investigations were done in the department of Biochemistry of these Institutions. Total of 60 T2DM patients were studied, all patients were examined clinically and systemic examination was done and confirmed by the investigations. All the data collected was statistically confirmed by faculty of SPM.

It was cross section study in which 33 cases of diabetes mellitus type-II suffering from metabolic syndrome were studied and compared with age and sex matched 27 type-II diabetic subjects not suffering from metabolic syndrome,

The study comprised of type-II diabetes mellitus patients aged 40-50 years attending medical OPD.

All the cases were proved cases of diabetes mellitus type-II as per criteria of World Health Organization (1999)[1].

- Approval has been taken from the ethical committee of the Institute.
- All procedures were carried out in agreement with the treating physician.

Inclusion Criteria

- All the patients with diabetes type-2 proved by recent blood glucose studies.
- Fasting plasma glucose and lipid-profile estimated prior to exercise testing to categories into metabolic syndrome groups & non-metabolic syndrome group.
- All the cases should be free from chronic complication of diabetes and any other endocrinal and metabolic disorder.

Exclusion Criteria

- Type-II diabetic patient with past history of cerebro-vascular accidents.
- Patients with evidence of orthopedic impairment
- Patient with abnormal finding in resting ECG as well as clinical examination
- Chronic Alcoholic's

Patients were grouped in two categories based on the criteria of metabolic syndrome according to International Diabetic Federation (2006)[5]:

1. Metabolic syndrome group (33)
2. Non Metabolic syndrome group (27)

All the patients selected for study were subjected to a detailed history taking by mean of planned- questionnaires. History of present and past illness was taken and family history especially of non-communicable disease, congestive heart failure was recorded. History of any medication was also taken. Users of all type of tobacco products were included in the study. Physical inactivity was measured by asking both work related and leisure time activities.

- Patients underwent careful systemic clinical examination for the clinical evidence of existence of any such disease that may affect exercise-capacity.

Statistical- Analysis

All values were expressed as mean $\pm$ standard deviation. Comparisons of means between the two groups were done using a student-t-test, Bivariate correlations between variables were evaluated by pearsons correlation, coefficient 'r'.Statistical analysis was done by using SPSS version 9.0 (statistical package for social science) and EP Info 5.2 statistical soft-ware.

Results

Table : 1
Relevant baseline anthropometric data of type-II diabetic patients (n=60)

Variables		Men (n=38) Mean+SD	No. (%)	Women (n=22) Mean+SD	No. (%)	Overall (n=60) Mean+SD
Age (Years)	40-45 (n=30)	42.66+1.65	21 (70)	42.11+1.45	9 (30)	42.5+1.5 (50)
	> 45-50 (n=30)	48.23+1.52	17 (57)	48.15+1.34	13 (43)	48.2+1.42 (50)
BMI (Kg/M^2)	< 25 (n=30)	23.5+1.09	23 (77)	22.88+0.80	7 (23)	23.4+1.05 (50)
	> 25 (n=30)	28.24+2.011	15 (50)	28.22+2.41	15 (50)	28.29+2.18 (50)
Waist Circumference (cm)	Men (< 90) Women(< 80) (n=11)	83.0+1.8	9 (82)	75.0+0.0	2 (18)	81.54+3.61 (18)
	Men (> 90) Women(> 80) (n=49)	93.31+4.49	29 (59)	95.7+7.9	20 (41)	94.28+6.17 (82)
Waist Hip Ratio	Men (< 0.9) Women (< 0.8) (n=21)	0.84+0.03	18 (86)	0.77+0.01	3 (14)	0.83+0.04 (35)
	Men (> 0.9) Women(> 0.8) (n=39)	0.98+0.04	20 (51)	0.94+0.10	19 (49)	0.96+0.08 (65)

in the age range 40-45 years 70% men (42.66±1.15 years) and 30% women (42.11+1.45 years) were studied, 57% men (48.23±1.52 years) and 43 % women (48.15+1.34 years) were in the age range > 45-50 years.

