

# Metabolic Syndrome among Nurses in Manipur

Dr. Geeta Thiyam, Registrar, Dept. of Medicine\*, Dr. Salam Ranabir, Assistant Professor of Medicine\*\*, Mrs. Kamala Devi, Biochemist\*\*, Dr. Lallan Prasad, Professor of Medicine\*\*, Dr. Th. Ibetombi Devi\*\*, Dr. Th. Premchand Singh, Former Professor of Medicine\*\*

\* Jawaharlal Institute of Medical Sciences, Imphal, Manipur

\*\* Regional Institute of Medical Sciences, Imphal

**Corresponding Author:** Dr. Th. Premchand Singh, Former Professor of Medicine, Regional Institute of Medical sciences, Imphal, Manipur. **Email:** premsingh47@gmail.com

*Abstract: There is a wide variation in the prevalence of metabolic syndrome (MetS) across the globe. It is reported to be higher in developed countries compared to the developing countries. The study aims to estimate the prevalence of metabolic syndrome among nurses in Manipur, amongoloid population of the North Eastern India who are ethnically different from the mainland India and to find out correlation of age, obesity and waist circumference with the prevalence of metabolic syndrome (MetS).*

*This is a cross sectional study in the Department of Medicine in collaboration with the Department of Biochemistry, Regional Institute of Medical Sciences, Imphal, Manipur. This study was conducted among 239 nurses after exclusion of those with any acute or chronic systemic illnesses which can influence the anthropometric and metabolic parameters. Metabolic syndrome was diagnosed according to International Diabetes Federation Criteria, 2005. Data was expressed in mean±standard deviation. 't' test was used to compare different parameters between those with MetS and those without MetS. We observed that 49 (20.5%) out of 239 nurses had MetS. The prevalence of MetS increased with age ( $p = 0.000$ ), from 6% among 21-30 years to 67% among 61-70 years. The mean body mass index among nurses with MetS was  $26.45 \pm 3.36 \text{ Kg/m}^2$  compared to  $24.36 \pm 2.45 \text{ Kg/m}^2$  in those without MetS ( $p = 0.000$ ). Apart from increased waist circumference, abnormalities in blood pressure seen in 36 (73%), fasting blood glucose in 26 (53%), serum triglyceride in 36 (73%) and high density lipoprotein cholesterol in 21 (43%) in subject with metabolic syndrome.*

*In conclusion this study showed a high prevalence of MetS (20.5%) among nurses in Manipur, a mongoloid population in North Eastern India.*

*Key words: Blood pressure, blood glucose, metabolic syndrome, waist circumference.*

## Introduction

Metabolic syndrome (MetS) affects around 20-25% of the world's adult population<sup>1</sup>. In North India, MetS affects 31.6% to 49.2% of the urban population<sup>2-7</sup>. In South India

it is reported in 18.3 to 46.4%<sup>8-12</sup>. In Mumbai, West India, the prevalence ranges from 19.5-35.2%<sup>13,14</sup>. In the rural population of Central India it is seen in around 9%<sup>15</sup>. In Sub-Himalayan region of Eastern India, MetS ranges

from 4% to 50% in different communities<sup>16</sup>.

Individuals with MetS have a 30%-40% probability of developing diabetes and/or CVD within 20 years<sup>17</sup>. This study was carried out to determine the prevalence of MetS among nurses in Manipur as there is no data on MetS among the mongoloid population of North-Eastern India.

## Material and Methods

This cross-sectional study was carried out after obtaining approval from the Institutional Ethical Committee in the Department of Medicine, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur. A total of 239 nurses were selected randomly from the nursing staff of RIMS Hospital. Sample size was calculated based on the prevalence of MetS of 33.2% among health care workers<sup>18</sup> with 95% precision, coming to a sample size of 237. Nurses suffering from acute MI, renal failure, liver disease, critical illness, cancer, any acute infection or with a history of endocrine disorder and/or previous treatment with hormones or steroids were excluded.

