

# PREVALENCE OF METABOLIC SYNDROME AND COMORBID CONDITIONS IN INMATES OF OLD AGE HOMES

Sathyanarayana Rao K.N.<sup>1</sup>, Subbalakshmi N.K.<sup>2</sup>

<sup>1</sup>Professor, Department of Pharmacology, K.S. Hegde Medical Academy, Nitte University, Mangalore, Deralakatte, Mangalore - 575 018, Karnataka, India.

<sup>2</sup>Associate Professor, Department of Physiology, Kasturba Medical College, Manipal University, Light House Hill Road, Mangalore - 575 001, Karnataka, India.

Correspondence:

Subbalakshmi N.K.

Associate Professor, Department of Physiology, Kasturba Medical College, Mangalore, Manipal University, Light House Hill Road, Hampanakatta, Mangalore - 575 001, Karnataka, India.

Mobile : +91 94839 10879 E-mail : rao.subbalakshmink@rediffmail.com

## Abstract :

**Introduction :** It is imperative that efforts are to be made to recognize individuals with metabolic syndrome from different sets of population so that they may be identified for intensive risk factor management to reduce cardiovascular risk. We evaluated the incidence and associated factors of metabolic syndrome in inmates of old age homes.

**Methods :** This study involved 189 subjects aged between 55-75 years of either sex housed in old age homes. In every subject waist circumference, blood pressure, fasting blood sugar and plasma lipids were measured. Ongoing treatments were taken into account. Patients with metabolic syndrome were identified using IDF-2005 definition. Data analysis was done by Chi -square test. p value less than 0.05 was taken as significant.

**Result :** Metabolic syndrome was found in 57.67% of study subjects. Prevalence of metabolic syndrome was higher in 55 - 60 years age group ( $\chi^2=17.06$ ,  $p<0.01$ ) and in females ( $\chi^2=4.33$ ,  $p<0.05$ ). Disease load of dyslipidemia, diabetes mellitus and hypertension was higher in metabolic syndrome group compared to non-metabolic syndrome group ( $\chi^2=11.40$ ,  $p<0.001$ ;  $\chi^2=47.90$ ,  $p<0.0001$ ;  $\chi^2=4.72$ ,  $p<0.05$  respectively). In patients receiving treatment for diabetes and hypertension, frequency of subjects with hyperglycemia and high blood pressure was higher in metabolic syndrome group compared to non-metabolic syndrome group ( $\chi^2=10.69$ ,  $p<0.01$ ;  $\chi^2=4.46$ ,  $p<0.05$  respectively).

**Conclusion :** In this population it is found that, 55-60 years age group and females are at greater risk for metabolic syndrome. Subjects with metabolic syndrome are resistant to anti-diabetic and antihypertensive treatment.

**Keywords :** metabolic syndrome, hyperglycemia, high blood pressure, dyslipidemia

## Introduction :

Toward the end of the 20<sup>th</sup> century, the clustering of risk factors for cardiovascular disease was first described, most notably the concurrent presence of obesity, type 2 diabetes, hyperlipidemia, and hypertension.<sup>(1-3)</sup> The term "metabolic syndrome" has now taken hold in the medical literature.

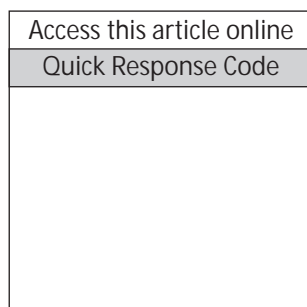
World-wide, the prevalence of metabolic syndrome ranges from 10% to 50%.<sup>(4)</sup> The National Health and Nutrition Examination Survey 1999–2002 estimated the

age-adjusted prevalence of metabolic syndrome in US adults aged 20 years and over to be 39.1% using International Diabetes Federation criteria (IDF criteria).<sup>(5)</sup> Overall prevalence of metabolic syndrome was 22.2% in an epidemiological study in adult population of Cyprus.<sup>(6)</sup> Using IDF criteria, the prevalence of metabolic syndrome was 13.5% for Korean men and 15.0% for Korean women.<sup>(7)</sup>