taking bmi as a gold standard the study population was classified into normal weight (BMI 18.5-24.9 kg/m^2) category, 50% of the study (23.4±1.05kg/m^2) population were fell into this group including 77% men (23.5±1.09 kg/m^2) and 23% women (22.80±0.80 kg/m^2). remaining 50% were classified as over weight/obese (BMI > 25 kg/m^2) category (28.29±2.18 kg/m^2) including 50% men (28.24±2.01 kg/m^2) and 50% women (28.22±2.41 kg/m^2). 82% of study population had abdominal obesity (wc 94.28±6.17 cm) including 59% men (93.31±4.49 cm) and 41% women (wc 95.7±7.9 cm). mean waist hip ratio of 65% of study population was (0.96±0.08) including 51% men (0.98±0.04) and 49% women (0.94±0.10)

Table : 2- Classification of study population based on existence of metabolic syndrome (N=60)

Groups	Men (n=38)	Women (n=22)
I Metabolic Syndrome Group	19(50)	14 (64)
II Non Metabolic Syndrome Group	19 (50)	8 (36)

(NUMBERS IN PARENTHESIS ARE PERCENTS)

BASED ON INTERNATIONAL DIABETIC FEDERATION (2005) 55% PATIENTS WERE FOUND TO HAVE METABOLIC SYNDROME. REMAINING 45% DIABETIC PATIENTS COULD NOT BE CLASSIFIED IN THIS CATEGORY.

Table : 3- Mean Values Of Anthropometric Parameter In Type-II Diabetic Patients

Variables	Metabolic Syndrome Groups		Non-Metabolic Syndrome Groups	
	Men (n=19)	Women (n=14)	Men (n=19)	Women (n=8)
Age (Years)	45.9+2.86	45.9+3.71	44.4+3.44	45.3+2.71
BMI (Kg/M^2)	27.15+2.8	27.72+3.07	26.66+1.06	24.43+2.48
Waist Circumference (Cm)	94.26+ 4.88	98.28+7.12	87.47+5.02	86+8.84
Waist Hip Ratio	0.98+0.04	0.96+0.10	0.856+0.04	0.847+0.07

The mean values of anthropometric data showed no gender difference in both the groups. The mean values of anthropometric measurements were higher in metabolic syndrome group as compared to non metabolic syndrome group.

Table : 4-
Comparison Of Anthropometric Parameter In Type-II Diabetic Patients (Student 'T' Test)

Variables	Metabolic Syndrome Overall (n=38)	Non-Metabolic Syndrome Overall (n=22)	't' Value	P Value
Age (Years)	45.9+3.19	44.6+3.21	1.5	NS
BMI (Kg/M^2)	27.39+3.91	23.89+1.6	5.5	< 0.001
Waist Circumference (Cm)	95.97+6.1	87.03+6.25	5.49	< 0.001
Waist Hip Ratio	0.97+0.08	0.85+0.05	7.17	< 0.001

An attempt has been made to compare anthropometric parameters of type-II diabetics patients with metabolic syndrome with those patients who were not having metabolic syndrome it was observed that all the measured anthropometric parameters were significantly (P=<0.001) higher in metabolic syndrome group.

Table : 5-
Distribution Of Type-II Diabetic Patients Based On Duration Of Disease (N=60)

Duration (years)	Men (n=38)	Women (n=22)	Overall (n=60)
1-4 years	15(68)	7 (32)	22 (37)
4-7 years	8 (57)	6 (43)	14 (23)
7-10 years	15 (62)	9 (38)	24 (40)

(Numbers in parenthesis are percents)

Based on the duration of disease it was found that majority of the patients (40%) were suffering from the disease from 7-10 years including 62% men and 38% women

Table : 6-
Distribution Of Type-II Diabetic, Patients Based On Family History Of Diabetes Hypertension And Obesity (N=60)

Family History	Positive		Negative	
	No. of Cases	%		No. of Cases
Diabetes	47	78	Diabetes	47
Hypertension	27	45	Hypertension	27
Obesity	31	51	Obesity	31

Incidence Of Family History Of Diabetes Hypertension And Obesity As Reported By The Respondents Was 78%, 45% & 51% Respectively.

