

# A Prospective Study on the Incidence of Metabolic Syndrome in Premenopausal and Postmenopausal Women

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ABSTRACT

**Background:** Metabolic syndrome is defined as a state of metabolic dysregulation characterized by insulin resistance, a predisposition to Type 2 diabetes mellitus and atherosclerotic vascular disease. The changing hormonal milieu with altered estrogen and testosterone ratio is the cause of metabolic syndrome at menopausal transition. **Aims and Objectives:** This study was designed to determine the incidence of metabolic syndrome and its various components in premenopausal and postmenopausal women from Punjab. **Materials and Methods:** This study was conducted on 200 females in the age group of 45–60 years attending outpatient department over a period of 2 years in the Department of Obstetrics and Gynaecology, Bebe Nanki Mother and Child Care Centre, Government Medical College, Amritsar. A detailed history and physical examination were done and recorded on a pro forma. Biochemical assessment comprising fasting blood glucose, triglycerides, and cholesterol was done. Metabolic syndrome was assessed as per the modified NCEP ATP III criteria. **Results:** Twenty-nine percent women were found to have newly onset metabolic syndrome, the incidence in premenopausal group was 16%, and in postmenopausal group was 42%. Among the components, the incidence of hypertension (58%) was the highest followed by waist circumference (42%). Maximum correlation of metabolic syndrome was found with high-density lipoprotein (odds ratio - 7.250) followed by waist circumference (odds ratio - 7.111). **Conclusion:** The incidence of metabolic syndrome was found to be higher in postmenopausal women than in premenopausal women. Currently, the need of the hour is lifestyle modification to reduce the emergence of metabolic syndrome and cardiovascular diseases.

**KEYWORDS:** Menopause, metabolic syndrome, postmenopausal women, premenopausal women

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## INTRODUCTION

The metabolic syndrome is a complex metabolic dysregulation that predicts future development of Type 2 diabetes mellitus and cardiovascular disease.<sup>[1]</sup> It is also called as syndrome X and insulin resistance syndrome. Metabolic syndrome is a clustering of impaired glucose metabolism, dyslipidemia, hypertension, and central obesity.<sup>[2]</sup>

There has been an increase in the incidence of metabolic syndrome in India and other South Asian Countries. The changes are attributed to sedentary lifestyle modification, socioeconomic transitions, and rural to urban migration.<sup>[3]</sup>

The incidence of metabolic syndrome among pre- and post-menopausal women has ranged from 13.8% in premenopausal to  $\geq 60\%$  in postmenopausal women varying greatly in different populations.<sup>[4]</sup>

Menopause is defined as the absence of menses for 12 consecutive months. It is defined by the World Health Organization, as the permanent cessation of menses

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due to the loss of ovarian follicular function or surgical removal of the ovary.<sup>[4]</sup> As per the Indian Menopause Society, average age of menopause is  $46.2 \pm 4.9$  years in Indian women with an average life expectancy of 71 years.<sup>[3]</sup> It is much less than western counterparts (51 years).

The etiology of the metabolic syndrome is unknown, but it is thought to be a combination of factors. Menopausal transition leads to decreased estrogen, which is thought to be cardioprotective and antiatherogenic. The decline in the estrogen/androgen ratio dilutes the vasorelaxant effects of estrogen on the vessel wall and promotes the production of vasoconstrictive factors such as endothelin, which leads to metabolic abnormalities culminating into metabolic syndrome. As there is a higher occurrence of obesity in the Punjabi community, this study was designed to calculate the incidence of metabolic syndrome in premenopausal and postmenopausal women of Punjab, especially Amritsar.

## MATERIALS AND METHODS

This study was conducted on 200 females in the age group of 45–60 years attending outpatient department in the Department of Obstetrics and Gynaecology, Bebe Nanki Mother and Child Care Centre, Government Medical College, Amritsar. The study was conducted after approval from the institutional thesis and ethical committee. The women were recruited in the study after an informed consent. Inclusion criteria comprised women in the age group of 45–60 years, and exclusion criteria included women on hormone replacement therapy, secondary hypertension and congenital obesity syndrome, smokers and alcoholics, and chronic medical illness such as hypothyroidism, Cushing's disease, and Type 1 diabetes mellitus.

