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Body Mass Index, Waist Hip Ratio And Atherogenic Index In Premenopausal And Postmenopausal Women

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Abstract:

It is a known fact that the incidence of cardiovascular diseases is lower in young women than young men. The reasons for this are not known but one of the possible factors may be the different hormonal makeup of the two sexes. Obesity measured either as body mass index (BMI), waist size or waist hip ratio (WHR) and Atherogenic index(AI) are the major determinants of cardiovascular risk factors. Hence we undertook this study to compare these parameters- BMI, WHR and Atherogenic index between women of reproductive age group and post menopausal age group. 50 premenopausal and 50 postmenopausal women were randomly selected for the study. Their BMI and WHR were calculated. AI was calculated after estimating their total cholesterol and HDL cholesterol. On comparison by Z test we found that As compared to reproductive age group, in postmenopausal women there is increase in BMI, WHR and atherogenic index.These changes are favorable for development of atherosclerosis which is one of the important cause for coronary artery disease. These changes are mainly due to decreased level of oestrogen in postmenopausal age which has got various effects on lipid profile. Hence post menopausal women should be guided to have proper physical exercise, and diet to avoid any cardiovascular complications.

1.Introduction

It is well recognized that the incidence of cardiovascular diseases is lower in young women than young men. But with advancing age, incidence of cardiovascular diseases in women tends to approach that of men. The reasons for this are not known but one of the possible factors may be the different hormonal makeup of the two sexes.[1]

Obesity measured either as body mass index (BMI), waist size or waist hip ratio (WHR) is a major determinant of cardiovascular risk factors. WHR is also an important determinant of hypercholesterolemia, low HDL and hypertriglyceridemia.

BMI is the most commonly used indicator of obesity in population studies. But it does not take into account body fat patterning as waist size, WHR and skin fold thickness do. Increased central or visceral fat independent of relative body weight is associated with a variety of metabolic disorders and increased cardiovascular mortality.[2,3]

2.Aims And Objectives

- To compare the Body mass index between women of reproductive age group and post menopausal age group.
- To compare the Waist hip ratio between women of reproductive age group and post menopausal age group.
- To compare the Atherogenic index between women of reproductive age group and post menopausal age group.

3.Materials And Methods

The present study is of cross sectional type conducted in 100 women. The study protocol was approved by the ethical committee of the institute. The subjects were selected randomly from the wards of Sassoon General hospital.

3.1.Inclusion Criteria

3.1.1.<u>Age Groups</u>

- Women between age group of 25-35 years.
- Women between 45-55 years of age in post menopausal age group, whose menstruation had ceased two years back.

3.1.2.<u>Diet</u>

Only vegetarian subjects were selected. (As diet affects lipid profile.)

3.1.3.<u>Socioeconomic Status</u>

lower middle and upper lower socioeconomic class.

3.2.Exclusion criteria

The subjects with history of

- Smoking, drinking alcohol, tobacco chewing

- Diabetes mellitus, hypertension (BP>140/90 mm Hg) or family history

- suggestive of Coronary heart disease

- Any major illness

- Taking drugs which are known to affect lipid metabolism, like statin drugs

- were excluded from the study.

The selected subjects were divided into two groups

Group		No. of subjects
I	Reproductive age group	50
II	Postmenopausal age group	50

Table 1

Before the actual study, written consent was taken from the selected subjects. Proper history of each subject was recorded. It included name, age, address, present medical illness, past history, family history, type of diet and menstrual history. Systemic examination of each subject was carried out. An evaluation of following parameters was done.

- Body mass index (BMI) in Kg/m^2

- Waist hip Ratio (WHR)

- TC: HDL-C Ratio - Atherogenic index

3.3.Measurement Of Height And Weight

Standing heights of subjects were recorded using stadiometer with heels together and heels, calf, buttocks and preferably back touching the stadiometer. The height was measured, without footwear, to the nearest one centimeter.

The weight was measured to the nearest 0.1 kg, in standing position; subjects were wearing light clothes and were bare footed.