Table : 7-
Clinical history of type-II diabetic patients

Variables		Men (n=38) No.	Women (n=22) No.	Overall (n=60) No./%
Anti-Diabetic Medication	No Medication	-	-	-
	Oral Medication Only (n=38)	24 (63)	14 (64)	38(63)
	Insulin Only	-	-	-
	Insulin +Medication (n=22)	14 (37)	8 (36)	22 (37)
β-Blocker Use	No (n=22)	16 (42)	6 (27)	21(35)
	Yes (n=38)	22 (57)	16 (72)	39 (65)
Metabolic Syndrome	No (n=27)	19 (50)	08 (36)	27 (45)
	Yes (n=33)	19 (50)	14 (63)	33 (55)
Hypertension	No (n=22)	16 (73)	6 (27)	21 (35)
	Yes (n=38)	22 (57)	16 (72)	39(65)
History of Endocrinal Disorder other than Diabetes	No	38 (100)	22 (100)	60 (100)
	Yes	-	-	-
History of Musculoskeletal Disorder	No	38 (100)	22 (100)	60 (100)
	Yes	-	-	-

(NUMBERS IN PARENTHESIS ARE PERCENTS)

Majority (63%) of study population were on oral anti-diabetics treatment and 37% were on combined (oral + insulin) therapy. 65% diagnosed cases of hypertension were on antihypertensive treatment (□-Blockers). None of the subjects were having any endocrinal disorder other than diabetes musculoskeletal disorder and/orthopaedic impairment.

Table:8-
Age Wise Prevalence Of Coronary Risk Factors In Type-Ii Diabetic Patients

Risk Factor	Age Categories (Years)			
	Men		Women	
	40-45 (n=21)	>45-50 (n=17)	40-45 (n=09)	>45-50 (n=13)
Smoking / Tobacco	14 (67)	11 (65)	2 (22)	6 (46)
Physical Inactivity	8 (38)	12 (70)	4 (44)	12 (92)
Obesity - Generalized - Abdominal	 7 (33) 15 (71)	 8 (47) 14 (82	 5 (55) 8 (88)	 10 (77) 12 (92)
Hypertension	9 (43)	13 (76)	5 (55)	11 (85)
Dyslipidemia	8 (38)	11 (65)	5 (55)	9 (69)

(numbers in parenthesis are percents)

In the patients aged more than forty five years irrespective of gender greater risk of cardiovascular disease was observed the major risk factor identified in the age group 42-45 years was abdominal obesity (77%) and smoking (53%). The men risk factors prevalent in diabetic patients aged > 45-50 years were abdominal obesity (87%) hypertension (80%) and physical inactivity (80%). The present study showed that physical inactivity of any type work related or leisure time influence health adversely.

Table : 9-
Prevalence Of Coronary Risk Factors In Study Population According To Bmi Categories

Risk Factors	Patients	BMI Categories (Kg/M2)		
		18-24.9	25-29.9	30-34.9
	Men	**23**	**11**	**04**
	Women	**7**	**12**	**03**
Smoking / Tobacco	Men	13 (56)	10 (91)	04 (100)
	Women	2 (28)	4 (33)	2 (66)
Physical Inactivity	Men	10 (43)	6 (54)	4 (100)
	Women	3 (43)	10 (83)	3 (100)
Abdominal Obesity	Men	14 (61)	12 (100)	4 (100)
	Women	5 (71)	11 (100)	3 (100)
Hypertension	Men	8 (34)	10 (91)	4 (100)
	Women	3 (43)	10 (83)	3 (100)
Dyslipidemia	Men	5 (22)	10 (91)	4 (100)
	Women	2 (28)	9 (75)	3 (100)

(NUMBERS IN PARENTHESIS ARE PERCENTS)

The prevalence of coronary risk factors was found to be very high in patients having BMI > 25 kg/m2. In low BMI category > 60% patients had abdominal obesity.

