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ORIGINAL RESEARCH

Comparative study of Anthropometric parameters of Obesity, Serum Lipid Profile, and Blood Pressure levels in Type-2 Diabetes Mellitus

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ABSTRACT
Among various types of diabetes, Diabetes mellitus type 2 is a chronic disease and the most prevalent variant. Diabetes mellitus had raised dramatically and predictions tell that it will continue to increase. India has the most number of diabetes patients and increasing rapidly. This study aims to compare patients with diabetes mellitus and non-diabetics. Different methods and protocols have been used to ensure the results and to compare the ratio between male and female patients. The result varies in both male and female patients and the age group.

Keywords: Diabetes mellitus type 2((T2DM)), Obesity, Parameters, Serum lipid profile, Blood pressure, Anthropometric parameters of obesity.

INTRODUCTION

Diabetes mellitus is a heterogeneous chronic metabolic disorder characterized by hyperglycemia and its lethal complications. Among the various types of diabetes, Type2 diabetes mellitus (T2DM) is the most prevalent variant and it is due to a combination of insulin resistance and relative insulin deficiency due to pancreatic β cell failure. T2Dm often has both quantitative and qualitative abnormalities of lipoproteins that are responsible for the increased incidence of microvascular and macrovascular complications.[1]

The worldwide prevalence of diabetes mellitus had risen dramatically. Basing on current trends, the International Diabetes Federation projects that 438 million individuals will have diabetes by the year 2030.2 Although the prevalence of both type 1 and type 2 DM is increasing worldwide, the prevalence of type 2 DM is rising much more rapidly, presumably because of increasing obesity, reduced activity levels as countries become more industrialized and the aging of the population. India is considered the diabetes capital of the world by 2020 AD. It is estimated that 35 million in our country already have diabetes and it is expected to reach 70 to 80 million by 2030. In India, the prevalence is 2-4% in rural and 4.0-11.6% in urban areas.3 Worldwide estimates project that in 2030 the greatest number of

Individuals with diabetes will be aged 45-64 years. Given the present scenario, this work was taken up to study the anthropometric parameters of obesity, serum lipid profile, and blood pressure levels in Type-2 DM

AIM ANDOBJECTIVE

To compare the following parameters between patients with type 2 diabetes mellitus and non-diabetic.

1) Anthropometric parameters of obesity.
2) Serum lipid profile
3) Blood pressure.

MATERIAL AND METHODS

Study site: The study will be conducted in Batra Hospital and Medical Research Centre. **Study Population:** Patient population will be a patient attending OPD and IP in the medicine department and

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family health check-ups. **Study design:** Prospective, Case and Control study (Observational).**Sample size:**220 cases and 220 control. The sample size for this prospective study is calculated as 220 at a 5% level of significance with a power of 80%. It is determined based ona previous study conducted in south India.[34]**Study duration:** 18 months (June 2014-Dec 2015).

CRITERIA

Inclusion Criteria for case group:

1) Newly detected type 2 Diabetes Mellitus
2) Male and female with age >30 years. Exclusion Criteria for case group:
   1) Patients with diabetes mellitus type 1
   2) Diabetes mellitus patient with a complication like: neuropathy, nephropathy, retinopathy, ischemic heart disease.
3) Patient with an acute diabetic complication like

a. diabetic ketoacidosis
b. hypoglycemia,
c. non-ketotic hyperosmolar coma.
a. Patient with any concurrent illness like, chronic liver disease, hypothyroidism, renal disease.
a. Patient on drugs like diuretics, steroids, oral contraceptive pills, beta-blocker.

Inclusion criteria for the control group:

1) Male and female with age >30 years,
2) Not having a history of DM or receiving any diabetic medication.
3) Not having impaired fasting glucose or type 2 diabetes mellitus following fasting blood glucose test.

METHODS FOLLOWED:

1. **Anthropometric parameters of obesity:** as per WHO recommendations by trained field scientists.
2. **Fasting serum lipid profile:** Cholesterol and triglyceride measurements were performed by using standard enzymatic techniques. LDL-cholesterol was performed by using the formula of Friedewald et al.
3. **Venous plasma glucose was measured by the glucose oxidase method.**
4. **Blood pressure measurement:** As mentioned in the measurement protocol.