Detailed history of clinical information including the age, smoking, alcohol consumption, inter current illness was taken. Detailed general and physical examination was performed. Anthropometric measurements including body weight, height, body mass index and waist circumference (WC) was recorded. Waist circumference was measured at the plane between the anterior superior iliac spine and lower costal margin at the narrowest part with the patient standing and during slight expiration. Fasting blood glucose and lipid profile was measured for each patient. Diagnosis of MetS was made using International Diabetes Federation (IDF) Criteria 2005 which defines MetS as central obesity plus two or more of the following factors: i) raised concentration of serum triglycerides  $\geq 150\text{mg}\%$ , ii) reduced concentration of serum (High Density Lipoprotein Cholesterol) HDL:

$<40\text{mg}\%$  in males and  $<50\text{mg}\%$  in females, iii) raised blood pressure: systolic blood pressure  $\geq 130\text{mmHg}$  or diastolic blood pressure  $\geq 85\text{mmHg}$ , and iv) raised fasting blood glucose  $\geq 100\text{mg}\%$ . Central adiposity is defined as waist circumference (WC)  $\geq 90\text{cm}$  in males and  $\geq 80\text{cm}$  in females among South East Asian population<sup>1</sup>.

## Statistical Analysis

Statistical analysis was done using Statistical Package for the Social Sciences (SPSS 16.0. version) software. Results were expressed as mean  $\pm$  standard deviation (SD). Student 't' was used to compare the mean values among nurses with and without metabolic syndrome. Pearson's chi-square test was used to compare categorical variables between the two groups. A p-value of  $<0.05$  was taken as statistically significant.

## Results

In the present study a total of 239 female nurses were randomly selected from the nursing staff of our hospital. The mean age was  $39.67 \pm 7.87$  (range, 27 to 62) years. The mean age of nurses with MetS was  $44.69 \pm 8.18$  years compared to  $38.37 \pm 7.27$  years ( $p = 0.000$ ) in those without MetS. Forty nine (20.5%) out of 239 nurses had MetS and the prevalence of MetS increased with age ( $p = 0.000$ ), from 6% among 21-30 years to 67% among 61-70 years. (Table 1)

There was no difference in mean height of nurses between nurses with and without MetS;  $152.03 \pm 2.55\text{cm}$  vs  $152.33 \pm 2.13$  ( $p = 0.449$ ). However, the nurses with MetS were significantly heavier than those without MetS;  $61.37 \pm 7.77\text{Kg}$  vs  $56.34 \pm 6.21\text{Kg}$  ( $p = 0.000$ ). Ninety-one (38.08%) nurses were overweight, 88 (36.82%) nurses were obese and 60 (25.1%) nurses were of normal weight. The mean BMI among nurses with MetS was  $26.45 \pm 3.36\text{Kg/m}^2$  compared to  $24.36 \pm 2.45\text{Kg/m}^2$  in those without MetS ( $p = 0.000$ ). Distribution of BMI among nurses with

Table 1 | Showing Prevalence of Metabolic Syndrome (Mets) in Relation to Age

Age group (years)	Number of nurses with MetS	Number of nurses without MetS	Total number of nurses	Prevalence of MetS (%)
21-30	2	29	31	6
31-40	16	105	121	13
41-50	18	40	58	31
51-60	11	15	26	42
61-70	2	1	3	67

**Table 2 | Showing The Distribution of Body Mass Index (BMI) of the Nurses with and without Metabolic Syndrome (Mets)**

BMI (Kg/M <sup>2</sup> )	With Mets N(%)	Without Mets N(%)	Total N(%)
<23	6(10.00)	54(90.00)	60(25.10)
23-24.99	10(11.00)	81(89.00)	91(38.08)
25-32.49	32(37.65)	53(62.35)	85(35.56)
≥ 32.50	1(33.33)	2(66.67)	3(1.26)
Total	49(20.50)	190(79.50)	239

and without MetS is shown in **Table 2**.