Table : 10
Prevalence Of Coronary Risk Factors In Study Population According To Waist Size Categories

Risk Factors	patients	Waist Size Categories (Cm)			
		70-79	80-89	90-99	> 100
	Men	**-**	**09**	**23**	**06**
	Women	**02**	**03**	**11**	**06**
Smoking / Tobacco	Men	-	2 (22)	22 (95)	4 (66)
	Women	-	1 (33)	4(36)	2 (33)
Physical Inactivity	Men	-	1 (11)	15 (65)	3 (50)
	Women	-	2 (66)	8 (72)	6 (100)
Generalized Obesity	Men	-	-	11 (48)	4 (67)
	Women	-	-	9 (82)	6 (100)
Hypertension	Men	-	1 (11)	16 (59)	5(83)
	Women	-	1 (33)	9 (82)	6 (100)
Dyslipidemia	Men	-	-	15 (65)	4 (66)
	Women	-	-	8 (73)	6 (100)

(NUMBERS IN PARENTHESIS ARE PERCENTS)

As evident from the observations majority of patients exhibited prevalence of abdominal obesity. The cardiovascular risk factors were prevalent in waist size category > 90 cm.

Table : 11-
Prevalence Of Coronary Risk Factors In Type-Ii Diabetic Patients In Relation To Duration Of Disease

Risk Factor	Duration of Disease (Years)					
	Men			Women		
	1-4 yr (n=15)	4-7 yr (n=08)	7-10 y (n=15)	1-4 yr (n=07)	4-7 yr (n=06)	7-10 yr (n=09)
Smoking/ Tobacco	5 (33)	6 (75)	15 (100)	2 (28)	1 (17)	5 (55)
Physical Inactivity	1 (7)	8 (100)	14 (93)	2 (28)	5 (83)	9 (100)
Obesity - Generalized - Abdominal	 3 (20) 7 (47)	 5 (62) 8 (100)	 8 (53) 14 (93)	 3 (43) 6 (86)	 4(67) 5 (83)	 8 (89) 9 (100)
Hypertension	1 (7)	7 (87)	14 (93)	2 (28)	5 (83)	9(100)
Dyslipidemia	1 (7)	7 (87)	11 (73)	2 (28)	5 (83)	7(77)

(NUMBERS IN PARENTHESIS ARE PERCENTS)

The observation revealed that greater the duration of disease more is the prevalence of coronary risk factors.

Table : 12-
Prevalence Of Cardiovascular Risk Factors Among Type-Ii Diabetic Patients (N=60)

Risk Factors	Men (38)		Women (22)	
	With Metabolic Syndrome (n=19)	Without Metabolic Syndrome (n=19)	With Metabolic Syndrome (n=14)	Without Metabolic Syndrome(n=08)
Smoking / Tobacco	18 (95)	9 (47)	6 (43)	2 (25)
Physical Inactivity	15 (78)	5 (26)	13 (92)	3 (37)
Obesity Generalized Abdominal	 14 (73) 19 (100)	 1(5) 10 (52)	 12 (85) 14 (100)	 3 (37) 6 (75)
Hypertension	19 (100)	3 (16)	14 (100)	2 (25)
Dyslipidemia	19 (100)	-	14 (100)	-

(NUMBERS IN PARENTHESIS ARE PERCENTS)

As evident from the data prevalence of cardiovascualr risk factors was more among patients having metabolic syndrome as compared to those who were not having metabolic syndrome

