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Prevalence of Metabolic Syndrome among Urban Older Adults of Hyderabad Metropolitan City in South India

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Abstract

Background: Ageing is associated with decline in metabolism, physical activity and increased prevalence of non-communicable diseases like hypertension, diabetes and dyslipidemia. This study was carried out with the objective to assess the prevalence of metabolic syndrome (MS) among urban older adult population.

Methodology: A community based cross-sectional pilot study was carried out among 112 geriatric population (≥60 years and over) in Hyderabad metropolitan city by adopting random sampling procedure. Anthropometric measurements and blood pressure were recorded and lipid profile and fasting blood sugar were estimated. International Diabetes Federation (IDF) criterion was adopted for diagnosis of metabolic syndrome. Descriptive statistics like mean (SD) and prevalence were calculated using SPSS (Version 19.0). Chi-square test was performed to study the association between the prevalence of Metabolic Syndrome and different variables.

Results: The prevalence of hypertension, central obesity, and high blood sugar was 79.3%, 76.6%, 62.2% respectively. While the proportion of geriatric population with hypertriglyceridemia, hypercholesterolemia and low HDL was 24.3%, 10.8%, 23.4%, respectively. Similarly, the prevalence of metabolic syndrome among urban geriatric population was 54.1% and it was significantly associated with central obesity and high body mass index (BMI).

Conclusions: In general, the prevalence of metabolic syndrome was high among urban geriatric population. It may be attributed to rapid urbanization and high prevalence of non-communicable diseases. Therefore, adaptation of healthy lifestyles during early stages of adulthood is very essential for the prevention and control of metabolic syndrome and promotion of healthy ageing.

Keywords: Older Adults; Elderly; Metabolic Syndrome and Urban

Introduction

Most regions and countries in the world are experiencing unprecedentedly rapid demographic change [1]. As a result, world population increased more than double to 6.5 billion in 2005 [2] with an increase in the proportion of the elderly.This rapid increase in the proportion of elderly population could be attributed to considerable decline in mortality and fertility rates globally due to rapid advancements in health care and improved access to public health care facilities [3]. As fertility rates decline, the proportion of persons aged 60 and over is expected to double between 2000 and 2050 (11% to 22%), and their actual number will be more than triple, reaching 2 billion by 2050 [4]. The most rapid increases in older populations are currently happening in the developing world. Indian population has approximately tripled during the last 50 years, but the number of elderly Indians has increased more than fourfold. In 2001, the elderly population (60+) of India was 77 million. As per census 2011, the absolute number of elderly population has crossed the 100 million mark. This number is expected to increase to 323 million, constituting 20 per cent of the total India population by 2050 [5].

As people age, they are at an increased risk of disease and disability, and often, have increasing health needs. Ageing affects almost all the systems of the body, and is associated with several physiological, metabolic and psychological changes. This enhanced longevity is associated with burden of several chronic non-communicable diseases, such as cardiovascular diseases (CVDs), diabetes, osteoporosis, cataract, cancer etc., which lead to disability and increased burden not only on the health system but also on the economy. High prevalence of overweight, obesity and related co- morbidities are considered as major health problems

among older adults [6]. Ageing is an important and universal contributor to etiology of metabolic decline and related diseases which include type 2 diabetes, cardiovascular diseases, stroke [7] and Insulin resistance [8]. Abdominal obesity is commonly observed during ageing contributes to insulin resistance and metabolic syndrome. Medical concerns such as cardiovascular diseases, type 2 diabetes, metabolic syndrome risk factors and obesity have a significant direct relationship with low or non-exercise activity [9]. Metabolic Syndrome is associated with a 2-fold risk of CVD and a 5-fold risk of diabetes. Individuals suffering from Metabolic Syndrome have a 30%–40% probability of developing diabetes and/or CVD within 20 years, depending on the number of components present [10]. It was reported that the prevalence of MS has been increasing in the populations of the developing countries as a result of changes in lifestyles and dietary pattern [11,12]. According to the published data, the prevalence of MS among the Indian population was ranged from 9 to 48% [13-16].