An elaborated history with reference to age, occupation, drug history, past history, family history, obstetric history, and menstrual history was taken, and the clinical examination was done and recorded on the pro forma. Socioeconomic status was recorded as per the Kuppaswamy's socioeconomic scale. Physical examination comprising the evaluation of weight, height, body mass index (BMI), waist circumference, hip circumference, and waist-to-hip ratio, systolic and diastolic blood pressure (DBP) was done. Biochemical assessment was done with venous blood sample obtained after 8–12 h fasting and assessed for triglycerides, fasting blood sugars, high-density lipoproteins (HDLs) and low-density lipoproteins, and total cholesterol.

Women were considered to have metabolic syndrome if they had any three or more of the following (modified NCEP ATP III criteria):

- Central obesity: waist circumference  $\geq 80$  cm
- Hypertriglyceridemia: serum triglycerides level  $\geq 150$  mg/dl
- Low HDL cholesterol  $< 50$  mg/dl
- High blood pressure (BP): systolic BP (SBP)  $\geq 130$  mmHg and/or DBP  $\geq 85$  mmHg or on treatment for hypertension
- High fasting glucose: serum glucose level  $\geq 100$  mg/dl or on treatment for diabetes.

After finding the incidence, the association of metabolic syndrome with different factors was seen taking care of the confounders. Then, the influence of duration of menopause on metabolic syndrome was determined. The incidence of individual component of metabolic syndrome in these women was calculated taking care of the confounders. Results were tabulated and subjected to statistical analysis.  $P < 0.05$  was considered statistically significant.

## RESULTS

Table 1 shows that out of the study group of 200 women, 29% of women were found to have newly onset metabolic syndrome. The incidence in premenopausal group was 16%, and in postmenopausal group was 42%. The difference was found to be statistically significant ( $P < 0.05$ ).

Table 2 shows that among the components of metabolic syndrome, the incidence of hypertension (58%) was highest followed by waist circumference (42%), abnormal triglyceride (40%), abnormal HDL (37%), and minimum incidence being that of diabetes/abnormal fasting (34%) in the total study population.

Table 3 shows that age, HDL level, waist circumference, waist-to-hip ratio, systolic and diastolic BP showed

**Table 1: Incidence of metabolic syndrome**

Metabolic syndrome	Number of cases (%)		
	Premenopausal	Postmenopausal	Total
Absent	84 (84.0)	58 (58.0)	142 (71.0)
Present	16 (16.0)	42 (42.0)	58 (29.0)
Total	100 (100.0)	100 (100.0)	200 (100.0)

**Table 2: Incidence of components of metabolic syndrome**

Components	Number of cases (%)	
	Premenopausal	Postmenopausal
Waist circumference	20 (20)	64 (64)
Hypertension	38 (38)	78 (78)
HDL	16 (16)	58 (58)
Triglyceride	26 (26)	54 (54)
Fasting blood sugar	22 (22)	46 (46)

HDL: High-density lipoprotein

a significant difference between premenopausal and postmenopausal women ( $P < 0.05$ ).

Table 4 shows that out of 42 postmenopausal women with metabolic syndrome, 40 had increased ( $\geq 5$  years) duration since menopause ( $P = 0.004$ ).

Table 5 shows that with increasing duration of menopause, waist circumference, BP, and fasting blood glucose increased but the difference was not statistically significant. The levels of HDL cholesterol and triglyceride increased significantly with increasing duration since menopause.

Table 6 shows that out of the 42 postmenopausal women having metabolic syndrome, 61.5% were homemakers, thus concluding that nonprofessional women have increased chances of developing metabolic syndrome than professional women.

Table 7 shows that the incidence of metabolic syndrome was found to be more in women with parity  $>3$ . The difference between the premenopausal and postmenopausal was found to be statistically significant. With increasing parity, various body and hormonal changes occur which increases the chances of development of the metabolic syndrome.

Table 8 shows that maximum correlation of metabolic syndrome was found with HDL (odds ratio - 7.250) followed by waist circumference (odds ratio - 7.111), hypertension (odds ratio - 5.785), triglyceride (odds ratio - 3.341), and least correlation was found with diabetes (odds ratio - 3.020).