MEASUREMENT PROTOCOLS[35]

1. **Height**: It was measured against a vertical board with an attached metric rule and a horizontal headboard was brought in contact with the uppermost point on the head. It was recorded bare-foot, with the person standing on a flat surface and weight distributed evenly on both feet, heels together and the head positioned so that the line of vision is perpendicular to the body. The arms were hanging freely by the sides, and the head, back, buttocks, and heels were in contact with the vertical board. The individual was asked to inhale deeply and maintained a fully erect position. The top-most point on the head with sufficient pressure to compress the hairs was taken as height to the nearest of 0.1 cm.
2. **Weight:** Weight was recorded without footwear with light clothes worn on the body, standing straight on the center of the weighing machine with bodyweight evenly distributed between both feet by the ISI certified weighing machine to the nearest 100 gms.
3. **Body mass index** Calculated as wt (kg)/ht2 (mt)
4. **Waist circumference** It was measured in cms with a flexible measuring tape, midway between the inferior margin of the last rib and crest of ilium, in the horizontal plane, at the end of expiration, to the nearest of 0.1 cm. The tape fits snugly and did not compress the underlying soft tissues.
5. **Hip circumference** It was also measured in cms with a flexible measuring tape at the level of maximum extension of buttocks (greater trochanter) bilaterally in the horizontal plane with the subject standing with arms at the sides and feet together with light clothes over the body.
6. **Waist-hip ratio:** WC/HC
7. **Triceps SFT** It is measured in the midline of the posterior aspect of the arm, over the triceps muscle, at a level midway between the lateral projection of the acromion process at the shoulder and the olecranon process of the ulna. Calipers were held in the right hand. A vertical fold of skin and subcutaneous tissue is packed up gently with the left thumb and index finger**.**
8. **Subscapular SFT** SSF is packed up gently on a diagonal, inclined inferolaterally at approximately 450 to the horizontal plane in the natural cleavage lines of the skin. The site is just inferior to the inferior angle on the scapula. The subject stands comfortably erect, with the arms relaxed at the sides of the body.
9. **Blood pressure** was recorded in supine and standing posture after a rest period of 10 min with the standard mercury sphygmomanometer, by the single observer. SBP = At the appearance of Korothkoff's first sound (phase I) DBP = At the disappearance of Korothkoff's sound (phase V)

Statistical analysis

The results are presented in mean ± SD and percentages. The Chi-square test was used to compare the categorical variables between cases and controls. The Unpaired t-test was used to compare the discrete variables between cases and controls. The Pearson correlation coefficient was calculated to find the correlation between the duration of diabetes and other study parameters. The multivariate binary logistic regression was carried out to find the significant factors associated with the risk of diabetes. The p-value< 0.05 was considered significant. All the analysiswas carried out on SPSS 16.0 version

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RESULTS

A total of 220 diabetic cases and 220 non-diabetic (Controls) were included in the study.

Table-1: Age distribution between cases and controls

Age in years	Cases (n=220)		Controls (n=220)		p-value[1]
	No.	%	No.	%	
<50	62	28.2	78	35.5	0.10
51-60	95	43.2	96	43.6	
>60	63	28.6	46	20.9	
Mean± SD	56.24 ± 7.42		53.62 ± 7.50		

[1]Chi-square test

Table-1 shows the age distribution between cases and controls. More than third of the cases (43.2%) and controls (43.6%) were in the age group 51-60 years. However, 28.6% of the cases and 20.9% controls were above 60 years. The mean age of cases and controls was 56.24 (±7.42) and 53.62 (±7.50) years respectively. There was no significant difference (p>0.05) in age between cases and controls showing comparability of the groups in terms of age.

Table-2: Gender distribution between cases and controls

Gender	Cases (n=220)		Controls (n=220)		p-value[1]
	No.	%	No.	%	
Male	116	52.3	129	58.6	0.21
Female	104	47.7	91	41.4	

[1]Chi-square test

Table-2 shows the gender distribution between cases and controls. More than half of the cases (52.3%) and controls (58.6%) were males. There was no significant difference (p>0.05) in gender between cases and controls showing comparability of the groups in terms of gender.

Table-3: Comparison of anthropometric parameters between cases and controls

	Cases (n=220)	Controls (n=220)	p-value[1]
Height in cms	153.62±7.42	165.14±6.81	0.0001*
Weight in kgs	62.41±11.81	67.93±9.91	0.002*
BMI kg/mtr^2	26.49±5.03	25.01±4.02	0.04*
WC	99.22±4.17	87.26±7.43	0.0001*
HC	100.46±8.56	94.61±6.67	0.0001*
WHR	1.00±0.09	0.89±0.12	0.0001*
Triceps SFT	19.72±6.12	16.27±6.34	0.0001*
Subscapular SFT	20.44±3.80	17.93±2.72	0.0001*
Biceps SFT	9.59±3.70	5.77±1.41	0.0001*
SI SFT	23.72±2.53	19.87±3.21	0.0001*
Total skin Thickness	73.54±13.22	59.77±10.12	0.0001*

Table-3 shows the comparison of anthropometric parameters between cases and controls. The height (p=0.0001) and weight (p=0.002) was observed to be significantly lower among the cases compared to controls. However, BMI was found to be significantly higher (p=0.04) higher among the cases (26.49±5.03) than controls (25.01±4.02). The WC, HC, WHR, triceps SFT, subscapular SFT, biceps SFT, SI SFT and total were found to be significantly higher (p=0.0001) among the cases compared to controls.

