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A Correlative Study of Body Composition and Lipid Profile in Postmenopausal Women

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Abstract

Introduction: Cardiovascular disease is a leading cause of mortality in men and women in industrialized world.As Indian population differs in body composition and lifestyle, this study was undertaken to correlate the body composition parameters and lipid profile parameters as well as correlation of these parameters in postmenopausal women. *Materials and Methods*: Sixty-nine postmenopausal women were selected after their consent and divided into two groups. Group-I consists of 32 postmenopausal women within 5 years of menopause and Group-II consists of 37 postmenopausal women after 5 years of menopause. The body composition parameters were measured by classical anthropometry and skin fold callipers and lipid profile parameters were analysed by enzymatic method. Institutional ethical clearance was obtained. *Statistical Analysis*: Data was expressed as mean±SD. Pearson correlation test was used for analysis. p value less than 0.01 was considered statistically significant. *Results*: No statistically significant correlation was found between most of the body composition parameters in both the groups except for the weight (r =-0.3600, p<0.05) BSA (r =-0.3555, p<0.05), and FM (r =-0.3946, p<0. 05) which were significantly correlated with HDL-C in Group-II subjects. *Discussion and Conclusion*: This correlation may be due to increased intra-abdominal adipose tissue, as it has high sensitivity to catecholamine induced lipolysis. Non-esterified fatty acids mobilized from Intra-abdominal adipose tissue into the portal circulation, may increase hepatic production of TG and Apo-B, and increase subsequent export of VLDL particles.

Keywords: Menopause; Correlation; Body Composition; Lipid Profile.

Introduction

Cardiovascular disease is a leading cause of mortality in men and women in industrialized world. The interactions between the various physiological risk factors for cardiovascular disease are complex; the incidence of cardiovascular disease increases with age in both sexes, but in women the risk increases markedly after menopause and eventually becomes equivalent to that of men. This observation has suggested, but has not proven, that estrogens have a protective effect against cardiovascular disease [1-3]. Menopause is a natural event in the ageing process and signifies the end of reproductive years with cessation of cyclic ovarian functions as manifested by cyclic menstruation. It is heralded by menopausal transition, a period when the endocrine, biological and clinical features of approaching menopause begins. The hormonal changes associated with menopause i.e. low plasma levels of estrogen and marked increase in LH and FSH levels exerts a significant effect on plasma lipids and lipoproteins [4].

The BMI matched obese postmenopausal women, had significantly higher, WC, WHR and intra-abdominal fat volume compared with premenopausal women. TC and TG were significantly higher and HDL-C was significantly lower in postmenopausal women. When age matched pre- and postmenopausal women were compared only TC was significantly higher in postmenopausal group [5,6]. However, older postmenopausal women (>50years) had significantly higher WC and WHR compared with younger postmenopausal women (<50years).

There was no difference in total body fat-free or appendicular skeletal muscle mass in healthy premenopausal women and early postmenopausal women. In contrast, total body fat mass was 28% higher and percentage fat 17% higher in postmenopausal women compared with

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premenopausal women. Postmenopausal women had a 49% greater intra-abdominal and a 22% greater abdominal subcutaneous fat area compared to premenopausal women. The menopause related difference in intra-abdominal fat persisted after statistical adjustment for age and total body fat mass, whereas no difference in abdominal subcutaneous fat was noted. A similar pattern of differences in total and abdominal adiposity was noted in sub samples of pre- and postmenopausal women matched for age or fat mass [7,8]. In healthy women, during the time from premenopausal to first year Postmenopausal examinations, the changes in LDL-C, TG, and BMI were larger than those between first and fifth year Postmenopausal examinations [9,10].

There have been studies regarding the effect of menopause on body weight, fat distribution, total fat %, and also on lipid profile, but most of the studies are conducted on western population. As Indian population differs in body composition and lifestyle, this study was undertaken to correlate the body composition parameters and lipid profile parameters as well as correlation of these parameters in postmenopausal women.

Materials and Methods

The present study was conducted in the department of physiology, Shimoga institute of Medical Sciences, Sagar Road, Shivamogga. Sixty-nine postmenopausal women were selected after their consent. The institutional ethical clearance was obtained. The participants were divided into two groups as, Group-I consists of 32 postmenopausal women within 5 years of menopause and Group-II consists of 37 postmenopausal women after 5 years of menopause. All healthy postmenopausal women, who attained menopause by natural means were included. Postmenopausal women who have undergone hysterectomy, diabetic, hypertensive, on hormone replacement therapy, lipid lowering drugs & with H/O Gynaecological& hormonal disorders were excluded.