Table : 13-
Mean Values Of Biochemical Parameters In Type-Ii Diabetic Patients

Variables	Metabolic Syndrome Groups		Non-Metabolic Syndrome Groups	
	Men (n=19)	Women (n=14)	Men (n=19)	Women (n=8)
Fasting Serum Glucose (mg/dl)	156+18.2	172+25.4	136+8.84	138+16.1
Total Cholesterol (mg/dl)	257.8+33.6	291.5+62	192+12.84	194.4+1.41
Serum Triglyceride (mg/dl)	183+28.81	191+26.8	135+10.9	124+9.4
LDL Cholesterol (mg/dl)	186+28.2	216+60	121+12.4	115+13.3
VLDL Cholesterol (mg/dl)	33.9+3.44	37.1+6.6	27.0+2.18	24.8+1.88
HDL Cholesterol (mg/dl)	35.0+2	37.0+4.3	44.0+2.5	55.0+1.8

It is evident from the mean values that measured biochemical parameters were also on higher site in women as compared to men dyslipidemia was not observed in non metabolic syndrome group.

TABLE : 14-
Comparison Of Biochemical Parameters In Type-Ii Diabetic Patients (Student 'T' Test)

Variables	Metabolic Syndrome Overall (n=38)	Non-Metabolic Syndrome Overall (n=22)	't' Value	P Value
Fasting Serum Glucose (mg/dl)	162.67+22.54	136.70+11.22	5.3	< 0.001
Total Cholesterol (mg/dl)	271.87+49.65	192.7+12.7	7.92	< 0.001
Serum Triglyceride (mg/dl)	186.85+27.85	131.85+11.5	9.49	< 0.001
LDL Cholesterol (mg/dl)	198.9+46.27	118.8+12.52	8.5	< 0.001
VLDL Cholesterol (mg/dl)	35.3+5.18	26.32+2.35	8.4	< 0.001
HDL Cholesterol (mg/dl)	35.75+3.27	47.51+5.28	10.37	< 0.001

Data revealed that all the biochemical parameters measured except HDL cholesterol were significantly higher (P < 0.001) in metabolic syndrome group. HDL cholesterol was significantly low (P < 0.001) in this group.

Discussion

The main aim of the present work was to study the cardiovascular/ metabolic characteristic of T2DM. The study comprised of 60 type-II diabetes patients, aged 40-50 years. 30 patients fell in the age range of 40-45 years with mean age (42-5± 1.5 years) remaining 30 patients in age group >45-50years(48.2±1.42 years). 50% of the study population were categorized as obese based on BMI (28.29±2.18 kg/m^2) 82% having abdominal obesity based on waist circumference measurements (94.28+6.17 cm). According to International Diabetes Federation (2005) 55% of study population categorized as having metabolic syndrome. The mean BMI and waist circumference of the patients having metabolic syndrome (27.39±3.91 Kg/m^2, 95.97±6.1 cm) were significantly (P < 0.001) higher than patients not having metabolic syndrome (23.89±1.6 kg/m^2, 87.03±6.25cm). The study demonstrated that patients with metabolic syndrome showed existence of both generalized and abdominal obesity. Janseen et al (2002)[6] reported that BMI and waist circumference independently contributes to the prediction of non-abdominal, abdominal, sub-cutanious and visceral fat. Based on these observations Jidong S. et al (2006)[7] in their study on metabolic syndrome in 248 patients substituted BMI (>25kg/m^2) for abdominal circumference in defining metabolic syndrome in the criteria laid down by ATP-III[8], They considered BMI as a reasonable alternative having same predictive value for visceral adiposity. In the present study significant positive correlation between BMI and waist circumference was observed (r=0.352,p<0.05). The finding of present study was consistent with finding of R. Gupta et al (2007)[9] who also showed significant positive correlation of BMI and waist circumference (r=0.77,p<0.001).The duration of disease in 60% of the subjects was ≤ 7years and in remaining 40% was more than 7years. Positive family history of diabetes mellitus, hypertension & obesity was found in 78%, 45% & 51% of study-population respectively. Majority (63%) of study population were on oral anti-diabetics treatment and 37% were on combined (oral + insulin) therapy. 65% diagnosed cases of hypertension were on antihypertensive treatment (β-Blockers,) None of the subjects were having any endocrinal disorder other than diabetes, musculoskeletal disorder and/orthopaedic impairment. Study of cardiovascular risk factor distribution revealed that the major risk factors in subjects with metabolic syndrome were obesity, hypertension dyslipidemia, physical inactivity was also found in appreciable number of cases. American Heart Association[10] Identify several factors that increases risk of coronary heart disease and heart attack some of them can be modified, treated and control some can't. The more risk factors one have, greater is the chance of developing coronary heart disease also greater the level of each risk factors greater the risk. Increasing age is an non modifiable risk factor over 83% of people who die of coronary heart disease are 65 or older. At older ages incidence of heart attack is more in women as compared to men. In the subjects aged more than forty-five years irrespective of gender, greater prevalence of coronary risk factors was observed.