3.4.Body Mass Index (BMI)

It is also known as Quetelet's index.[4] It was calculated by following formula

$$BMI = \frac{Weight\ (kg)}{[Height\ (m)\ ]^2}$$

3.5.Waist-Hip Ratio (WHR)

Waist circumference was measured at midpoint between lower border of rib cage and the iliac crest.[5]

Hip circumference was measured at the maximum protrusion of gluteal muscles or at the level of greater trochanter of femur.[5]

$$WHR = \frac{Waist\ circumference\ (cm)}{Hip\ Circumference\ (cm)}$$

The circumference was measured with a measuring tape with a least count of 1 mm, when subject was in standing position and breathing normally.

3.6.Collection Of Blood Sample

From the women of reproductive age group, blood samples were collected during 6th to 10th day of menstrual cycle as hormonal level varies with phases of menstrual cycle. Serum lipid profile levels are more accurate when blood samples are collected 8-10 hrs after the last meal. So instructions were given to the subjects to take dinner at 9-10 pm and remain fasting overnight till blood samples were collected in the next day morning. Blood samples were collected in the morning between 7-8 am by venepuncture of antecubital vein, with all aseptic precautions. 5ml of blood was collected with disposable syringe in plain bulb. Clear, unhaemolysed serum was obtained by centrifuging blood at 3000 rpm for 15 min.

Total Cholesterol Estimation was done by CHOD-PAP method. Estimation of HDL cholesterol was done by Phosphotungstic acid method.

3.6.1.Atherogenic Index

Atherogenic index was calculated by using the formula,

$$\text{Atherogenic index} = \frac{\text{Total Cholesterol}}{\text{HDL-C}}$$

3.7.Statistical Analysis

All the values of above parameters were arranged in tabular form and analysis was done by SPSS software version 11, by using "Z" test and correlation. P value <0.05 was considered as statistically significant.

4.Results

Parameters	Group I (Reproductive age group)	Group II (Postmenopausal age group)	Z Value	P Value
	Mean ± SD (n=33)	Mean ± SD (n=33)		
Height (Cms)	153.26 ± 8.06	152.38 ± 6.46	0.87	>0.05
Weight (Kgs)	51.49 ± 8.31	55.15 ± 6.32	2.02	<0.05
BMI (Kg/m2)	22.35 ± 2.36	24.45 ± 3.98	2.85	<0.01

Table 2: Comparison Of Height, Weight And Body Mass Index In Study Groups

Table 2 shows mean values and standard deviations of height, weight and BMI in group I in comparison to that of group II.

Among two groups there is no significant difference in height(P>0.05).

The mean weight in group II is higher than that of group I and the difference is statistically significant(P<0.05).

The mean BMI in group II is higher than that of group I and the difference is statistically significant(P<0.01).

Parameter	Group I (Reproductive age group)	Group II (Postmenopausal age group)	Z Value	P Value
	Mean ± SD (n=33)	Mean ± SD (n=33)		
WHR	0.80 ± 0.04	0.85 ± 0.03	3.73	<0.001

Table 3: Comparison of Waist-Hip ratio in study groups

Table 3 shows that the mean value of WHR in group II is higher than that of group I and the difference is statistically significant(P<0.001).

Parameter	Group I (Reproductive age group)	Group II (Postmenopausal age group)	Z Value	P Value
	Mean ± SD (n=33)	Mean ± SD (n=33)		
TC/HDL	2.79 ± 0.58	5.08 ± 0.86	12.69	<0.0001

Table 4: Comparison of TC/HDL ratio in study groups

Table 4 shows mean values and standard deviations of TC / HDL (Atherogenic index) of group I (Reproductive age group) in comparison with that of group II (Postmenopausal age group).