Table-4: Comparison of blood pressure between cases and controls

	Cases(n=220)	Controls(n=220)	p-value[1]
Supine			
SBP	136.89 ± 22.81	134.53 ± 23.15	0.53
DBP	88.87 ± 11.72	86.13 ± 13.13	0.18
Standing posture			
SBP	132.89 ± 23.61	129.13 ± 25.15	0.34
DBP	90.34 ± 15.12	84.00 ± 14.80	0.01*

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Values are in mean±SD, [1]Unpaired t-test, *Significant

Table-4 shows the comparison of blood pressure between cases and controls. Only DBP in standing posture was found to be significantly (p=0.01) higher among the cases (90.34±15.12) than controls (84.00±14.80).

Table-5: Comparison of blood sugar level between cases and controls

	Cases (n=220)	**Controls (n=220)**	**p-value[1]**
FBS	128.32 ± 36.12	80.00 ± 11.15	0.0001*
PPBS	202.59 ± 55.15	113.57 ± 21.11	0.0001*

Values are in mean ± SD, [1]Unpaired t-test, *Significant

Table-5 shows the comparison of blood sugar level between cases and controls. The increased level of FBS and PPBS was observed among the cases compared to controls and the difference was statistically significant (p=0.0001).

Table-6: Comparison of lipid profile between cases and controls

	Cases (n=220)	**Controls (n=220)**	**p-value[1]**
TC	193.49 ± 22.10	183.82 ± 27.42	0.02*
TG	245.71 ± 41.18	147.76 ± 44.12	0.0001*
HDL	38.75 ± 3.81	47.98 ± 6.14	0.0001*
LDL	104.21 ± 24.22	116.80 ± 96.91	0.27
VLDL	50.70 ± 14.81	29.52 ± 8.12	0.0001*
TC/HDL	5.03 ± 0.71	3.85 ± 0.12	0.0001*

Values are in mean ± SD, [1]Unpaired t-test, *Significant

Table-6 shows the comparison of lipid profile between cases and controls. The increased level of TC, TG, VLDL and TC/HDL ratio was observed among the cases compared to controls and the difference was statistically significant (p<0.05). However, decreased level in HDL was found among the cases than controls and the difference was statistically significant (p=0.0001).

Table-7: Comparison of anthropometric parameters among male and females between cases and controls

Anthropometric parameters	**Male**			**Female**		
	Cases	**Controls**	**p-value[1]**	**Cases**	**Controls**	**p-value[1]**
Height in cms	159.76 ± 5.71	169.28 ±2.62	0.0001*	148.64 ± 4.52	159.76 ±6.81	0.0001*
Weight in kgs	67.79 ±6.21	66.93 ±11.01	0.68	58.05 ±13.52	69.24 ±8.22	0.0001*
BMI kg/mtr^2	26.69 ±3.61	23.34 ±3.82	0.0001*	26.33 ±5.91	27.17 ±3.13	0.46
WC	101.41 ± 2.22	87.09 ±8.91	0.0001*	97.45 ±5.31	87.48 ±5.12	0.0001*
HC	98.15 ±3.80	94.14 ±7.61	0.007*	102.33± 11.12	95.21 ±5.41	0.0001*
WHR	1.03 ±0.02	0.92 ±0.03	0.0001*	0.96 ±0.01	0.86 ±0.12	0.0001*
Triceps SFT	14.95 ±2.11	12.75 ±4.11	0.006*	23.58 ±5.72	20.85 ±6.92	0.06
Subscapular SFT	17.37 ±1.36	16.51 ±2.01	0.04*	22.92 ±3.42	19.78 ±2.31	0.0001*
Biceps SFT	7.97 ±1.91	5.55 ±1.51	0.0001*	10.90 ±4.39	6.06 ±1.12	0.0001*
SI SFT	23.88 ±1.46	20.31 ±3.43	0.0001*	23.60 ±3.17	19.29±2.91	0.0001*
Total skin Thickness	64.21±2.90	55.01±7.61	0.0001*	81.10±13.56	65.98±9.42	0.0001*

[1]Unpaired t-test, *Significant

Table-8: Comparison of blood pressure among male and females between cases and controls

Blood pressure	**Male**			**Female**		
	Cases	**Controls**	**p-value[1]**	**Cases**	**Controls**	**p-value[1]**
Supine						
SBP	144.88 ±26.72	130.70 ±17.91	0.007*	130.43 ±16.72	139.52 ±29.42	0.09
DBP	91.76 ±13.42	83.35 ±9.22	0.002*	86.52 ±9.73	89.76 ±17.21	0.30
Standing posture						
SBP	140.53 ±27.12	123.63 ±18.24	0.002*	126.71 ±18.62	136.30 ±30.62	0.09
DBP	95.00 ±16.13	81.44 ±8.45	0.0001*	86.57 ±12.42	87.33 ±20.12	0.84

[1]Unpaired t-test, *Significant

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Table-9: Comparison of blood sugar level among male and females between cases and controls