The main risk factors identified in the age group 40-45 years were abdominal obesity (77%) & smoking (53%) and in diabetic patient aged >45-50 years. (48.2±1.4^{2}years) were abdominal obesity (87%) hypertension (80%) & physical inactivity (80%).

The present study showed that physical inactivity of any-type work related or leisure-time influences health adversely. The prevalence of cardiovascular risk factors was found to be

very high in subjects having BMI > 25 kg/m^2 size category > 90 cm. In Framingham study Hubert et al. (1985)[11], Garrison et al (1996)[12] and Jousilhati et al.[13] reported that obesity as determined by body-weight>20% of desirable/ BMI was independent risk factor for cardiovascular disease In both men and women. Ming Wei et al (1999)[14] studied the relationship between low cardio respiratory fitness and mortality in normal weight, over weight and obese men a total of 25714 adult men (43.8±10.1 years) participated in the study in their study- relative risk for all cause-mortality in obese men ranged from 2-3 (95%CI,1.7-2.9) for men with hypertension and obese men with diabetes 3.1(95%CI,3.3-4.2), approximately 50% of obese men had low fitness which led to a population attributable risk of 39% for cardio-vascular disease mortality and 44% for all cause mortality.

The association between BMI, waist size category and cardiovascular parameters was examined and significant positive correlation of BMI was observed with fasting serum glucose, total cholesterol triglyceride, LDL cholesterol and cardiovascular exercise parameters, resting pulse, blood pressure. Waist size showed significant positive correlation with serum glucose. In earlier report of US National cholesterol education program (ATP-III 2002)[8] suggested cut off levels of waist size, > 102 cm for men and > 88 cm for women as a marker of C-V risk factors. The present study showed that there was very high prevalence of diabetes, hypertension, metabolic syndrome at waist size > 90 cm in men and > 80 cm in women, values lower then suggested by ATP-III[8]. Similar study have been performed by R. Gupta et al. (2007)[9] they investigation associated of obesity measured by BMI, waist size and cardiovascular risk factors in urban Indian population. They reported significant positive correlation of BMI waist circumference, waist hip ratio with systolic blood pressure, S. glucose LDL cholesterol and negative correlation with physical activity and HDL cholesterol in both men and women with increasing BMI waist circumference waist hip ratio, prevalence of syndrome increased significantly for trend (< 0.05). Krauss RM et al. (1998)[15] studied the impact of obesity cardiovascular disease and reported that obese subjects on an average have higher blood pressure total cholesterol, triglyceride, fasting S. glucose and plasma insulin level and lower HDL cholesterol level than lean persons. The findings of present study corroborates with the above finding.