## DISCUSSION

Metabolic syndrome increases the risk of cardiovascular diseases as well as morbidity and mortality due to it. On the other hand, menopause with its incidental hormonal changes appears to increase the risk of cardiovascular disease independently of normal aging, and premenopausal women may be protected against cardiovascular diseases compared with men and postmenopausal women of a similar age.<sup>[5]</sup> The present study was conducted enrolling total number of 100 premenopausal and postmenopausal women. This study was intended to determine the incidence of metabolic syndrome and its components in premenopausal and postmenopausal women, as well as the association between the menopausal status and metabolic syndrome with its components.

In our study, the incidence of metabolic syndrome in the overall study group was 29%. The incidence of metabolic syndrome was found to be 16% in premenopausal group and 42% in postmenopausal group, and the difference

**Table 3: Mean of all components in both groups**

Components	Premenopausal	Postmenopausal	P
Age (years)	48.74±2.028	52.40±4.155	0.000
SBP (mmHg)	129.92±13.65	140.72±19.83	0.03
DBP (mmHg)	84.24±10.94	88.40±11.82	0.01
HDL level (mg/dl)	62.88±12.51	46.00±12.2	0.00
Triglyceride (mg/dl)	153.06±35.32	169.52±43.88	0.041
Waist circumference (cm)	80.66±6.92	86.00±9.14	0.001
Waist to hip ratio	0.91±0.08	0.93±0.05	0.04

HDL: High-density lipoprotein, SBP: Systolic blood pressure, DBP: Diastolic blood pressure

**Table 4: Metabolic syndrome and duration of menopause**

Years since menopause	Metabolic syndrome		Total
	Absent	Present	
<5	24	2	36
>5	34	40	74
Total	58	42	100

**Table 5: Components with duration of menopause**

Components	Duration since menopause (years)		P
	<5	>5	
HDL <50 mg/dl	8	50	0.021
Triglyceride >150 mg/dl	6	48	0.00
Waist circumference (cm) >80 cm	14	50	0.375
SBP >130 and DBP >85 mmHg	22	56	0.503
Fasting blood glucose $\geq 100$ mg/dL	6	40	0.06

HDL: High-density lipoprotein, SBP: Systolic blood pressure, DBP: Diastolic blood pressure

**Table 6: Metabolic syndrome and occupation**

Group	Metabolic syndrome		Total Number of Cases (%age)
	Absent cases (%age)	Present cases (%age)	
Premenopausal			
Nonprofessional (homemaker)	52 (83.9)	10 (16.1)	62 (100.0)
Professional	32 (84.2)	6 (15.8)	38 (100.0)
Total	84 (84.0)	16 (16.0)	100 (100.0)
Postmenopausal			
Nonprofessional (homemaker)	20 (38.5)	32 (61.5)	52 (100.0)
Professional	38 (79.2)	10 (20.8)	48 (100.0)
Total	58 (58.0)	42 (42.0)	100 (100.0)

in both the groups was found to be statistically significant ( $P = 0.004$ ). The results of our study were partly in accordance with study by Ahuja.<sup>[6]</sup> It was seen that 28% of the study group had metabolic syndrome, of which 21% were postmenopausal, and 7% were premenopausal women. Our results were in accordance

**Table 7: Metabolic syndrome and parity**

Group	Metabolic syndrome overall		Total Number of Cases (%age)
	Absent cases (%age)	Present cases (%age)	
Premenopausal (parity)			
<3	82 (82)	2 (2)	84 (84)
>3	2 (2)	14 (14)	16 (16)
Total	84 (84)	16 (16)	100 (100)
Postmenopausal			
<3	58 (58)	4 (4)	62 (62)
>3	0 (0)	38 (38)	38 (38)
Total	58 (58)	42 (42)	100 (100)

**Table 8: Correlation of other components with incidence of metabolic syndrome**

Component	OR
HDL	7.250
Waist circumference	7.111
BP	5.785
Triglyceride	3.341
Fasting blood sugar	3.020

OR: Odd ratio, BP: Blood pressure, HDL: High-density lipoprotein

with study by Toppo *et al.*,<sup>[7]</sup> which was conducted enrolling 300 each premenopausal and postmenopausal women at Raipur from March 2015 to August 2016, according to the overall prevalence of metabolic syndrome in premenopausal and postmenopausal women was found to be 38% as per the NCEP criteria.

