ORIGINAL RESEARCH

Prevalence of Metabolic Syndrome and Associated Factors among Menopausal Women in District Nuh

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ABSTRACT
Background: Metabolic syndrome is a cluster of the most dangerous cardiovascular risk factor associated with diabetes and raised fasting plasma glucose, abdominal obesity, high cholesterol and high blood pressure. Primary cause of metabolic syndrome has been suggested to be central obesity and insulin resistance. The problem is increasing because of upsurge of sedentary life habits. Moreover, among postmenopausal women obesity and increased weight gain is seen along with other risk factors of metabolic syndrome. This study has been planned to determine the prevalence of metabolic syndrome and thus to facilitate improvement of the burden due to this syndrome in the aspirational district Mewat, Nuh.
Objectives: To assess the disease burden due to metabolic syndrome in district Nuh, Haryana.
Material and Methods: A community based cross-sectional analytical study conducted in the area catered by PHC Nuh, Haryana. Study population comprised of 315 postmenopausal women aged 45-80 years following inclusion and exclusion criteria and willing to participate. Data was collected with the help of self-designed study proforma which was pre-tested and pre-validated before use which include assessment of insulin resistance, BMI, blood pressure, triglyceride and HDL levels.
Results: In our study the metabolic syndrome was prevalent among 101 (32.06%) of the total 315 study postmenopausal women. Results shows significant relationship between metabolic syndrome and insulin resistance, BMI, blood pressure, triglyceride levels and HDL levels.
Conclusion: Significant presence of metabolic syndrome and its components among the postmenopausal women of the study area indicate that they are at higher risk for developing diabetes and cardiovascular diseases in future.
Keywords: Metabolic syndrome, Postmenopausal women.

INTRODUCTION:

Metabolic syndrome also called as insulin resistance or syndrome X. It is an important risk factor for cardiovascular disease (CVD), type 2 diabetes mellitus (DM) and it consists of a combination of metabolic abnormalities that includes insulin resistance, central obesity, hypertension, high triglycerides and low HDL levels.[1]

As defined by International Diabetes Federation metabolic syndrome is a combination of the most dangerous cardiovascular risks factor including diabetes mellitus and elevated fasting plasma glucose, abdominal obesity, high cholesterol and high blood pressure.[2] Primary underline cause of metabolic syndrome has been suggested to be central obesity and insulin resistance.[3,4] The problem is increasing because of upsurge of sedentary life habits.

According to WHO guidelines diagnostic criteria for clinical diagnosis of metabolic syndrome is presence of insulin resistance or glucose >6.1 mmol/L (110 mg/dl), 2hour glucose>7.8mmol (140mg/dl) required along with any two or more of the following:[5]

1.   HDL cholesterol <0.9 mmol/L (35 mg/dl) in men, <1.0 mmol/L (40 mg/dl) in women.
2.   Triglycerides (TG) >1.7 mmol/L (150mg/dl).
3.   Waist/hip ratio >0.9 (men) or >0.85 (women) or BMI >30 kg/m2.
4.   Blood pressure $>140/90$ mmHg

Postmenopausal women are predisposes to increased prevalence of metabolic syndrome. The cause of this increased burden of metabolic syndrome in this population may be directly due to ovarian insufficiency and/or indirectly due to metabolic consequences of central fat distribution resulting from deficient estrogen.[6]

It is estimated that around 20-25% people worldwide are suffering from metabolic syndrome. According to recent studies there is two times increased risk of developing cardiovascular diseases and 5fold increased risk of developing type 2 diabetes mellitus in people suffering from metabolic syndrome.[2] The primary underline cause of metabolic syndrome has been suggested to be central obesity and insulin resistance. Exact etiology still not found, it is a multifactorial syndrome, it increases with age, degree of obesity and sedentary lifestyle.[7]

No such study is available regarding burden of metabolic syndrome among postmenopausal women in this demographic area. Therefore this study has been planned to determine the prevalence of metabolic syndrome to facilitate improvement of the burden due to this syndrome in the aspirational district Mewat, Nuh.