Prospective studies have established that metabolic syndrome is associated with a doubling of the risk of cardiovascular disease.<sup>(8)</sup> In the Atherosclerosis Risk in Communities Study, middle-aged men and women with the metabolic syndrome were 1.5–2 times more likely than control subjects to develop coronary heart disease.<sup>(9)</sup> An analysis of the Framingham Offspring Study cohort yielded

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similar results.<sup>(10)</sup> Importantly, this risk was also extended to people with metabolic syndrome who did not have diabetes.<sup>(11)</sup> Metabolic syndrome is more prevalent with increasing age, affecting half of adults aged 60 years and over.<sup>(5)</sup> Hence it is imperative that efforts are to be made to recognize individuals with metabolic syndrome from different sets of population so that they may be identified for intensive management of risk factors. Thus, this study was undertaken to evaluate the prevalence and associated factors of metabolic syndrome in inmates of old-age homes.

#### Methods:

This was a cross sectional study done on inmates of old-age homes in one year period. This study was undertaken after the approval by the institutional ethical committee overseeing human studies in accordance with the Ethical Standards laid down in the Declaration of Helsinki and obtaining consent from study participants.

The parameters measured were: Waist circumference, blood pressure, fasting blood glucose and plasma lipids.

The study population comprised of 189 inmates of old age homes, aged between 55-75 years of either sex.

Inclusion criteria: 1. who were willing to take part in this programme 2. Could stand up for measurement of waist circumference.

Exclusion criteria were 1. Subjects who were bed ridden 2. Subjects with acute illness.

All the subjects were subjected to clinical examination. In the personal interview with the subjects, detailed history was obtained with special reference to age, history of diabetes, hypertension and other cardiovascular disease. All medications taken by the inmates were noted. Apart from this, in the personal interview information on level of physical activity was inquired into. This included information on occupational activity and participation in any structured exercise programmes. In all the subjects, waist circumference was measured. Blood pressure was recorded in sitting position. Two readings were taken five

minutes apart in the sitting position. The mean of the two was recorded as blood pressure. Fasting blood samples were taken for estimation of blood glucose and plasma lipids. The goal of treatment is to lower blood sugar to 100mg/dl in fasting condition; lowering systolic blood pressure to 140 mm Hg; and lowering diastolic blood pressure to 90 mm Hg. Poor glycemic control was defined as fasting blood sugar level more than 100 mg/dl in subjects treated for diabetes mellitus. Poor blood pressure control was defined as systolic blood pressure more than 140 mm Hg or diastolic blood pressure more than 90 mmHg or both in subjects treated for hypertension. Dyslipidemia was measured as per IDF criteria.<sup>(12)</sup>

Patients with metabolic syndrome were identified using IDF-2005 definition<sup>(12)</sup> with adoption of the Asian criteria for central obesity (central obesity defined as waist circumference greater than or equal to 90 cm for men and greater or equal to 80 cm for women as per Asian-Indian population; plus any two of the following factors:

- 1. Raised triglyceride level: more than 150 mg per dl (1.7mmol per L) or specific treatment for this lipid abnormality.
- 1. Reduced HDL cholesterol: less than 40 mg per dl (0.9 mmol per L) for males and less than 50 mg per dl (1.1 mmol per L) in females, or specific treatment for this lipid abnormality.
- 1. Raised blood pressure: systolic greater than or equal to 130 mmHg or diastolic greater than or equal to 85 mmHg or treatment of previously diagnosed hypertension.
- 1. Raised blood glucose level greater than or equal to 100 mg per dl (5.6 mmol per L), or previously diagnosed type 2 diabetes).

Data were analyzed employing Chi-square test. The p value less than 0.05 were taken as significant

#### Result :

In a total number of 189 subjects studied, 74 were with diabetes mellitus, 109 were with hypertension and 161

were with dyslipidemia. All the diabetics were treated with blood sugar lowering agents and all the hypertensive subjects were treated with antihypertensive drugs. Dyslipidemia was not treated separately in any of the study subjects. All of them led sedentary life (In this study those referred to as sedentary were institutionalized and not taking part in any occupational activity and were not participating in any structured exercise programmes).