Blood sugar level	Male			Female		
	Cases	Controls	p-value[1]	Cases	Controls	p-value[1]
FBS	115.44±16.32	80.12±8.16	0.0001*	138.74±44.51	79.85±14.91	0.0001*
PPBS	174.85±33.72	110.0 ±12.15	0.0001*	225.05±60.14	118.12±26.42	0.0001*

[1]Unpaired t-test, *Significant

Table-10: Comparison of lipid profile among male and females between cases and controls

Lipid Profile	Male			Female		
	Cases	Controls	p-value[1]	Cases	Controls	p-value[1]
TC	190.31 ± 26.21	181.70±30.15	0.19	196.06 ±25.61	186.59 ±23.92	0.10
TG	258.99 ± 46.12	138.71±44.16	0.0001*	234.96 ±44.23	159.55 ±42.41	0.0001*
HDL	38.09 ±4.14	45.28±4.13	0.0001*	39.29 ±2.91	51.50 ±7.94	0.0001*
LDL	100.44± 21.53	108.71±29.83	0.17	107.27 ±26.18	127.34 ±143.23	0.37
VLDL	52.29± 9.12	27.73± 8.81	0.0001*	49.41± 18.16	31.85± 8.13	0.0001*
TC/HDL	5.05 ±0. 34	4.05±0.71	0.0001*	5.01 ±0.60	3.59 ±0.15	0.0001*

[1]Unpaired t-test, *Significant

Table-11: Anthropometric parameters associated with risk of diabetes-Multivariate binary logistic regression

Variables	OR	95.0% C.I. for Odds ratio		p-value
		Lower	Upper	
BMI	1.12	1.02	1.85	0.005*
WC	2.11	1.43	3.10	0.0001*
HC	1.77	1.15	2.94	0.01*
Triceps SFT	1.51	1.29	1.99	0.01*
Total	2.28	1.35	3.88	0.002*

OR-Odds ratio, CI-Confidence interval, *Significant

Table-11 shows the anthropometric parameters associated with the risk of diabetes. The multivariate binary logistic regression analysis revealed that BMI, WC, HC, triceps SFT and total were found to be significantly associated with the risk of diabetes. The BMI was 1.12 times higher among the cases than controls and this was significant (OR=1.12, 95%CI=1.02-1.85, p=0.005). However, WC was found to be
2.11 times higher among the cases compared to controls (OR=2.11, 95%CI=1.15-2.94, p=0.0001).

Table-12: Lipid parameters associated with risk of diabetes-Multivariate binary logistic regression

Variables	OR	95.0% C.I. for Odds ratio		p-value
		Lower	Upper	
TC	1.83	1.11	2.34	0.002*
TG	1.42	1.04	1.90	0.02*
HDL	0.71	0.50	0.99	0.04*
PBPS	1.03	1.00	1.07	0.03*

OR-Odds ratio, CI-Confidence interval, *Significant

Table-12 shows the lipid profile parameters associated with the risk of diabetes. The multivariate binary logistic regression analysis revealed that increased level of TC, TG and PBPS were found to be significantly associated with the risk of diabetes. However, decreased HDL was found to be significantly associated with the risk of diabetes. The TC was 1.83 times higher among the cases than controls and this was significant (OR=1.83, 95%CI=1.11-2.34, p=0.002). However, HDL was found to be 29% lower among the cases compared to controls (OR=0.71, 95%CI=0.50-0.99, p=0.04).

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Table-13: Prevalence of obesity as per BMI among cases and controls

BMI	Cases (n=220)		Controls (n=220)		OR (95%CI), p-value[1]
	No.	%	No.	%	
Underweight	18	8.2	37	16.8	1.00 (Ref.)
Normal	55	25.0	122	55.5	0.92 (0.48-1.77), 0.92
Overweight	99	45.0	46	20.9	4.42 (2.28-8.58), 0.0001*
Obese	48	21.8	15	6.8	6.57 (2.93-14.76), 0.0001*

[1]Logistic regression, OR-Odds ratio, CI-Confidence interval, *Significant

Table-14: Prevalence of overweight as per WC among cases and controls

WC	Cases (n=220)		Controls (n=220)		OR (95%CI), p-value[1]
	No.	%	No.	%	
Overweight	216	98.2	136	61.8	33.35 (11.95-93.02), 0.0001*
Non-overweight	4	1.8	84	38.2	1.00 (Ref.)

[1]Logistic regression, OR-Odds ratio, CI-Confidence interval, *Significant

Table-15: Prevalence of overweight as per WHR among cases and controls

WHR	Cases (n=220)		Controls (n=220)		OR (95%CI), p-value[1]
	No.	%	No.	%	
Central obesity	217	98.6	128	58.2	51.99 (16.12-167.58), 0.0001*
Non-overweight	3	1.4	92	41.8	1.00 (Ref.)