AIM: To assess the disease burden due to metabolic syndrome in district Nuh, Haryana
OBJECTIVES:
1.   To estimate the prevalence of metabolic syndrome among Postmenopausal women in area catered by PHC Nuh and Nagina, district Nuh.
2.   To study association of selected factors with metabolic syndrome among Postmenopausal women.

MATERIAL & METHODS

Study Design: A community based cross-sectional analytical study was conducted in the area catered by PHC Nuh, Haryana
Study Period: between October 2021-April 2022
Study Subjects: 315 postmenopausal women (PMW) residing in the study area
Inclusion Criteria

Postmenopausal women who are residents of area giving written informed consent to participate in the study.

Exclusion Criteria

1. Critically ill / bed ridden patients not able to participate in the study.
2. Hysterectomy done before the onset of natural menopause.
3. Oophorectomy done before onset of natural menopause.
4. Any obvious pathological condition suggestive of causing cessation of menstruation.

Sampling Methodology:

The study was conducted in the area catered by the PHC Nuh and Nagina. All the villages of the study area were listed along with Anganwadi centers (AWCs) located in those villages. From the list, 15 AWCs selected randomly using the lottery technique. One at a time Anganwadi worker was contacted and house to house visit was performed including filling of proforma with sample collection. All the participants were first informed one day prior to the visit for overnight fasting by their Anganwadi worker. Initially written informed consent taken from the participant after explaining the details about the procedure to be done. After that proforma was completed for each subject including demographic information, menopausal status, followed by general physical examination including BP, height and weight. After completion of examination venous blood sample was collected.

Data Collection Methods:

The data was collected with the help of self-designed interview schedule/study proforma which was pretested and pre-validated before use. With written informed consent, study subjects were interviewed and general physical and clinical examination was done as per the study proforma. Blood sample was collected for the biochemical analysis required to fulfill the criteria of the study.

Basal Metabolic Index (BMI): BMI was calculated using the formula weight (kg)/height^2 (m).

5ml venous blood sample was collected after a 12 hour overnight fasting from antecubital vein under all aseptic conditions. Triglyceride, HDL and blood glucose were estimated by cobas c 501 autoanalyzer by enzymatic colorimeter method and serum insulin analysis done by sandwich ELISA method at SHKM Govt Medical College, Nuh.

Indirect index for the assessment of Insulin resistance was calculated by using HOMA- IR index uses the formula by Mathews et al.:

Insulin Resistance $=$ insulin(mU/l) $\times$ [glucose (mg/dl) $\div$ 405][8]

Data Management and Statistical Analysis:

The data entry was done in the Microsoft EXCEL spreadsheet and the final analysis was done with the use of Statistical software. For statistical significance, p value of <0.05 was considered statistically significant.

Ethical Consideration

The proposed study entitled "prevalence of metabolic syndrome and associated factors among menopausal women in district Nuh" was conducted at the Department of Biochemistry, Shaheed Hasan Khan Mewati, Govt. Medical College, Nuh, Haryana after authorization by institutional ethics committee approval n0.EC/OA- 14/2021 Dated 25.02.2021. Informed consent was taken from all the study subjects. No drugs were used in the study. All the procedures used in the study do not carry any harmful effect on the patient. Thus, the present study is well within the ethical norms and ethically justified.

RESULTS

Majorityi.e.,169(53.65%) of study participants (postmenopausal women) were in the age group above 60 years. Age group was <60 years of only 146 out of 315 study subjects (46.35%).

Metabolic syndrome was present in only 101 out of 315 patients (32.06%). (table1).