It is now generally accepted that excess visceral fat is associated with insulin resistance and metabolic risk factors for coronary vascular disease metabolic syndrome is a clinical concept that facilitates the identification of patients who have a metabolic derangements, making them more prone to arteriosclerosis and thus a risk for adverse cardiovascular events. A steep increase in prevalence of hypertension metabolic syndrome was observed at waist circumference >90 cm in addition 69% subjects in this category had history of tobacco use and physical inactivity. None of the coronary risk factor was found to present in waist circumference category <80cm. Central obesity is the key feature of syndrome reflecting the fact that the syndrome prevalence is driven by the strong relationship between waist size and increasing adiposity. J. Sowers (2003)[16] suggested that central obesity is linked with hyperinsulinemia, insulin resistance, dyslipidemia and proinflammatory and prothrombotic clinical states. Adipose tissue synthesizes and secretes biologically active molecules that may affect cardiovascular risk factors. These chemical messengers include adiponectin, resistin, leptin, plasminogen activator inhibitor-1, tumor necrosis factors and interlukein-6. In overweight and obese individuals, weight loss may improve sensitivity leading to coronary vascular disease and consequently for cardiovascular events. Sharma P. et al. (2005)[17] suggested that inflammation or oxidative stress may be important underlying etiology of metabolic syndrome, which are reported to be associated with metabolic syndrome several reports suggested that for any given BMI Indian tends to have increased waist circumference. The finding of the present study identified abdominal obesity in 66% type-II diabetic patient having BMI < 25 kg/m^2.

McKeigue PM et al (1991)[18], Banerji MA et al. (1999)[19] and Chaudalia M. et al. (1999)[20] reported that Indian have excess body fat, abdominal and trunkle obesity. The observations revealed that greater the duration of disease more was the prevalence of cardiovascular risk factors.The present study compared the prevalence of cardiovascular risk factors and came out with the finding that prevalence of cardiovascular risk factors were more among diabetic subjects having metabolic syndrome than those who were not having metabolic syndrome. Fox et al (2008)[21] reported that approximate prevalence of metabolic syndrome in patients with coronary heart disease was 50%, with a prevalence of 37% in patients with pre-mature coronary artery disease particularly in women. In a study conducted by Nurcan Arat (2008)[22] in 61 patients with angiographically normal coronary arteries were evaluated in two groups according

to presence (32) or absence (29) metabolic syndrome. The patients with metabolic syndrome exhibited hypertension (44%), increase blood glucose (37%), hypertriglyceridemia (31%) a low HDL cholesterol level (30%).The prevalence of these risk factors was low in patients without metabolic syndrome. In the present study estimation of biochemical parameters revealed significantly higher values of all parameters measured in patients with metabolic syndrome compared to patients not having metabolic syndrome.

Conclusion

Diabetes mellitus is a unique endocrinal disorder, the poor control of which leads to complications involving nearly all the system of human body. It is estimated that large majority of patients with diabetes mellitus type-II or impaired glucose tolerance test have the metabolic syndrome. Presence of metabolic syndrome in these populations is associated with higher prevalence of coronary vascular disease than found in patients without metabolic syndrome. The goal of identifying metabolic risk abnormalities in type-II diabetes patients is to prevent mortality and to save the community from the burden of costlier complication of diabetes. The diagnosis of metabolic syndrome and its association with cardiovascular risk factors may point to right direction for effective prevention of cardiovascular complications. As revealed from the study in the type-II diabetes mellitus patients associated with metabolic syndrome, prevalence of cardiovascular risk factor was high.

References

1. World Health Organization Definition diagnosis and classification of diabetes mellitus and its complications report of a WHO consultants part-I (1999) 1993: 1-31. http://www.staff.ncl.ac.uk / Philip.home/who_dmc.htm.

2. Sicree R, Shaw J, Zimmet P. Diabetes and impaired glucose tolerance. In: Gan D, editor. Diabetes Atlas. International Diabetes Federation. 3rd ed. Belgium: International Diabetes Federation; 2006 p. 15-103.