[1]Logistic regression, OR-Odds ratio, CI-Confidence interval, *Significant

Table 16: showing comparison of anthropometric parameters of obesity between present study and other studies

Skinfold thickness (mm): (A) Males

	Subhankar Chowdhury et al.[36]		Robert Feldman et al.[37]		Present Study	
	Cases	Controls	Cases	controls	Cases	controls
Total study population(N)	30	-	149	447	116	129
Biceps skinfoldThickness	-	-	-	-	7.97±1.91	5.55±1.51
Triceps skinfoldThickness	8.53±2.7	-	14.8±6.8	14.3±6.3	14.95±2.11	12.75±4.11
Subscapular skinfoldThickness	16.20±5.31	-	17.8±8.0	16.9±7.2	17.37±1.36	16.51±2.01
Suprailiac skinfoldThickness	-	-	23.7±13.0	22.0±11.7	23.88±1.46	20.31±3.43
Total skinfold Thickness	-	-	-	-	64.21±2.90	55.01±7.61

Table 17: showing comparison of anthropometric parameters of obesity between present study and other studies

Skinfold thickness (mm): (B) Females

	Subhankar Chowdhury et al.[36]		Robert Feldman et al.[37]		Present Study	
	Cases	Control	Cases	Control	Cases	Controls
Total study population (N)	30	-	138	414	104	91
Biceps skinfold Thickness	-	-	-	-	10.90±4.39	6.06±1.12
Triceps skinfold Thickness	14.7±6.97	-	23.5±8.5	23.0±8.5	23.58±5.72	20.85±6.92
Subscapular skinfold Thickness	22.77±10.23	-	21.0± 12.4	18.2± 9.4	22.92± 3.42	19.78± 2.31
Suprailiac skinfold Thickness	-	-	23.7±13.4	21.7±11.7	23.60±3.17	19.29±2.91
Total skinfold Thickness	-	-	-	-	81.10± 13.56	65.98± 9.42

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Table 18: showing comparison of other anthropometric parameters of obesity between present study and other studies

(A) Males

	Subhankar Chowdhury et al.[36]		Han et al.[38]		Present Study	
	Cases	controls	Cases	Control	Cases	controls
Total study population (N)	30	-	63	5794	116	129
Waist circumference (cms)	-	-	100.0±12.5	92.1±10.6	101.41±2.22	87.09±8.91
Hip circumference (cms)	-	-	102.1±8.7	101.7±6.5	98.15±3.80	94.14±7.61
Waist-hip Ratio	0.87±0.04	-	0.977±0.057	0.904±0.07	1.03±0.02	0.92±0.03
Height cms)	-	-	173.1±6.6	178.2=7.2	159.76±5.71	169.28±2.62
Weight (kg)	-	-	85.6±15.8	81.9=11.9	67.79±6.21	66.93±11.0
Body mass index (kg/m^2)	18.52±2.72	-	28.5±4.5	25.7=3.6	26.69±3.61	23.34±3.82

Table 19: showing comparison of other anthropometric parameters of obesity between present study and other studies

(B) Females

	Subhankar Chowdhury et al.[36]		Han et al.[38]		Present Study	
	Cases	controls	Cases	Controls	Cases	controls
Total study population (N)	30	-	51	6592	104	91
Waistcircumference (cms)	-	-	96.7±15.2	80.9±10.9	97.45 ±5.31	87.48 ±5.12
Hipcircumference (cms)	-	-	108.5±13.0	102.2±8.3	102.33 ±11.12	95.21 ±5.41
Waist-hip Ratio	0.91±0.05	-	0.891±0.091	0.790±0.069	0.96 ±0.01	0.86 ±0.12
Height (cms)	-	-	162.9±5.9	165.7±6.7	148.64 ±4.52	159.76 ±6.81
Weight (kg)	-	-	79.3±16.3	68.4±11.4	58.05 ±13.52	69.24 ±8.22
Body mass index (kg/m^2)	21.25±4.76	-	29.9±6.3	24.9±4.1	26.33 ±5.91	27.17 ±3.13

Table 20: showing comparison of serum lipid profile in-between the present study and other studies

(A) Males

	Subhankar Chowdhury et al.[36]		Bhoraskar et al.[39]		Present Study	
	Cases	controls	Cases	Controls	Cases	controls
Total study population (N)	30	-	377	42	116	129
1.Total Cholesterol	190.57 ±50.2	-	187.22 ±26.42	200.3 ±39.4	190.31 ±26.21	181.70 ±30.15
2.HDL Cholesterol	49.91 ±9.02	-	44.28 ±10.21	37.8 ±8.1	38.09 ±4.14	45.28 ±4.13
3.LDL Cholesterol	-	-	107.76 ±29.41	127.5 ±33.2	100.44 ±21.53	108.71 ±29.83
4.VLDL Cholesterol	-	-	-	-	52.29 ±9.12	27.73 ±8.81
5.Triglycerides	127 ±20.67	-	178.09 ±96.08	174.8 ±97.7	258.99 ±46.12	138.71 ±44.16
6. TCH/HDL ratio)	4.02 ±1.52	-	4.62 ±1.37	5.6 ±1.9	5.05 ±0.34	4.05 ±0.71

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Table 21: showing comparison of serum lipid profile in between the present study and other studies
(B) Females