Table 1: Distribution of metabolic syndrome of study subjects

Metabolic syndrome	Frequency	Percentage
No	214	67.94%
Yes	101	32.06%
Total	315	100.00%

Association of anthropometric parametric and metabolic syndrome among study postmenopausal women was examined statistically. These findings are presented in table 2. Proportion of study postmenopausal women with metabolic syndrome was significantly higher among postmenopausal women with body mass index >=30 kg/m² (78.57%) as compared to those with BMI <18.5 kg/m² (10%), 18.5 to 24.9 kg/m²normal BMI}(20.31%), 25 to 29.99 kg/m²{overweight}(34.90%). Proportion of study postmenopausal women without metabolic syndrome was significantly higher among postmenopausal women with normal BMI as compared to those with BMI >=30 kg/m². (p value<.0001)

Significant association was seen in body mass index (kg/m²) with metabolic syndrome (p value <.05).

Table 2: Association of anthropometric parameters with metabolic syndrome

Anthropometric parameters	Study subjects with metabolic syndrome [n=101]		Study subjects without metabolic syndrome [n=214]		Total (N=315)	P value
Body mass index (kg/m²)						
<18.5kg/m²	1 (10%)		9 (90%)		10 (100%)	
{Underweight}	[0.9%]		[4.2%]		[3.17%]	
18.5to24.99kg/m² {Normal BMI}	26 [25.7%]	(20.31%)	102 [47.6%]	(79.69%)	128 (100%) [40.6%]	
25 to 29.99 kg/m²	52	(34.90%)	97	(65.10%)	149 (100%)	<.0001*
{Overweight}	[51.4%]		[45.3%]		[47.3%]	
>=30kg/m²	22	(78.57%)	6 (21.43%)		28 (100%)	
{Obese}	[21.7%]		[2.8%]		[8.8%]	
Total	101 [100%]	(32.06%)	214 [100%]	(67.9%)	315(100%) [100%]	
Mean ± SD	27.12 ± 3.7		24.37 ± 3.83		25.25 ± 4	
Median (25th - 75th percentile)	28 29.922)	(24.974-	24.83 27.701)	(21.244 -	25.72 (21.782- 28.429)	<.0001‡
Range	17.9-32.39		15.82-31.86		15.82-32.39	

‡ **Mann Whitney test, * Fisher's exact test**

Observations of comparison of triglyceride and HDL (mg/dl) levels with status of metabolic syndrome are shown in table 3. Proportion of study postmenopausal women with metabolic syndrome was significantly higher among those with high triglyceride levels(i.e.,43.81%) as compared to those with normal triglyceride levels {<=150 mg/dL} (i.e., 2.25%). Proportion of study postmenopausal women without metabolic syndrome was significantly higher among those with normal triglyceride levels {<=150 mg/dL(i.e.,97.75%) as compared to those with high triglyceride (i.e.,56.19%). (p value <.0001)

Proportion of study postmenopausal women with metabolic syndrome was significantly higher in low HDL {<40 mg/dL} (42.50%) as compared to normal HDL {40 to <60 mg/dL} (26.67%), high HDL {>=60 mg/dL} (13.33%). Proportion of study postmenopausal women without metabolic syndrome was significantly higher in high HDL (86.67%) as compared to low HDL and normal HDL.

Significant association was seen in Triglyceride(mg/dL) and HDL(mg/dL) profile with metabolic syndrome. (p value<.05).

Table 3: Association of Triglyceride and HDL with metabolic syndrome

TG & HDL	Study subjects with metabolic syndrome [n=101]	Study subjects without metabolic syndrome [n=214]	total (N=315)	P value
Triglyceride (mg/dL)				
Normal {<=150 mg/dL}	2 (2.25%) [1.98%]	87 (97.75%) [40.65%]	89 (100%) [28.2%]	<.0001*
High {>150 mg/dL}	99 (43.81%) [98.01%]	127 (56.19%) [59.34%]	226 (100%) [71.1%]	
Total	101 (32.06%) [100%]	214 (67.9%) [100%]	315(100%) [100%]	
Mean ± SD	200.48 ± 32.55	165.4 ± 40.8	176.64 ± 41.66	
Median (25th-75th percentile)	197 (179-213)	165 (131-189)	179 (143-201)	<.0001‡
Range	131-289	110-280	110-289	
HDL (mg/dL)				
Low {<40 mg/dL}	51 (42.50%) [50.49%]	69 (57.50%) [32.24%]	120 (100%) [38.09%]	
Normal {40 to <60 mg/dL}	48 (26.67%) [46.15%]	132 (73.33%) [61.68%]	180 (100%) [57.1%]	0.005*
High {>=60 mg/dL}	2 (13.33%) [1.98%]	13 (86.67%) [6.07%]	15 (100%) [4.7%]	
Total	101 (32.06%)	214 (67.9%)	315(100%)	