Atherogenic Index is higher in group II as compared with that of group I and the difference is highly significant (P<0.0001).
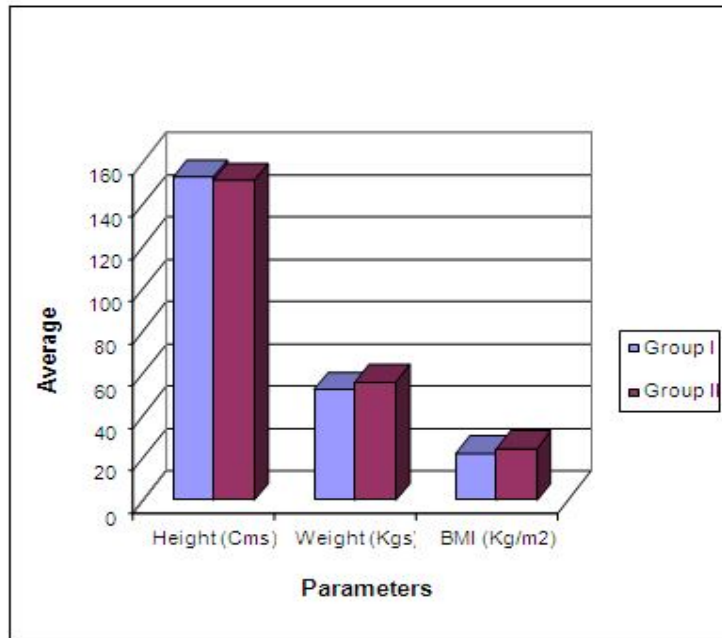
Figure 1: Multiple Bar diagram showing comparison of Height, Weight and Body Mass Index between group I (reproductive age group) and group II (postmenopausal age group).
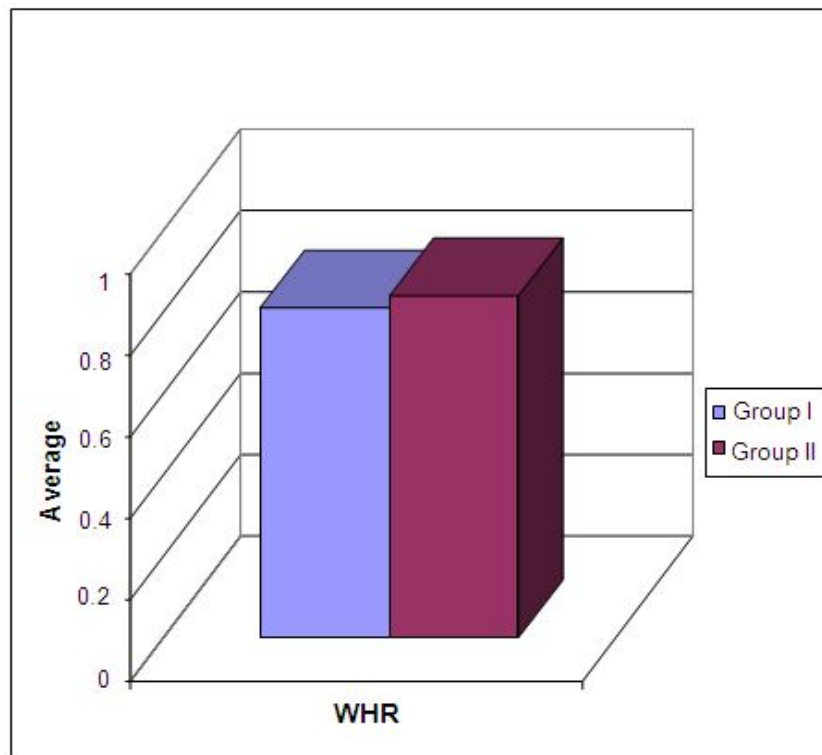

Figure 2 : Multiple Bar diagram showing comparison of Waist Hip Ratio between group I (reproductive age group) and group II (postmenopausal age group).
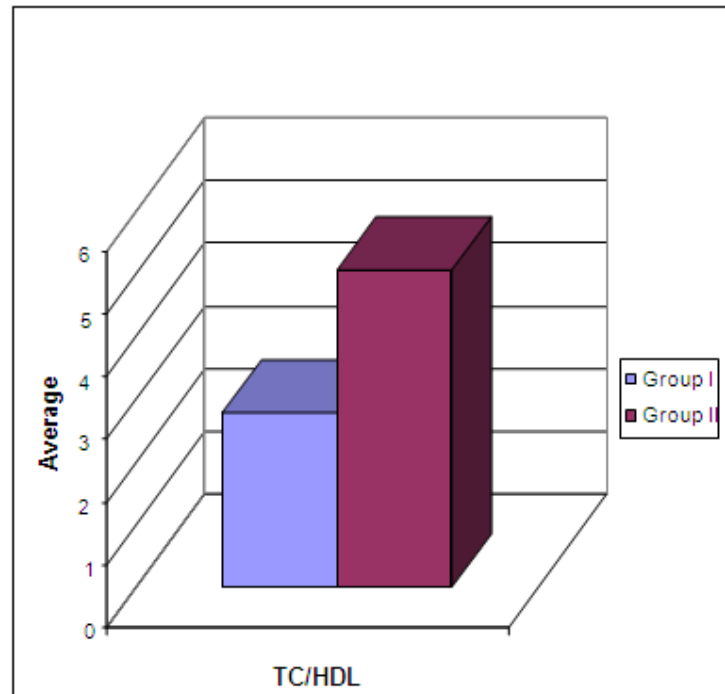
Figure 3: Multiple Bar diagram showing comparison of TC/HDL between group I (reproductive age group) and group II (postmenopausal age group).