	Subhankar Chowdhury et al.[36]		Bhoraskar et al.[39]		Present Study	
	Cases	controls	Cases	controls	Cases	controls
Total study population (N)	30	-	326	20	104	91
1.Total Cholesterol	218.43 ±68.99	-	206.00 ±36.11	191.5 ±37.7	196.06 ±25.61	186.59 ±23.92
2.HDL Cholesterol	43.79 ±8.36	-	46.09 ±10.38	44.9 ±9.2	39.29 ±2.91	51.50 ±7.94
3.LDL Cholesterol	-	-	122.65 ±33.65	122.2 ±32.9	107.27 ±26.18	127.34 ±143.23
4.VLDL Cholesterol	-	-	-	-	49.41 ±18.16	31.85 ±8.13
5.Triglycerides	129.57 ±21.56	-	187.10 ±84.60	121.6 ±63.7	234.96 ±44.23	159.55 ±42.41
6. TC/HDL ratio)	5.20 ±1.95	-	4.79 ±1.57	4.4 ±1.0	5.01 ±0.60	3.59 ±0.15

Table 22: showing comparison of hypertension in-between present study and other study

		Singh et al.[40]		Present Study	
		Cases	Controls	Cases	Controls
1.Total study population (N)	M	30	707	116	129
	F	25	735	104	91
2. Number of hypertensive patients	M	16(53.3%)	239(33.8%)	122(55.45%)	78(35.45%)

DISCUSSION

1. **Age** The mean age of male and female diabetics is significantly higher than that of non-diabetic subjects. Similar results were observed by Sosenkoet al.[41], Han al.[38]it suggests that as mean age in population advances, the number of people with diabetes also increases.
2. **Anthropometric parameters of obesity**

a. **Skinfold thickness:** The mean biceps, suprailiac, and total skinfold thickness in male and female diabetics were significantly higher than in non-diabetics. It suggests that persons with type 2 DM have increased subcutaneous fat than non-diabetics. Similar results were observed by Robert Feldman et al.[37] Triceps and subscapular skinfold thickness was higher in both sexes in diabetics than non-diabetics, but this is not statistically significant. Total skinfold thickness was higher in female diabetics than male diabetics suggesting increased subcutaneous fat in female diabetics than male diabetics.

b. **Height** The mean height in male and female diabetics was shorter than in those non-diabetic groups and this difference is statistically significant. It suggests that type 2 DM in cross-section surveys is associated with short stature. Similar results were observed by Han et al.[38]

c. **Weight:** The mean weight values were not different in the two groups suggesting a poor marker of body fat.

d. **Body mass index** The mean BMI of male diabetics was 26.69±3.61 and female diabetics 26.33 ±5.91 suggesting that they were overweight (Grade 1 obesity). Similar results were observed by Han et al.[38] There was a statistically significant difference between male diabetics and non-diabetics. Whereas this was not seen between female diabetics and non-diabetics**.**

e. **Waist circumference:** The mean waist circumference was very significantly higher in male and female diabetics than non-diabetics. It suggests the presence of abdominal obesity in type 2 DM. similar results were observed by Han et al.[38]

f. **Hip circumference:** The mean values of hip circumference were higher in male and female diabeticsthannondiabetics which is of statistical significance.

g. **Waist-hip ratio:** The mean values for the waist-hip ratio were very significantly higher in male and female diabetics than non-diabetics. Similar results were observed.by Han et al.[38], sosenko et al.[41]and Singh et al.[40] It suggests that diabetics have central obesity more common than non-diabetic. WHR is the single most important bedside anthropometric parameter of obesity for

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the detection of central obesity. It is a very sensitive indicator of central obesity.

3. Fasting serum lipid profile (Table Nos. 20 and 21)

a. Total cholesterol mean values of total cholesterol among male and female- diabetics, and nondiabetics did not vary significantly suggesting that diabetic dyslipidemias do not alter TCH levels significantly. Similar results were observed by Sosenkoet al.[41] and Bhoraskaret al.[39]

b. HDL – cholesterol: The mean values of HDL-C among male and female diabetics were very significantly lower than that of non-diabetics. Similar results were observed by Sosenkoet al.[41], SubhankarChowdhuryet al.[36], Bhoraskar et al[39]. Low HDL level in diabetics increases the risk of coronary artery diseases.

c. LDL-Cholesterol: The mean values of LDL-C were not different in diabetics and non-diabetics which is one of the features of diabetic dyslipidemia. However, there will be an increase in small, dense LDL-particles which makes it more atherogenic and higher risk for coronary artery disease in diabetics. Similar results were observed by Sosenkoet al.[41] and in literature.

d. VLDL- cholesterol: The mean values of VLDL-C were very significantly higher in diabetics than nondiabetics. This Is because of increased triglyceride production and VLDL is calculated as Triglyceride/5. e. Triglycerides The mean values of TG were very significantly higher in male and female diabetics than non-diabetics. Similar results were observed by Han et al.[38], SubhankarChowdhury et al.[36], Bhoraskar et al[39]. It is one of the features of diabetic dyslipidemia. Hypertriglyceridemia in diabetes can be due to increased production as in euglycemia, poorly controlled glycemia, or obesity.

e. Total cholesterol/HDL-C ratio: The mean values of the TCH/HDL ratio were significantly higher in diabetics than non-diabetics. Similar results were observed by Sosenko et al, SubhankarChowdhury et al and Bhoraskar et al. increased TCH/HDL ratio increased the risk of coronary artery disease.