	[100%]	[100%]	[100%]	
Mean ± SD	38.12 ± 9.37	42.48 ± 11.01	41.08 ± 10.69	<.0001‡
Median (25th-75th percentile)	39 (31-43)	42 (37-47)	41 (35-46)	
Range	18-83	20-83	18-83	

*fisher's exact test, ‡ Mann Whitney test, † Chi square test

Mean ±SD, median and range of systolic and diastolic blood pressures(mmHg) among study postmenopausal women with and without metabolic syndrome are presented in table 4. Significant association of systolic blood pressure (mmHg) was seen with metabolic syndrome (p value <.05). Median (25th-75th percentile) of systolic blood pressure (mmHg) in study postmenopausal women with metabolic syndrome was 142 (134-150) which was significantly higher as compared to study postmenopausal women without metabolic syndrome 134(128-138.75).

Table 4: Association of blood pressure (mmHg) with metabolic syndrome

Blood pressure (mmHg)	Study subjects with metabolic syndrome (n=101)	Study subjects without metabolic syndrome (n=214)	Total (N=315)	P value
Systolic blood pressure (mmHg)				
Mean ± SD	141.42 ± 12.16	133.93 ± 11.63	136.33 ± 12.29	<.0001‡
Median (25th-75th percentile)	142 (134-150)	134 (128-138.75)	135 (128-143.5)	
Range	116-164	102-164	102-164	
Diastolic blood pressure (mmHg)				
Mean ± SD	84.41 ± 8.24	83.28 ± 7.83	83.64 ± 7.97	0.357‡
Median (25th-75th percentile)	84 (80-90)	82 (78-88)	83 (78-88)	
Range	60-98	60-100	60-100	

‡ Mann Whitney test

DISCUSSION

The present study has highlighted the problem of metabolic syndrome (MetS) in this area. In the study conducted by Sharma et al., 2016, conducted a cross sectional study in the postmenopausal women in North India among 350 women in the 45-55 years age group. The results of the study showed that prevalence of the metabolic syndrome (MetS) in the study sample was 62.6% with more frequency in the older and obese women.[6] Chhabra et al., 2014

prevalence of MetS in rural postmenopausal women of North India was found to be 41%.[9] Pathania et al., 2013, found prevalence of MetS among postmenopausal women as 66%.[10] Other studies conducted - Christakis, Marie, et al (2020) conducted a cross-sectional analysis of Canadian women aged 45-85 years old in 2020 and found that 32.6% of postmenopausal women meet criteria for Metabolic syndrome.[11] The results of study carried out by Marchi R D et al. (2016) showed that MetS was significantly higher in the postmenopausal women (22.2%)[12]; Rajesh et al., 2016 conducted a study among Females of Jimma Town SouthWest, Ethiopia and found that prevalence of metabolic syndrome using different criteria was 41.2% (IDF) and 26.1% (NCEP) in age group 45-54 years and 37.9% (IDF), 21.1% (NCEP) in age group >54 years.[13] Jouyandeh et al., 2013 conducted a cross sectional study in which the prevalence of the Metabolic Syndrome among postmenopausal women in Tehran was estimated to be around 30% which were very similar to the findings of the presentstudy.[14]

It is apparent from compiled results of these studies that postmenopausal female segment of population has higher figures of the problem of metabolic syndrome, irrespective of criteria and region.