Among the study subjects metabolic syndrome was diagnosed in 109 (57.67%). Amongst the 118 female study subjects 72 (61.01%) and among the 71 male study subjects 37 (52.11 %) were found to have metabolic syndrome. This difference in frequency of subjects with metabolic syndrome between male and female was significant ( $\chi^2 = 4.33, p < 0.05$ ).

The age of study subjects ranged from 55-75 years. The distribution of study subjects with and without metabolic syndrome in different class intervals of age is presented in Table I. The prevalence of metabolic syndrome was highest in subjects aged between 55-60 years ( $\chi^2 = 17.06, p < 0.01$ , Table I).

Data on comorbid conditions of study subjects with and without metabolic syndrome is presented in Table II. Frequency of subjects with dyslipidemia, diabetes mellitus and hypertension was significantly higher in metabolic syndrome group compared to non- metabolic syndrome group ( $\chi^2 = 11.40, p < 0.001$ ;  $\chi^2 = 47.90, p < 0.0001$ ;  $\chi^2 = 4.72, p < 0.05$  respectively).

The response of subjects to treatment was studied. Data on frequency of subjects with poor glycemic and poor blood pressure control in metabolic and non-metabolic syndrome group is presented in Table III. Frequency of subjects with poor glycemic control and poor blood pressure control was significantly higher in metabolic syndrome group compared to non-metabolic syndrome group ( $\chi^2 = 10.69, p < 0.01$ ;  $\chi^2 = 4.46, p < 0.05$  respectively, Table III).

Waist circumference of all the study subjects in metabolic syndrome was higher. In the non-metabolic group, waist

circumference of 30 subjects was within normal range (20 subjects with dyslipidemia and 10 subjects with hypertension). Waist circumference of another 50 subjects was above normal value (all the 11 subjects were with diabetes mellitus, 30 subjects with hypertension and 9 subjects with dyslipidemia alone).

Dyslipidemia prevailed in 60 subjects receiving antihypertensive therapy alone; 19 subjects receiving blood sugar lowering agents; and 42 subjects receiving treatment both for diabetes and hypertension. Lipid profile of 28 study subjects was normal (Among them 10 subjects were with hypertension and receiving antihypertensive therapy).

#### Discussion :

The metabolic syndrome is characterized by a group of risk factors including, abdominal obesity, dyslipidemia, elevated blood pressure, and impaired glucose tolerance.<sup>(1)</sup> The original World Health Organization definition emphasized insulin resistance.<sup>(13)</sup> But the more recent definition from the National Cholesterol Education Program Adult Treatment Panel III (ATPIII) had treated the individual components equally<sup>(14)</sup> while the International Diabetes Federation (IDF) takes central obesity as a pre-requisite.<sup>(12)</sup> We estimated the prevalence of metabolic syndrome as per IDF criteria and explored the clinical characteristics associated with this syndrome in inmates of old age homes.

The worldwide prevalence of metabolic syndrome reported ranged from 3.5 % to 50%.<sup>(4-6, 15, 16)</sup> In the present study, 57.56 % were diagnosed to have metabolic syndrome. Thus our study reports higher prevalence of metabolic syndrome. It is reported that prevalence of metabolic syndrome may vary with ethnic background.<sup>(17)</sup> Thus higher prevalence observed in our study suggests that Indian Asians may be more prone to metabolic syndrome compared to other parts of the world. However, certain reports from different parts of India has observed that even within the same ethnic population group significant differences in the prevalence metabolic syndrome may prevail.<sup>(18, 19)</sup> Thus it appears that apart from ethnicity,

several other characteristic features of given population may collectively contribute to the higher prevalence of metabolic syndrome.