4. Blood pressure levels (Table No. 22)

a. Systolic BP: There was no difference in SBP levels in diabetic and non-diabetic subjects in supine posture. This is contrary to the literature which says that diabetics will have high SBP levels than non-diabetics. The absence of this difference in the present study can be attributable to receiving anti-hypertensive therapy in both groups for hypertension and selection bias.

b. Diastolic BP: There was no difference in DBP level in diabetic and non-diabetic subjects in the supine posture, as hypertensive patients in both groups were receiving antihypertensive therapy. However, the prevalence of hypertension in type 2 DM was higher in either sex than in non-diabetic subjects. Similar results were observed by Singh et al.[41]

CONCLUSIONS

A. Anthropometric parameters of obesity were significantly higher in male and female diabetics compared to non-diabetic subjects.

1. Biceps, suprailiac, and total skinfold thickness were significantly higher in male and female diabetics than non-diabetics whereas triceps and subscapular skinfold thickness differences between these two groups were not significant.
2. Waist circumference, hip circumference, and waist-hip ratio were significantly higher in male and female diabetics than non diabetics. However, this difference was not observed with weight and bodymass index in females. Body mass index in male diabetics was also significantly higher than male non-diabetics.

B. Serum triglycerides, VLDL-cholesterol, and total cholesterol/HDL ratio were significantly higher in male and female diabetics than non-diabetic subjects. HDL-cholesterol showed an inverse relationship. Total cholesterol and LDL cholesterol did not vary significantly in the two groups.

C. Systolic and diastolic blood pressure levels in supine and standing posture among diabetics and non-diabetics on antihypertensive therapy were not different (statistically). However, the prevalence of hypertension was higher in the diabetic than non-diabetic population.

REFERENCES

1. Assamang G, Schute: The prospective Cardiovascular Minister (procam) study; Prevalence of hyperlipidemia in persons with hypertension and/or diabetes mellitus and the relationship to coronary heart disease: American Heart Journal 1988; 116:1713.
2. Dan L. Longo [et al.]. Harrison's Principles Of Internal Medicine. 18th edition, 2012, chapter 344, pages 2995 to 2998.chapter 77, page 628.
3. Bijani PK, Shah Kokila, Reheja BS, HDL Cholesterol in Diabetes JAPI;1984:32.
4. Lawrence HB, Pancreas, Edinburgh: Chapter 12 in Grays Anatomy, Churchill Livingstone, 1995, 1790 pp.
5. Tripathy BB, Clinical types of diabetes peculiar to tropics, India: Medicine Update, Ed. Ashok Kumar Das, Vol. 8, 1998, 609 pp.
6. Sasan BW et al, Islets of Langerhans, Morphology and its implications, London: Joslin's Diabetes Mellitus, Ed. C. Ronal Kahn, 1st Indian Edition, 1996, 15pp.
7. Jorgenson LN, Rapid acting insulin analogues, India: Novonordisk diabetes updates update 1997 Proceedings, 113 pp.
8. Morris FW et al. Molecular aspects of insulin action, London: Joslins Diabetes Mellitus, Ed. C. Ronal Khan, et al., 1st Indian Edition, 1996, 139 pp.
9. Niall M. et al. Insulin secretion in vivo, London: Joslins Diabetes Mellitus, Ed C. Ronal Khan, et al., 1st Indian Edition, 1996, 82 pp.