The mean waist circumference (WC) of the nurses was 88.12±12.93 cm. Central adiposity was common among the nurses studied, 194 (81.17%) subjects out of 239 had waist circumference (WC) e<sup>7</sup> 80 cm. However nurses with MetS were more obese with a mean waist circumference (WC) of 95.18±9.58 compared to those without MetS 86.3±13.07 cm ( $p=0.000$ ).

Out of the total 239 nurses, 54(22.6%) nurses were found to be hypertensive of which 4 nurses had prior history of hypertension. The mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) was 120.60±13.10 mmHg and 78.46±9.14 mmHg respectively. 46(19.25%) nurses had high SBP (e<sup>7</sup> 130 mmHg) and 36 (15.06%) had high DBP (e<sup>7</sup> 85 mmHg). Both the mean SBP and DBP was significantly higher among the nurses with MetS than those without MetS (SBP, 131.71±20.22 vs 117.74±8.50 mmHg;  $p=0.000$ ) and (DBP, 86.94±11.03 vs 76.28±7.13 mmHg;  $p=0.000$ ).

The mean FBG was 86.28±21.17 mg/dl. Impaired

fasting glucose was found in 46 (19.25%) nurses, and 10 (4.18%) nurses were found to be diabetic of which 2 nurses were already diagnosed diabetic in the study. Twenty-six (53.06%) out of 49 nurses with MetS had high FBG. Mean FBG among nurses with MetS and without MetS nurses were 100.29±29.58 and 82.67±16.68 mg/dl respectively ( $p=0.000$ ). The mean TG level among the nurses studied was 141.72 ± 53.44 mg/dl. Mean TG level in nurses with MetS and nurses without MetS were 177.03 ± 48.36 and 132.61 ± 50.95 mg/dl respectively ( $p=0.000$ ). High TG (e<sup>7</sup> 150mg/dl) was found in 101 (42.26%) out of the 239 nurses in the study and 36(73.5%) out of 49 nurses with MetS. The mean HDL-c level of all the 239 nurses was 51.76±11.57 mg/dl. 63nurses (26.36%) had low HDL-c (<50mg/dl). Among nurses with MetS, 21(42.86%) out of 49 nurses had low HDL-c. The mean HDL-c was 48.52±13.84 mg/dl and 52.6±11.03 mg/dl respectively in those with and without MetS ( $p=0.015$ ). Comparison of various parameters among nurses with and without metabolic syndrome is shown in **Table 3**.

**Table 3 | Comparison of Various Parameters among Nurses with and without Metabolic Syndrome**

Parameter	Nurses with MetS	Nurses without MetS	p- value
Age (years)	44.7±8.2	38.4±7.3	0.00
Height (cm)	152.3±2.1	152.0±2.6	0.45
Weight (Kg)	61.4±7.8	56.3±6.2	0.00
BMI (Kg/m <sup>2</sup> )	26.5±3.4	24.4±2.5	0.00
WC (cm)	95.2±9.6	86.3±13.1	0.00
Systolic BP (mmHg)	131.7±20.2	117.7±8.5	0.00
Diastolic BP(mmHg)	86.9±11.0	76.3±7.1	0.00
Fasting blood glucose(mg/dl)	100.3±29.6	82.7±16.7	0.00
Serum triglyceride (mg/dl)	177.0±48.4	132.6±51.0	0.00
Serum HDL (mg/dl)	48.5±13.8	52.6±11.0	0.00

## Discussion

To our knowledge this was the first study to evaluate MetS among the nurses population in the North Eastern India. Out of 239 nurses, MetS was seen in 49 nurses with a prevalence of 21% and this result is similar with the finding of Gustavo *et al.*<sup>19</sup>, in which the overall prevalence of MetS was also 21.6%. But in the study by Chuang *et al.*<sup>20</sup> the prevalence of MetS is 12.9% (15.5% in men and 10.5% in women). These figures are lower than those reported from the study population of Kinmen, an island of the coast of South China<sup>21</sup>. These large variations in the prevalence of the MetS could be partly accounted for by differences in study populations, lifestyles and socio-economic status.