In the present study there was significant difference in prevalence of metabolic syndrome in different intervals of age. The peak prevalence was observed in the subjects aged between 55-60 years. Thereafter it declined to 42.30% in the subjects aged 70-75 years (table 1). Nalia Hamid et al who had conducted a hospital based study in Pakistan on association between metabolic syndrome and age observed that metabolic syndrome is more common in age group 51-60 years, which concurs with findings of our study.<sup>(20)</sup> However they had employed NCEP ATP III criteria based on Asian guidelines unlike ADF criteria followed in our study.<sup>(20)</sup> Despite difference in criteria employed in defining metabolic syndrome and population studied the similar findings in these two studies suggest that, Asians in 55-60 years age group are at greater risk for metabolic syndrome.

In the present study, prevalence of metabolic syndrome was found to be relatively higher in females compared to males. Our finding is in agreement with the findings of a population based cross sectional survey in Chandigarh, a city in North India, and Jaipur Heart Watch Studies, in which female subjects were reported to be at greater risk for metabolic syndrome.<sup>(21, 22)</sup> But Chow et al found a prevalence of metabolic syndrome of 26.9% in males and 18.4% in females from a developing region of rural Andhra Pradesh, India<sup>(23)</sup>. Similarly, another study from Urban India reported higher prevalence of metabolic syndrome in males compared to females.<sup>(24)</sup> The worldwide reports on gender difference in metabolic syndrome are also conflicting. In US population in general age-adjusted prevalence was similar for women and men but among African Americans women had about a 57% higher prevalence than men did and among Mexican Americans, women had about a 26% higher prevalence than men did.<sup>(25)</sup> But a hospital based study in Nigeria in type 2 diabetics the frequency of occurrences was similar for men and women in 35-80 years age group.<sup>(26)</sup> At the same time, the

prevalence of metabolic syndrome is reported to be higher in females in Gulf Cooperation Council Countries.<sup>(27)</sup> Meanwhile, nationwide population based survey in Taiwan observed 20.4% of men and 15.3 % of women with metabolic syndrome.<sup>(28)</sup> At the same time, a study based on 11 prospective European cohort studies comprising 6156 men and 5356 women without diabetes and aged from 30 to 89 years reports slightly higher prevalence of metabolic syndrome in males than in females.<sup>(29)</sup> A study from Peshawar, Pakistan reports metabolic syndrome in 66% of males and 34% of females.<sup>(20)</sup> Thus it appears that metabolic syndrome afflicts both men and women of all races but in some selected population females may be more susceptible to metabolic syndrome.

The presence of hypertension constitutes one criterion for metabolic syndrome but not a prerequisite by ADF definition. In the present study frequency of subjects with hypertension were significantly higher in metabolic syndrome group compared to subjects free from metabolic syndrome. Our finding is in accordance with the findings of a recent evaluation of the Framingham Heart Study, which found that hypertension was the risk factor most often associated with the diagnosis of metabolic syndrome.<sup>(30)</sup> In our study, all the subjects with hypertension in metabolic syndrome and non-metabolic syndrome group were treated alike with antihypertensive drugs. Nonetheless higher frequency of subjects with poor blood pressure control was found in metabolic syndrome group. Poor blood pressure control despite antihypertensive therapy observed in our study is in agreement with the observational cross-sectional survey in 12 European countries on blood pressure control and cardiometabolic risk factors which has revealed that metabolic syndrome is associated with poor blood pressure control.<sup>(31)</sup> Similarly Zidwick et al too have observed poor blood pressure control in subjects with metabolic syndrome with or without diabetes mellitus.<sup>(32)</sup> Thus it appears that the subjects of metabolic syndrome are resistant to antihypertensive treatment despite usage of antihypertensive drugs.

In the present study, among the 74 study subjects with diabetes mellitus 63 were diagnosed with metabolic syndrome and 11 were without metabolic syndrome. Nonetheless all these 74 diabetic subjects were treated alike with blood sugar lowering agents. But the frequency of diabetic subjects with poor glycemic control was higher in metabolic syndrome group compared to without metabolic syndrome group. Thus our study findings suggest that the subjects with metabolic syndrome are resistant to antidiabetic treatments despite use of blood sugar lowering agents. On the other hand, Worawongprapa O observed that in metabolic syndrome group and as well in diabetic patients without metabolic syndrome, the glycemic control of the majority still had not reached the standard of diabetes care.<sup>(33)</sup> Thus it appears that, although poor glycemic control is common in diabetic subjects with metabolic syndrome, underlying cause of hyperglycemia is not just confined to characteristics of metabolic syndrome alone.