3. Diabetes Fact Sheet N 312, World health organization November 2008 http://www.who.int/mediacentre/factsheet/f312/en/.

4. Lt Gen SR Mehta Col As Kashyap et al. Diabetes mellitus in Indian : The modern scourge MJAFI (2009) 65 (1) : 50-54.

5. Sicree R, Shaw J, Zimmet P. Diabetes and impaired glucose tolerance. In: Gan D, editor. Diabetes Atlas. International Diabetes Federation. 3rd ed. Belgium: International Diabetes Federation; 2006 p. 15-103.

6. Janseen I. Heymsfield; SB. Allison DB kolter DP. Ross R. Body mass index and waist circumference independently contribute to the prediction of non abdominal, abdominal subcutaneous and visceral fat Am. I clin nutr. 2002:75: 683-8.

7. Jidong Song, Yoon-Hu-Choi, Jeong Boe Park Metabolic syndrome is associated with delayed heart rate recovery after exercise J Korean Med. (2006) Sci. 21:621-6.

8. 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). J. Am. Med. Assoc. 2001; 285: 2486–97.

9. R. Gupta, Priyanka Rastogi, M. Sarna VP et al. Body mass index waist size waist hip ratio and cardiovascular risk factors in urban subjects (2007) JAPI vol. 55.

10. Christian Spies MD, Christian Atte MD, Alka Kanaya MD, Sharon S, Pipkin MPH, Nelson B, Schiller MD and Mary A, Whooley MD Association of metabolic syndrome with exercise capacity and heat rate recovery in patient with coronary heart disease in the heart and soul study. The American Journal of cardiology volume (2005) 95 issue 10, P. 1175-1179.

11. Hubert H.B, Feinlib m. mc Namara PM, castelli wp, obestity as an independent risk factor for-cardiovascular disease, a 26-year fallow-up of participants in the Framingham study circulation 67:968-77.

12. Garrison RJ, Castelli WP weight afnd thirty year mortality of men in the Famingham study ann inters

med 103: 1006-09.

13. Jousilhati P. Tjoumelhito J. vartiainen E, pekkanen J, Puska P. body weight cardiovascular risk factors and coronary mortality: 15 year fallow-up of middle-age dmen afnd women in estern finland, circulation (1996) 93: 1372-79.

14. Ming Wel MD, MPH James B, Kampert Ph.D., Carolyn E. Barlow, MS, Million Z, et al. Relationship between low cardio respiratory fitness and mortality in normal weight, over weight and obese men journal of American medical association (1999) 282:1547-1553.

15. Krauss RM, Winston M, Fletcher BJ Grundy SM, obesity impact on cardiovascular disease circulation (1998) 98: 1472-76.

16. J. Sower obesity as a cardiovascular risk factor *1. The American journal of medicine, volume 115, Issue 8, f2003: 37-41.

17. Sharma P, Mishra S. Ajmera P and Mathur S. Oxidative stress in metabolic syndrome. Indian J clin biochem (2005) 20 (1): 150-4.

18. Mckeigue PM. Shah B. Marmati MG. Relationship of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in south-Asians. Lancet (1991) 337:382-6.

19. Banerji MA. Faridi N, Atluri R, chaiken RL, lebority HE, body composition, visceral resistance in Asian Indian men. I clin Endocrinal metab (1999) 84:137-44.

20. Chaudalia M, Abate N, Garg A, Stray Gundersen J, Grund y s m relationship between generalized and upper body obesity to insulin resistance in Asian Indian men. J clin Endocrinal metab-1999; 84:2329-35.

21. Fox K, Jord I, Steg PG, Tendera M, Robetson M, Jerrasi R. Heart rate as a prognostic risk factor in patients with coronary artery disease and left-ventricular systolic dysfunction (BEAUTIFUL) : a subgroup, analysis of a rand omised controlled trial. Lancet; (2008) 372:817-821.

22. Nurcan Arat, Yeliz Sokmen, Jbrahim Akpinas, Zehra Golwasi Exercise capacity in patients with metabolic syndrome in the presence of normal coronary arteries ; turk cardiac derm Ass (2008) : 36: 19-25.