The prevalence of MetS increased with age from 6% in those aged 21 to 30 years to 67% in the age group 61 to 70 years ( $p = 0.000$ ). Since aging is associated with increased risk of insulin resistance, the hormonal alteration and increase in visceral adipose tissue<sup>22</sup>, the prevalence of the MetS in this study was expected to increase steeply with age. This result was similar with the study of Hildrum *et al.*<sup>23</sup>, in which the prevalence increased from 11% among participants aged 20 through 29 years to 47.2% in the 80 to 89 years group in men and from 9.2% to 64.4% for women in corresponding age groups.

Also in the study by Perez *et al.*<sup>24</sup> prevalence significantly rose with age, from 12.8% among participants aged 21 to 29 years to 58.2% for participants aged 70 to 79 years ( $p < 0.001$ ). However, in the study by Sawant *et al.*<sup>14</sup> the prevalence of MetS did not change with respect to age difference, 20 to 40 and 41 to 60 age groups showed similar prevalence of MetS and a marginal decrease was seen in more than 60 age group. In women, prevalence continuously increased with age, which could in part be an effect of menopause<sup>25</sup>. Although menopausal status was not included in the survey, there was another study that reported visceral fat accumulation and acute increase of insulin resistance after menopause<sup>26</sup>. Several population studies have reported an increase in the prevalence of the MetS with age regardless of definition, though some have reported a peak in the seventh decade and then a decline in both sexes or only in men<sup>27</sup>.

The development of obesity, or more specifically an increase in abdominal fat, is thought to be the primary event in the progression of MetS. A tendency to gain fat in the abdominal area, as opposed to the hip, buttock, and limb areas, is linked to a rise in fatty acids in the blood, which is thought to lead to insulin resistance, high blood pressure, abnormal blood lipids, and eventually diabetes.

Asian Indians tend to develop central obesity rather than generalised obesity<sup>22</sup>. About three fourth of the nurses who participated in this study were overweight/obese (BMI  $\geq 23$  Kg/m<sup>2</sup>) and is the prime determinant of MetS prevalence. A steep rise in the prevalence of MetS is observed in obese nurses (i.e. BMI  $\geq 25$ ). In the study by Park *et al.*<sup>28</sup>, a steep rise in the prevalence of MetS was observed in overweight men and women. Overall 4.6%, 22.4% and 59.6% of normal weight, overweight and obese men, respectively, met the MetS diagnostic criteria. Similarly, in women, the corresponding prevalence rates were 6.2%, 28.1% and 50% respectively. Participants with BMI less than 23 meeting the MetS criteria may be the metabolically obese, normal weight individuals as referred to by Ruderman *et al.*<sup>29</sup> who purportedly have insulin resistance as the central feature of their cluster of metabolic abnormalities. Gupta *et al.*<sup>30</sup> also showed a strong association between MetS and overweight particularly when the whole population is considered, prevalence of MetS was significantly higher in overweight and obese subjects.

The IDF emphasizes central obesity as an essential criterion for the MetS, due to the evidence linking ethnicity-specific waist circumference to CVD and to the other components of the MetS<sup>1</sup>. In addition to the role of genetic factors, environmental factors are thought to play a major role in the increasing frequency of abdominal obesity. Excessive or unbalanced intake of food and technological advances limiting physical activity are partly responsible for the obesity epidemic<sup>31</sup>.

In this study, presence of abdominal obesity considerably increases the prevalence of MetS. Kozan *et al.*<sup>32</sup> reported a relatively lower frequency of MetS and abdominal obesity among health worker which may have resulted from a number of factors including younger age, higher level of physical activity due to working conditions and awareness about healthy lifestyle habits. Although BMI serves as a useful marker of obesity and related insulin resistance, stronger correlations are observed between abdominal obesity and metabolic risk factors. The ATP III included waist circumference as a proxy measure of abdominal obesity and waist circumference is well correlated with visceral adipose tissue and is a better anthropometric predictor of metabolic risk factors than BMI<sup>33</sup>.