DOI: 10.69605/ijlbpr_13.10.2024.71

10. Robert SS, Diabetes Mellitus, India: Cecil Textbook of Medicine, A Prism Indian Edition, 20th Edition, 1996, 1258 pp.
11. American Diabetes Association. Diagnosis and classification of Diabetes mellitus. Diabetes Care 2014; 37(Suppl.1):S81-90.
12. American Diabetes Association, Screening for diabetes, America: Clinical Practice Recommendation, 2002, 21 pp.
13. Daniel W. Foster, Diabetes Mellitus, New York: Harrison's Principle Of Internal Medicine, Ed. Anthony S. Fauci, MD et al, McGraw-Hill, 14th Edition, Vol. 2, 1998, 2060 pp.
14. Krishna das KV, Diabetes mellitus, India: Chapter 99 in Short textbook of medicine, Jaypee Brothers, 1992, 341 pp.
15. Siddharth N. Shah and Archana R. Bhali, Acute metabolic complications in diabetes mellitus, India: Post-graduate medicine, Vol. II, 1997, 278 pp.
16. Shishir Kumar, Insulin history and development, India: NNDU 1996 Proceedings, Ed. Anil Kapur, Health Care Communication, 1996, 25pp.
17. Maji D, Management of diabetes mellitus, Indian guidelines, India: Chapter 40 in Medicine Update, Ed. S.B. Gupta, Vol. 12, 2002, 262 pp.
18. ShyamSundar P, Newer OHAS, Bangalore: in South Zone Diabetes Update 1998 proceedings.
19. Chenz AY and Fantus IG. Oral anti hyperglycemic therapy for type-2 diabetes mellitus. CMAJ.2005; 172(2): 213-26
20. Krishna Das, Diabetes mellitus, India: Chapter 89 in Text of Medicine, Krishna Das. Jaypee Brothers, 3rd Edition, 1999, 407 pp.
21. Tasher T, Obesity in Epidemiology of chronic non-communicable diseases and condition, India: Chapter 6 in park's textbook of preventive and social medicine, Ed. K. Park, BanarsidasBhanot, 16th Edition, Reprint 2001, 296 pp.
22. De Wilde JA, Van Dommelen P, Middelkoop BJC, Appropriate body mass index cut-offs to determine thinness, overweight, and obesity in South Asian children in the Netherlands.
23. Misra A, Vikram NK, Gupta R, Pandey RM, Wasir JS, Gupta VP et al, 2006,"Waist circumference cutoff points and action levels for Asian Indians for identification of abdominal obesity" 2006 Jan;30(1):106-11.
24. Jeffrey SF, Obesity, New York: Chapter 77 in Harrison's principle of internal medicine, Ed. Anthony S. Fauci, et al., McGraw-Hill, 15th Edition, 2001, 479 pp.
25. Henning, BN et al., obesity in type 2 DM, Chapter 56 in Diabetes mellitus: A fundamental and clinical text, Ed. Derek Le Roith, 2nd Edition, 567 pp.
26. Peter, James DYCK et al. Clinical and neuropathological criteria for the diagnosis and staging of diabetic polyneuropathy, London: Chapter 108 in Brain, Ed.P.K Thomas, 1985, 861 pp.
27. Bajaj JS, cellular and molecular biology of adiposity and adipogenesis, Chapter 68 in Medicine Update, Ed. S.B. Gupta, India: Vol. 12, 2002,459 PP.
28. American Diabetes Association, Management of Dyslipidemia in adults with diabetes, America: Clinical Practice Recommendations, 2002, 74 pp.
29. Hemraj BC et al. Classification of Lipid Disorders and Dyslipidemias, Mumbai: Monograph on Lipid Disorder: Implications and Management, Ed. B.B. Tripathy et al., India: college of physician, Academic Wing of Association of Indian Physicians of India, 2002, 35 pp.
30. Henry N. et al., Disorders of Lipoprotein Metabolism, New York: Chapter 344 in Harrison's Principles of Internal Medicine, Ed. Anthony S. Fauci et al., McGraw-Hill, 15th Edition, 2001, 2245 pp.
31. Lily J, Diabetic Dyslipidemia, India: Chapter 97 in Medicine update, Vol. 10, 2000, 547 pp.
32. American Diabetes Association. Diabetes Care. 2014; 37(suppl 1):S14-S80
33. Vijay R, Hypertension in Diabetes, Bangalore: chapter 40 in Type 2 Diabetes, The Indian Scenario, Ed. Jayaram BM Microlabs Ltd, 1st Edition, 2002, 201 pp.
34. Raja Reddy P.I., Jayarama N.2 and Mahesh V. I Department of Physiology, 2 Departmentof General Medicine, 3 Department Community Medicine, Sri Dev Raj Urs Medical College, Tamaka, Kolar-563101, India.
35. Physical status: The use and interpretation of anthropometry, Geneva: Report of a WHO expert committee, WHO technical report series 854, 1995, 324pp.
36. ChowdhurySubhankar, SatinatMukhopadhay, and BR Sengupta, "correlation between adiposity indices and plasma lipids in NIDDM". Journal of Diabetic Association of India, 30:2:28-31.
37. Robert, Feldman MD, et al. 1989, "Difference in diabetic and nondiabetic fat distribution patterns by skinfold measurements", Diabetes, 18:7:478-486.
38. Han TS et al, 1998. "Associations of body composition with type 2 diabetes mellitus". Diabetic Medicine, 15:129-135.
39. Bhoraskar A.S. et al., "Dyslipidemias in middle and upper Socio-economic urban population with or without NLDDM". Journal of Diabetic Association of India, 33:4:84-88.
40. Singh RB et al, 1996, "Clinical characteristics and hypertension among known patients on non-insulin dependent diabetes mellitus in North and South Indians". Journal Diabetic of Association India, 36:2:45-50.
41. Sosenka JM et al. 1993 "Plasma lipid levels at diagnosis in type 2 diabetic patients".Diabetic Medicine: 10:814-819.