Measurement of Physiological Parameters

Height was measured on a wooden stadiometer, bearing a flat stand and a vertical surface with marking in centimetres. A sliding head piece was used for accurate work. Height was recorded and expressed in centimetres. Body weight (Wt) of all the subjects was measured by using weighing scale and expressed in kilogram. Body surface area (BSA) in Sq. Mts (m^2) was calculated by Duboi's nomogram. The body mass index was derived by Quetelet's index from body weight (kg)/height (m^2). Waist circumference was measured at narrowest part of torso with plastic tape.

Hip circumference was measured at maximal extension of buttocks with plastic tape. Waist-Hip Ratio was calculated by dividing waist circumference by hip circumference.

Body fat percentage was calculated by using skin fold callipers. A skin fold callipers is a device which measures the thickness of a fold of skin with its underlying layer of fat. By measuring at key locations it is possible to estimate the total percent of body fat of a person. The callipers used is scientifically developed and calibrated. The instrument has springs which exerts certain pressure on skin fold (10g/mm^2) and measures the thickness in millimetres.

The fold of skin with its underlying layer of fat was pulled out and grasped in the fingers of left hand, while holding the callipers in the right hand, the jaws of callipers were held about one fourth inch from the fingers of the left hand, which continues to hold the fold of the skin. The trigger of the callipers was released so that the entire force of the jaws was on the skin folds.

The skin fold thickness was measured on the left side at four sites such as Back of the mid-arm (Triceps), Front of the mid–arm (Biceps), Below the shoulder blade on the back (sub scapular) and Waist area above hip bone (suprailiac). The measurement was taken in all four areas & added together, and then body fat percentage was determined from the chart in the instruction manual.

The fat mass was calculated as FM=Wt/100XBF% and expressed in kilograms. Fat free mass was calculated and expressed in kilograms as FFM=Weight-fat mass. Fat mass index was calculated from fat mass in (kg)/Height in (m^2). Muscle Mass was calculated by knowing fat free mass as MM=50% of FFM.

Measurement of Lipid Profile Parameters

After overnight fasting 2ml of venous blood was collected from each subject and centrifuged at 3000rpm for 15min to obtain the serum which was used for analysis.

The level of Triglyceride, Total-cholesterol, HDL-cholesterol, LDL- cholesterol, VLDL- cholesterol were measured using semi-automated analyser (Erba star 21 plus) using commercially available kits.

Statistical Analysis

Data was expressed as mean±SD. The pearson correlation test was used to correlate the body composition and lipid profile between two groups of postmenopausal women. P value less than 0.05 was the level of significance.

Results

In the present study, we evaluated and correlated all the body composition parameters and lipid profile between post menopause of five years with post menopause of ten years. The correlation betweenbody weight, and total cholesterol, triglyceride, HDL, LDL, VLDL, total cholesterol to HDL ratio and HDL to LDL ratio was found to be nonsignificant ($p>0.05$) in group I whereas, body weight was significantly negatively correlated with HDL in group-II subjects ($r=-0.3600$, $p<0.05$, Table 1).

The correlation of body mass index, waist circumference, hip circumference, waist hip ratio, fat percentage, free fat mass, muscle mass with total cholesterol, triglyceride, HDL, LDL, VLDL, total cholesterol to HDL ratio and HDL to LDL ratio was found to be nonsignificant ($p>0.05$, Table 1,2,3,4).

Table 1: Correlation of body weight, body mass index and body surface area with the lipid profile in two different groups