In conclusion this study showed a high prevalence of MetS among nurses in Manipur, a mongoloid population in North Eastern India who are ethnically different from the mainland India. Metabolic syndrome MetS was seen

more among nurses with increasing age, who are more obese and associated with higher blood pressure and glucose levels.

## References

1. The IDF consensus worldwide definition of the metabolic syndrome. The metabolic syndrome. *IDF Communications* 2006;1-23.
2. Gupta R, Deedwania PC, Gupta A, Rastogi S, Panwar RB, Kothari K. Prevalence of metabolic syndrome in an Indian urban population. *Int J Cardiol* 2004;97:257-61.
3. Misra A, Wasir JS, Pandey. An evaluation of candidate definitions of the metabolic syndrome in adult Asian Indians. *Diabetes Care* 2005;28:398-403.
4. Wasir JS, Misra A, Vikram NK, Pandey RM, Gupta R. Comparison of definitions of the metabolic syndrome in adult Asian Indians. *J Assoc Physicians India* 2008;56:158-64.
5. Sharma SK, Reddy EV, Sharma A, Kadiravan T, Mishra HK, Sreenivas V, *et al*. Prevalence and risk factors of syndrome Z in urban Indians. *Sleep Med* 2010;11:562-8.
6. Mangat C, Goel NK, Walia DK, Agarwal N, Sharma MK, Kaur J, *et al*. Metabolic syndrome: A challenging health Issue in highly urbanized Union Territory of North India. *Diabetol Metab Syndrome* 2010;2:19
7. Ravikiran M, Bhansali A, Ravikumar P, Bhansali S, Dutta P, Thakur JS, *et al*. Prevalence and risk factors of metabolic syndrome among Asian Indians: A community survey. *Diabetes Res Clin Pract* 2010;89:181-8.
8. Ramachandran A, Snehalatha C, Satyavani K, Sivasankari S, Vijay V. Metabolic syndrome in urban Asian Indian adults: A population study using modified ATP III criteria. *Diabetes Res Clin Pract* 2003;60:199-204.
9. Deepa M, Farooq S, Datta M, Deepa R, Mohan V. Prevalence of metabolic syndrome using WHO, ATPIII and IDF definitions in Asian Indians: The Chennai Urban Rural Epidemiology Study (CURES-34). *Diabetes Metab Res Rev* 2007;23:127-34.
10. Pemminati S, Prabha Adhikari MR, Pathak R, Pai MR. Prevalence of metabolic syndrome (METS) using IDF 2005 guidelines in a semi urban south Indian (Bolor Diabetes Study) population of Mangalore. *J Assoc Physicians India* 2010;58:674-7.
11. Kaur P, Radhakrishnan E, Rao SR, Sankarabaiyan S, Rao TV, Gupte MD. The metabolic syndrome and associated risk factors in an urban industrial male population in South India. *J Assoc Physicians India* 2010;58:363-71.
12. Ramachandran A, Snehalatha C, Satyavani K, Sivasankari S, Vijay V. Metabolic syndrome does not increase the risk of conversion of impaired glucose tolerance to diabetes in Asian Indians-Result of Indian diabetes prevention programme. *Diabetes Res Clin Pract* 2007;76:215-8.
13. Mahadik SR, Deo SS, Mehtalia SD. Increased prevalence of metabolic syndrome in non-obese Asian Indian-an urban-rural comparison. *Metab Syndr Relat Disord* 2007;5:142-52.
14. Sawant A, Mankeshwar R, Shah S, Raghavan R, Dhongde G, Raje H, *et al*. Prevalence of metabolic syndrome in urban India. *Cholesterol* 2011;2011:920983.
15. Kamble P, Deshmukh PR, Garg N. Metabolic syndrome in adult population of rural Wardha, central India. *Indian J Med Res* 2010;132:701-5.