In the present study, disease load of dyslipidemia, diabetes mellitus and hypertension was significantly higher in subjects with metabolic syndrome. However prevalence of hypertension was not so high as dyslipidemia and diabetes mellitus (Table II). This finding suggests that association of dyslipidemia and diabetes mellitus is closely related to metabolic syndrome. Whereas association of hypertension may depend on other factors not necessarily a constant feature of metabolic syndrome. Among the 74 diabetic subjects studied, all were treated for diabetes. These findings suggest that the pharmacological therapy intending to control diabetes mellitus may not facilitate reduction of central obesity.

Our study is with certain limitations. Life style modification is considered as one of the remedial measures for metabolic syndrome. We did not evaluate food intake in relation to level of physical activity for lack of expertise of dietitian to measure nutritional status in this population. Hence beneficial effect of life style modification could not be evaluated. Similarly genetic predisposition to metabolic syndrome was not considered.

All the study subjects with diabetes mellitus and hypertension were treated alike irrespective of presence or absence of metabolic syndrome. But incidence of hyperglycemia and high blood pressure was higher in metabolic syndrome group (Table III). Dyslipidemia persisted despite of receiving treatment for diabetes and hypertension. These findings emphasize the primary prevention of metabolic syndrome condition and stresses on, need of treatment of each condition separately.

Table I. Prevalence of metabolic syndrome in different class intervals of age

Age group (in years)	Total Number	Prevalence of metabolic syndrome †*
55- 60	39	35 (88.23%)
61-65	61	38 (62.21%)
66-70	63	38 (60.31%)
71-75	26	11 (42.30%)

† Frequency with percentage in parenthesis.

\*  $\chi^2 = 17.06, p < 0.001$

Table II. : Frequency of comorbid conditions in patients with and without metabolic syndrome

Conditions	With metabolic syndrome (n = 109)	Without metabolic syndrome (n = 80)
Dyslipidemia	101 (92.66%)*	60 (75%)
Diabetes mellitus	63 (57.79%) **	11 (13.75%)
Hypertension	68 (62.38%) ‡	41 (51.25%)

n= sample size. Values are in total number and percentage in parenthesis.

\*  $p < 0.001$  compared to non-metabolic syndrome group ( $\chi^2 = 11.40$ )

\*\*  $p < 0.0001$  compared to non-metabolic syndrome group ( $\chi^2 = 47.90$ )

‡  $p < 0.05$  compared to non-metabolic syndrome group ( $\chi^2 = 4.72$ )

Table III. : Frequency of subjects with poor glycemic and blood pressure control in subjects with and without metabolic syndrome

Parameters measured	Metabolic syndrome group (n = 109)	Non-metabolic syndrome group (n = 80)
Poor glycemic control	55/63 † **	5/11 ‡
Poor blood pressure control	47/68 † ‡ *	20/41 ††

n= sample size

‡ 55 out of 63 diabetics in metabolic syndrome and 5 out of 11 in non-metabolic syndrome group

†† 47 Out of 68 hypertensive subjects in metabolic syndrome group and 20 out of 41 in non-metabolic syndrome group

\*\*  $p < 0.01$  compared to non-metabolic syndrome group ( $\chi^2 = 10.69$ )

\*  $p < 0.05$  compared to non-metabolic syndrome group ( $\chi^2 = 4.46$ )



However based on our study findings it could be concluded that prevalence of metabolic syndrome is higher in age group 55-60 years and in females. Disease load of hypertension and diabetes mellitus is found to be higher in subjects with metabolic syndrome. Hyperglycemia and

high blood pressure persists despite receiving blood sugar lowering agents and antihypertensive drugs.

#### Conflict of Interest Statement :

There are no conflicts of interest

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