Sl. No	Parameter	Group-I(N=32)			Group-II(N=37)		
		R	P	S/NS	R	P	S/NS
1	Wt vs TC	-0.1539	>0.05	NS	-0.008	>0.05	NS
2	Wt vs TG	0.2179	>0.05	NS	0.1682	>0.05	NS
3	Wt vs HDL	-0.3148	>0.05	NS	-0.3600	<0.05	S
4	Wt vs LDL	-0.1726	>0.05	NS	0.0141	>0.05	NS
5	Wt vsVLDL	0.2261	>0.05	NS	0.1660	>0.05	NS
6	Wt vs TC/HDL	0.1594	>0.05	NS	0.2659	>0.05	NS
7	Wt vs HDL/LDL	0.0260	>0.05	NS	-0.1245	>0.05	NS
8	BMI vs TC	-0.0200	>0.05	NS	-0.0787	>0.05	NS
9	BMI vs TG	0.3089	>0.05	NS	-0.0030	>0.05	NS
10	BMI vs HDL	-0.3193	>0.05	NS	-0.1105	>0.05	NS
11	BMI vs LDL	-0.0728	>0.05	NS	-0.0557	>0.05	NS
12	BMI vsVLDL	0.3353	>0.05	NS	-0.0040	>0.05	NS
13	BMI vs TC/HDL	0.2771	>0.05	NS	0.0787	>0.05	NS
14	BMI vsHDL/LDL	-0.0608	>0.05	NS	0.0843	>0.05	NS
15	BSA vs TC	-0.2780	>0.05	NS	0.0583	>0.05	NS
16	BSA vs TG	0.0656	>0.05	NS	0.2291	>0.05	NS
17	BSA vs HDL	-0.2878	>0.05	NS	-0.3555	<0.05	S
18	BSA vs LDL	-0.2354	>0.05	NS	0.0616	>0.05	NS
19	BSA vsVLDL	0.0374	>0.05	NS	0.2269	>0.05	NS
20	BSA vs TC/HDL	0.0224	>0.05	NS	0.2625	>0.05	NS
21	BSA vsHDL/LDL	0.0735	>0.05	NS	-0.2175	>0.05	NS

Table 2: Correlation of waist circumference, hip circumference and waist-hip ratio with the lipid profile in two different groups

1	WC vs TC	0.0173	>0.05	NS	0.0794	>0.05	NS
2	WC vs TG	0.2538	>0.05	NS	0.0938	>0.05	NS
3	WC vs HDL	-0.2433	>0.05	NS	-0.2218	>0.05	NS
4	WC vs LDL	-0.2450	>0.05	NS	0.0990	>0.05	NS
5	WCvsVLDL	0.2668	>0.05	NS	0.0920	>0.05	NS
6	WCvsTC/HDL	0.2546	>0.05	NS	0.2579	>0.05	NS
7	WC vs HDL/LDL	-0.0655	>0.05	NS	0.0800	>0.05	NS
8	HC vs TC	-0.1192	>0.05	NS	0.0447	>0.05	NS
9	HC vs TG	0.3025	>0.05	NS	0.1517	>0.05	NS
10	HC vs HDL	-0.2998	>0.05	NS	-0.2668	>0.05	NS
11	HC vs LDL	-0.1732	>0.05	NS	0.0566	>0.05	NS
12	HC vsVLDL	0.3203	>0.05	NS	0.1503	>0.05	NS
13	HC vs TC/HDL	0.2256	>0.05	NS	0.2454	>0.05	NS
14	HC vsHDL/LDL	0.0224	>0.05	NS	-0.0648	>0.05	NS
15	WHR vs TC	0.2720	>0.05	NS	0.0480	>0.05	NS
16	WHR vs TG	0.0007	>0.05	NS	0.0529	>0.05	NS
17	WHR vs HDL	0.1015	>0.05	NS	-0.0283	>0.05	NS
18	WHR vs LDL	0.2604	>0.05	NS	0.0678	>0.05	NS
19	WHR vsVLDL	-0.0014	>0.05	NS	-0.0539	>0.05	NS
20	WHRvsTC/HDL	0.1170	>0.05	NS	0.0883	>0.05	NS
21	WHRvsHDL/LDL	-0.1439	>0.05	NS	-0.0346	>0.05	NS

Table 3: Correlation of body fat percentage, fat mass and free fat mass with the lipid profile in two different groups

1	BF% vs TC	-0.0458	>0.05	NS	-0.1493	>0.05	NS
2	BF% vs TG	0.2500	>0.05	NS	0.1510	>0.05	NS
3	BF% vs HDL	-0.2746	>0.05	NS	-0.2457	>0.05	NS
4	BF% vs LDL	-0.0849	>0.05	NS	-0.1503	>0.05	NS
5	BF% vsVLDL	0.2691	>0.05	NS	0.1500	>0.05	NS
6	BF%vsTC/HDL	0.2532	>0.05	NS	0.0894	>0.05	NS
7	BF%vsHDL/LDL	-0.0447	>0.05	NS	0.0714	>0.05	NS
8	FM vs TC	-0.1382	>0.05	NS	-0.0883	>0.05	NS
9	FM vs TG	0.2202	>0.05	NS	0.1865	>0.05	NS
10	FM vs HDL	-0.2883	>0.05	NS	-0.3946	<0.05	S
11	FM vs LDL	-0.1667	>0.05	NS	-0.0678	>0.05	NS
12	FM vsVLDL	0.2343	>0.05	NS	0.1849	>0.05	NS
13	FM vsTC/HDL	0.1700	>0.05	NS	0.2415	>0.05	NS
14	FM vsHDL/LDL	0.0316	>0.05	NS	-0.0678	>0.05	NS
15	FFM vs TC	-0.1661	>0.05	NS	0.0566	>0.05	NS
16	FFM vs TG	0.1955	>0.05	NS	0.1323	>0.05	NS
17	FFM vs HDL	-0.3247	>0.05	NS	-0.2912	>0.05	NS
18	FFM vs LDL	-0.1703	>0.05	NS	0.0775	>0.05	NS
19	FFM vsVLDL	0.1957	>0.05	NS	0.1304	>0.05	NS
20	FFM vsTC/HDL	0.1315	>0.05	NS	0.2538	>0.05	NS
21	FFM vsHDL/LDL	0.0200	>0.05	NS	-0.1572	>0.05	NS