16. Sarkar S, Das M, Mukhopadhyay B, Chakrabarti CS, Majumder PP. High prevalence of metabolic syndrome and its correlates in two tribal populations of India and the impact of urbanization. *Indian J Med Res* 2006;123:679-86.
17. Enas EA, Mohan V, Deepa M, Farooq S, Pazhoor S, *et al*. The metabolic syndrome and dyslipidemia among Asian Indians: a population with high rates of diabetes and premature coronary artery disease. *Journal of the Cardiometabolic Syndrome* 2007;2:267-75.
18. Ouz A, Saun G, Uzunlulu M, Alpaslan B, Yorulmaz E, *et al*. Frequency of abdominal obesity and metabolic syndrome in healthcare workers and their awareness levels about these entities. *Turkish Society of Cardiology* 2008;36:302-09.
19. Gustavo VM, Andrea G, Rodrigo CO, Adriano MP, Gilberto K. Prevalence of Metabolic syndrome in a rural area of Brazil: Sao Paulo. *Medical Journal* 2007;125(3):155-62.
20. Chuang SY, Chen CH, Chou P. Prevalence of metabolic syndrome in a large health check-up population in Taiwan. *J Chin Med Association* 2004;67:611-20.
21. Chuang SY, Chen CH, Tsai SZ, Chou P. Clinical identification of the metabolic syndrome in Kinmen. *Acta Cardiol Sin* 2001;18:16-23.
22. Boden G, Chen X, DeSantis RA, Kendrick Z. Effects of age and body fat on insulin resistance in healthy men. *Diabetes Care* 1993;16:728-33.
23. Hildrum B, Mykletun A, Hole T, Midthjell K, Dahl AA. Age-specific prevalence of the metabolic syndrome defined by the International Diabetes Federation and the National Cholesterol Education Program: the Norwegian HUNT 2 study. *BMC Public Health* 2007;7:220 doi:10.1186/1471-2458-7-220.
24. Perez CM, Guzman M, Ortiz AP, Extrella M, Valle Y, *et al*. Prevalence of the metabolic syndrome in San Juan, Puerto Rico. *Ethn Dis* 2008; 18:434-41.
25. Kim MH, Kim MK, Choi BY, Shin YJ. Prevalence of the Metabolic Syndrome and its association with Cardiovascular Diseases in Korea. *J Korean Med Sci* 2004;19:195-201.
26. Fujimoto WY, Bergstrom RW, Boyko EJ, Chen K, Kahn SE, *et al*. Type 2 diabetes and the metabolic syndrome in Japanese Americans. *Diabetes Res Clin Pract* 2000;50:573-6.
27. Al-Lawati JA, Mohammed AJ, Al-Hinai HQ, Jousilahti P. Prevalence of the metabolic syndrome among Omani adults. *Diabetes Care* 2003;26:1781-5.
28. Park YW, Zhu S, Palaniappan L, Heshka S, Carnethon MR, *et al*. Prevalence and Associated Risk Factor Findings in the US Population from the Third National Health and Nutrition Examination Survey 1988-1994. *Arch Intern Med* 2003;163:427-36.
29. Ruderman N, Chisholm D, Pi-Sunyer X, Schneider S. The metabolically obese, normal-weight individual revisited. *Diabetes* 1998;47: 699-713.
30. Gupta A, Gupta R, Sarna M, Rastogi S, Gupta VP, *et al*. Prevalence of diabetes, impaired fasting glucose and insulin resistance syndrome in an urban Indian population. *Diabetes Res Clin Pract* 2003;61 (1): 69-76.
31. Ford ES, Li C. Physical activity or fitness and the metabolic syndrome. *Expert Rev Cardiovasc Ther* 2006;4:897-915.
32. Kozan O, Oguz A, Abaci A, Erol C, Ongen Z, *et al*. Prevalence of the metabolic syndrome among Turkish adults. *Eur J Clin Nutr* 2007;61: 548-53.
33. Haffner SM, Ferrannini E, Hazuda HP, Stern MP. Clustering of cardiovascular risk factors in confirmed prehypertensive individuals. *Hypertension* 1992;20:38-45.

***“The secret of change is to focus all of your energy, not on fighting the old, but on building the new.”***

— Socrates