Significant presence of metabolic syndrome and its components in these postmenopausal women indicated that they are at higher risk for developing diabetes and cardiovascular diseases in the nearby future

CONCLUSION

In our study the metabolic syndrome was prevalent among 101 (32.06%) of the total 315 study postmenopausal women. Results shows significant relationship between metabolic syndrome and insulin resistance, BMI, blood pressure, triglyceride levels and HDL levels

The prevalence of metabolic syndrome and its components in the postmenopausal women of Nuh has illustrated that living in rural areas, low socioeconomic status, menopause and older age might be the reasons for their higher magnitudes These women have paucity of awareness of metabolic syndrome risk factors and its complications with less accessibility to proper health care facilities. Significant presence of metabolic syndrome and its components in these postmenopausal women indicated that they are at higher risk for developing diabetes and cardiovascular diseases in the nearby future. Therefore early identification of metabolic syndrome components would help to reduce the risk of related morbidity and mortality.

REFERENCES

1. Mgrundy S. Metabolic Syndrome: Connecting and Reconciling Cardiovascular and Diabetes Worlds. Pages 1093-1100, ISS.2006;47:1093–100.
2. Alberti KG, Zimmet P, Shaw J. Metabolic syndrome-a new world-wide defi nition. A Consensus Statement from the International Diabetes Federation. Diabet Med 2006 May;23(5):469-80
3. Appel, S. J., Jones, E. D., & Kennedy-Malone, L. Central obesity and the metabolic syndrome: implications for primary care providers. Journal of the American Academy of Nurse Practitioners 2004,16(8),335–342.
4. Roberts, C. K., Hevener, A. L., & Barnard, R. J. Metabolic syndrome and insulin resistance: underlying causes and modification by exercise training. Comprehensive Physiology 2013, 3(1),1–58.
5. Saklayen MG. The Global Epidemic of the Metabolic Syndrome. CurrHypertens Rep. 2018 Feb26;20(2):12.

6. Sharma S. et al.Prevalence of metabolic syndrome in pre- and post-menopausal women: A prospective study from apex institute of NorthIndia.2016,(7),169-174.
7. Lemes IR, Sui X, Fernandes RA, Blair SN, Turi-Lynch BC, Codogno JS, et al. Association of sedentary behavior and metabolic syndrome.2019;167:96–102
8. Matthews D.R, Hosker J.R, Rudenski A.S, Naylor B.A, Treacher D.F,Turner R.C. Homeostasis model assessment: insulin resistance and β-cell function from fasting plasma glucose and insulin concentrations in man. Diabetologia .1985.28, 412–419.
9. Chhabra, N., Sodhi, K., Kukreja, S. et al. (2014). Central obesity and prevalence of metabolic syndrome in postmenopausal women. Webmedcentral Obesity 5(1): WMC004532.
10. Pathania D, Bunger R, Mishra P, Pathak R, Arora A. An epidemiological study of metabolic syndrome in a rural area of Ambala distirct, Haryana.J Family Community Med. 2014 May-Aug; 21(2):130–133
11. Christakis MK, Hasan H, De Souza LR, Shirreff L. The effect of menopause on metabolic syndrome: cross-sectional results from the Canadian Longitudinal Study on Aging. Menopause.2020;27(9):999-1009.
12. Marchi R, Dell'Agnolo CM, Lopes TCR, et al. Prevalence of metabolic syndrome in pre- and postmenopausal women. Arch Endocrinol Metab.2017;61(2):160-166.
13. Rajesh PN, Mossie A, Mezgebu Y. Prevalence of Metabolic Syndrome And Its Components In Jimma Town, South West Ethiopia. International Journal of Medical Science and Clinical Inventions.2016, 3(3): 1684-1704.
14. Jouyandeh Z, Nayebzadeh F, Qorbani M, Asadi M. Metabolic syndrome and menopause. J Diabetes Metab Disord.2013;12(1):1