Table 4: Correlation of fat mass index and muscle mass with the lipid profile in two different groups.

1	FMI vs TC	-0.0583	>0.05	NS	-0.1245	>0.05	NS
2	FMI vs TG	0.2731	>0.05	NS	0.0671	>0.05	NS
3	FMI vs HDL	-0.2961	>0.05	NS	-0.1944	>0.05	NS
4	FMI vs LDL	-0.1044	>0.05	NS	-0.1086	>0.05	NS
5	FMI vsVLDL	0.2955	>0.05	NS	0.0663	>0.05	NS
6	FMI vsTC/HDL	0.2460	>0.05	NS	0.1005	>0.05	NS
7	FMI vsHDL/LDL	-0.0265	>0.05	NS	0.0781	>0.05	NS
8	MM vs TC	-0.1606	>0.05	NS	0.0557	>0.05	NS
9	MM vs TG	0.1924	>0.05	NS	0.1330	>0.05	NS
10	MM vs HDL	-0.3217	>0.05	NS	-0.2918	>0.05	NS
11	MM vs LDL	-0.1637	>0.05	NS	0.0775	>0.05	NS
12	MM vsVLDL	0.1924	>0.05	NS	0.1312	>0.05	NS
13	MM vsTC/HDL	0.1319	>0.05	NS	0.2539	>0.05	NS
14	MM vsHDL/LDL	0.0173	>0.05	NS	-0.1568	>0.05	NS

The correlation between body surface area and total cholesterol, triglyceride, HDL, LDL, VLDL, total cholesterol to HDL ratio and HDL to LDL ratio was found to be nonsignificant (p>0.05) in group I whereas, body surface area was significantly negatively correlated with HDL in group-II subjects (r=-0.3555, p<0.05, Table 2). The correlation between fat mass and total cholesterol, triglyceride, HDL, LDL, VLDL, total cholesterol to HDL ratio and HDL to LDL ratio was found to be nonsignificant (p>0.05) in group I whereas, body surface area was significantly negatively correlated with HDL in group-II subjects (r=-0.3946, p<0.05, Table 3).

Discussion

In the present study, the mean values of body weight, BMI, BSA, WC, HC, FM, FFM, FMI and MM were more in Group-I compared to Group-II and WHR and BF% were more in Group-II compared to Group-I but not statistically significant. All the body composition parameters were within physiological limits in both the groups except BF% and FM which were found to be above the normal range.

The body composition parameters and lipid profile parameters were correlated in both Group-I and Group-II subjects. No statistically significant correlation was found between most of the parameters in both the groups except for the weight (r =-0.3600, p<0.05) BSA (r =-0.3555, p<0.05), and FM (r =-0.3946, p<0. 05) which were significantly correlated with HDL-C in Group-II subjects. This correlation may be due to increased intra-abdominal adipose tissue, as it has high sensitivity to catecholamine induced lipolysis. Non-esterified fatty acids mobilized from Intra-abdominal adipose tissue into the portal circulation, may increase hepatic production of TG and Apo-B, and increase subsequent export of VLDL particles. Increased VLDL-TG in turn depress circulating concentrations of HDL-C due to the action of cholesterol–ester transfer protein [11,12]. Further study with more sophisticated methods like dual x-ray absorptiometry, computerized tomography scan and magnetic resonance imaging to measure body composition parameters may throw a better light in correlating body composition parameters with lipid profile parameters.

Conclusion

There was no statistically significant correlation between most of the body composition parameters and lipid profile parameters in both the groups except for the weight, BSA and FM which were significantly negatively correlated with HDL-C in Group-II subjects. This correlation may be due to an increased intra-abdominal adipose tissue, as it has high sensitivity to catecholamine induced lipolysis.

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