5.Discussion

In the present study, estimation of Atherogenic Index and measurement of Body Mass Index and Waist Hip Ratio was carried out in reproductive age group and postmenopausal age group.

Postmenopausal women have significantly higher BMI as compared to reproductive age group($P<0.01$) as shown in table 1 and Fig 1. Table 2 and Fig 2 show that the mean values of WHR in postmenopausal women are higher than that of reprouctive age group and the difference is statistically significant($P<0.001$). Atherogenic Index was higher in postmenopausal women as compared with that of premenopausal women and the difference was highly significant ($P<0.0001$).

Although obesity is an important determinant of lipoprotein levels, the distribution of body fat is also critical.[6,7] More recently, body fat distribution, as assessed by various skinfold and circumference measurements, has been related to diabetes and coronary heart disease.[8,9]

WHR has been consistently related to adverse levels of triglycerides and HDL-C.[4,7-9] In contrast, levels of total cholesterol are less strongly associated with body fat distribution.[4]

Specific genetic factors also determine central deposition of fat with its metabolic correlates, including the risk of cardiovascular diseases.[10]

These menopause related changes in body fat distribution are related to oestrogenic depletion after menopause. As a result of oestrogenic depletion, the women have lower sex hormone binding globulin, which increases free androgen level and this results into higher androgenicity.[5]

Also in postmenopausal women, there is higher activity of lipoprotein lipase in the abdominal subcutaneous adipose tissue than the premenopausal women. [11] Lipoprotein lipase is an extracellular enzyme which is present at the luminal surfaces of the capillaries of most of the tissues, but predominantly those of adipose tissue and cardiac and skeletal muscle. It hydrolyses the triacylglycerol contained in chylomicrons and VLDL to yield fatty acids and glycerol. Fatty acids are stored by the adipose tissue or utilized for energy by the muscle. Glycerol is used by liver.
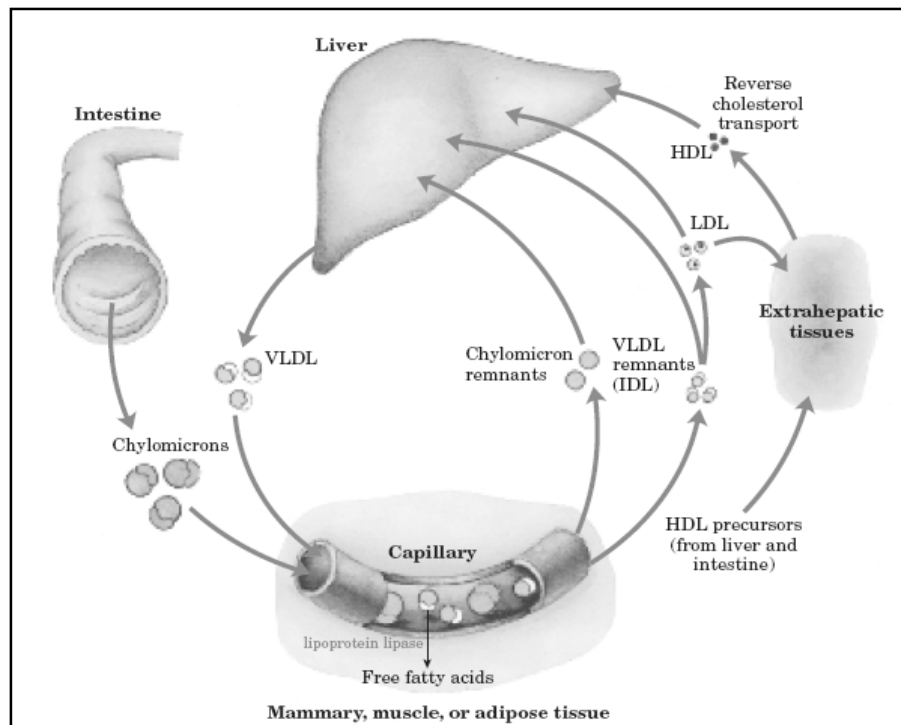