In our study, the incidence of different components of metabolic syndrome in the study population was also calculated. The highest incidence was found for hypertension (58%) followed by waist circumference (42%), high triglyceride (40%), low HDL (37%), and diabetes (34%). Our study was partially in agreement with the study done by Gupta *et al.*,<sup>[8]</sup> in which they found maximum prevalent component of metabolic syndrome to be hypertension (51%) followed by waist circumference (34%), triglyceride (33%), and diabetes (17%).

In our study, the component whose incidence was highest in premenopausal and postmenopausal group was hypertension (58%). Out of 90 women with SBP >130 mmHg, 60 women were postmenopausal, and 30 were premenopausal. The difference was statistically significant ( $P = 0.002$ ). Out of 106 women with diastolic BP >85 mmHg, 68 women were postmenopausal as compared to 38 women who were premenopausal. The difference was found to be statistically significant ( $P = 0.071$ ). The mean SBP in premenopausal and postmenopausal women was found to be 129.92 and 140.72 mmHg, respectively.

The difference was statistically significant ( $P = 0.002$ ). However, the mean diastolic BP in premenopausal and postmenopausal women was 84.24 and 88.40 mmHg, respectively. The difference was not found to be statistically significant ( $P = 0.071$ ). Our findings were in total accordance with the study done by Cho *et al.*,<sup>[9]</sup> which showed significantly higher levels of SBP among postmenopausal women than premenopausal women ( $P \leq 0.001$ ), whereas mean DBP, though, elevated in postmenopausal women, but was not statistically significant from the premenopausal group.

In our study, the incidence of abnormal waist circumference was found to be 42% in overall study group. Out of 100 postmenopausal women, 64 (64%) women were found to have waist circumference  $\geq 80$  cm. This finding was in agreement with the study done by Ruan *et al.*<sup>[10]</sup> in Pakistan, where the frequency of high waist circumference was 57%, and it was significantly higher in females (89%) as compared to males (47%).

In our study, the incidence of diabetes in premenopausal and postmenopausal group was found to be 34% overall. Out of 34% of women with abnormal fasting blood sugar, 46 women were postmenopausal, and 22 were premenopausal. The mean fasting blood glucose level in premenopausal and postmenopausal women was found to be 105.44 mg/dl and 169.69 mg/dl, respectively.

A significant difference was found in serum triglyceride levels which were greater in postmenopausal group as compared to premenopausal group. Our results were in accordance with the study done by Figueiredo *et al.*<sup>[11]</sup>

Our study also found a statistically significant difference in the levels of HDL among premenopausal and postmenopausal women. Out of 74 women with HDL levels <50 mg/dl, 58 women were postmenopausal, and 16 women were premenopausal. Another study by Pandey *et al.*,<sup>[4]</sup> which enrolled 45 premenopausal and 45 postmenopausal women, also concluded that postmenopausal women had lower levels of HDL cholesterol.

Our study also tried to find the effect of BMI on the occurrence of metabolic syndrome. The difference was not found to be statistically significant ( $P = 0.788$ ).

As the age of menopause depends on various factors such as inheritance, smoking, number of pregnancies, and use of contraceptive pills, there is enough evidence showing wide range of variations in the mean age of menopause across various countries. Our study found a significant effect of age on the incidence of metabolic syndrome, which is in agreement with most of the studies conducted in the past.

In our study, out of 42 postmenopausal women with metabolic syndrome, 36 women had achieved menopause before the age of 50 years. Women having early menopause were found to have higher incidence of metabolic syndrome. In our study, the mean age of menopause was found to be 44.39 years, lower than other parts of country, concluding that women in this part of country are at more risk of developing metabolic syndrome, even after matching the confounding factors such as obesity and hypertension, which were highly significant in our study in Punjab. This was in agreement with the study carried by Jesmin *et al.*<sup>[12]</sup>

## CONCLUSION

The overall occurrence of metabolic syndrome was found to be higher in postmenopausal women than in premenopausal women. The higher occurrence may be attributed to the higher prevalence of obesity and hypertension in the people of North India, especially Punjab. Hence, the need of the hour is to better understand the factors contributing to metabolic syndrome and cardiovascular diseases. Hence, lifestyle modifications and changes in dietary habits can help a long way to decrease the morbidity and mortality associated with metabolic syndrome.

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## Conflicts of interest

There are no conflicts of interest.

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