Figure 4: Lipoproteins and lipoprotein transport

These physiological changes may result in a more male type central adipose tissue distribution after menopause causing increase in WHR.

Hormone Replacement Therapy can prevent central distribution of fat which explains the role of sex hormones.

Changes in BMI and WHR can be related to reduced physical activity and mental stress during postmenopausal period. During reproductive age, a lady is exposed to possibly more stressful conditions which release hormones like epinephrine, nor-epinephrine. They enhance activity of adenyl cyclase by binding to receptors on the surface of adipocytes and thus increase lipolysis. Thus there is less fat accumulation.

Thus collectively speaking, the increments of total body fat and central fat distribution during menopausal period is influenced by hormonal changes as well as decreased level of physical activity and mental stress during this period.

Conclusion

As compared to reproductive age group, in postmenopausal women there is –

- Increase in BMI
- Increase in WHR
- Increase in atherogenic index

These changes are favorable for development of atherosclerosis which is one of the important cause for coronary artery disease. These changes are mainly due to decreased level of oestrogen in postmenopausal age which has got various effects on lipid metabolism. Since HRT has its own limitations, it can't be used as a routine treatment. It should be restricted to particular group of patients. Majority of post menopausal women should be guided to have proper physical exercise, dietary habits and if needed HRT and psychiatric help in order to have happy, healthy and enjoyable life after menopause.

6.Reference

1. Hjortland MC, McNamara PM, Kannel WB. Some atherogenic concomitants of menopause : The framingham study. American journal of epidemiology 1976; 103: 304-311.

2. Gupta M R, Rastogi P, Sarna, Gupta VP, Sharma SK, Kothari K. Body- mass index, waist-size, waist-hip ratio and cardiovascular risk factors in urban subjacts. JAPI 2007; 55: 621-27.

3. Crawford SL and Johannes CB. The epidemiology of cardiovascular disease in postmenopausal women. J Clin Endocrinol Metab 1999; 84(6): 1803-1806.

4. Freedman DS, Jacobsen SJ, Barboriak JJ. Body fat distribution and male / female differences in lipids and lipoproteins. Circulation 1990; 81: 1498-1506

5. Chang CJ, Wu CH, Yao WJ, Yang YC, Wu JS, Lu FH. Relationships of age, menopause and central obesity on cardiovascular disease risk factors in Ch Kissebah AH, Freedman DS, Peiris AN. Risk of obesity. Med Clin North Am 1989; 73: 111-138.

6. Kissebah AH, Freedman DS, Peiris AN. Risk of obesity. Med Clin North Am 1989; 73: 111-138.

7. Vague J. The degree of masculine differentiation of obesities: A factor determining predisposition to diabetes, atherosclerosis, gout and uric calculous disease. Am J Clin Nutr 1956; 4: 20-34.

8. Hartz AJ, Rupley DC, Kalkhoff RD, Rimm AA. Relationship of obesity to diabetes: Influence of obesity level and body fat distribution. Prev Med 1983; 12: 351-357.

9. Stern MP, Haffner SM. Body fat distribution and hyperinsulinemia as risk factors for diabetes and cardiovascular disease. Arteriosclerosis 1986; 6: 123-30

10. Samras, Spector TD, Nguyen TV, Baan K, Campbell LV, Kelly PJ. Independent genetic factors determine the amount and distribution of fat in women after menopause. J Clin Endocrinol Metab 1997; 82: 781-85.

11. Rebuffe-Scrive M, Lonnroth P, Marin P, Wesslau C, Bjorntorp P, Smith U. Regional adipose tissue metabolism in men and postmenopausal women. Int J Obes 1987; 11: 347-55.

12. Nelson DL, Cox MM. Lehninger principles of biochemistry.4th ed:787-832.