The risk of development of metabolic syndrome is increased with advancing age, affecting about half of the adults aged ≥60 years [11]. Similarly, according to Modified NCEP ATPIII and IDF criterion, 47.1% (Men:40.7% & Women:54%) and 35.6% (Men:23.1% & Women:49%) of urban geriatric population of Kolkata had MS, respectively [17].

Data on Metabolic Syndrome among adult population are readily available in India. However, there is a paucity of such data among geriatric population in India, particularly among urban geriatric population of Hyderabad, a metropolitan city of South India. Therefore, keeping in view the magnitude of disease burden among the older population, a community based study was carried out during the year 2015 among the urban geriatric population of Hyderabad city with the objective of assessing the prevalence of metabolic syndrome and its determinants.

Methods

A community based cross-sectional pilot study adopting simple random sample was carried out among the urban geriatric population of Hyderabad metropolitan city during the year 2015. A total of 112 subjects of both genders were covered from the sampling frame of older adults (60 years and over) for the study. A pre-tested questionnaire was administered to elderly to obtain the data on lifestyle, physical activity, type of diet and history of non-communicable diseases.

Anthropometric measurements

Anthropometric measurements such as height, weight, waist circumference (WC) and hip circumference (HC) were recorded on all the selected older adults, using standard equipment and adopting standard procedure. Weight was measured with minimum clothing using SECA digital weighing scale (nearest to 0.1 kg)). Height was measured using anthropometric rod, with the subject made to stand erect on a flat surface (without footwear) with feet together. The nutritional status of the older adults was assessed based on body mass index (BMI) classification, which is derived by weight in kilograms divided by height in meters' square [18]. The WHO recommended BMI cut-off values for Asian adults were used to calculate overweight and obesity [19], while the WC cut-off values of ≥ 90 cm and ≥ 80 cm were considered for men and women respectively, to calculate abdominal or central obesity. [20]

Clinical assessment

Blood pressure was measured thrice using an OMRON BP apparatus with the interval of at least 5 minutes between measurements. BP was recorded on the left arm of the subject in sitting position. Systolic and diastolic blood pressure was calculated as the mean of the three measurements. Fasting blood glucose and lipid profile was estimated from the subjects with 12 hours fasting.

Biochemical analysis

Fasting blood samples (6 ml) were collected from each subject by venipuncture for analysis of total plasma cholesterol, triglycerides (TG) and HDL. The plasma was separated from the whole blood by centrifugation and the lipid profile was estimated using kit methods (Bio-Systems). Fasting blood glucose was estimated by glucometer (Accu-Check Active Glucometer- Roche Diagnostics).

Definition of Metabolic Syndrome

Metabolic syndrome was defined as per the International Diabetes Federation (IDF) [21] criteria of presence of central obesity (Waist circumference for South Asian Men: ≥90 cm and South Asian Women: ≥80 cm) plus 2 of any of the following:

Measure	Categorical Cut-off Points
Elevated waist circumference for Asian adults	Men: ≥ 90 cm Women: ≥ 80 cm
Elevated triglycerides (drug treatment for elevated triglycerides is an alternate indicator)	≥150 mg/dL or 1.7 mmol/L or specific treatment for this lipid abnormality
Reduced HDL-C (drug treatment for reduced HDL-C is an alternate indicator)	Men: <40 mg/dL or 1.03 mmol/L Women: <50 mg/dL or 1.29 mmol/L

Measure	Categorical Cut-off Points
Elevated blood pressure (antihypertensive drug treatment in a patient with a history of hypertension is an alternate indicator)	Systolic BP ≥ 130 or Diastolic BP ≥ 85 mm Hg
Elevated fasting glucose (drug treatment of elevated glucose is an alternate indicator)	>100 mg/dL or 5.6mmol/L

Source: Alberti *et al*. Circulation. 120(16):1640-5.0
Table 1: Criteria for Clinical Diagnosis of the Metabolic Syndrome

Ethical clearance and Consent

The study protocol was approved by the Scientific Advisory Committee of National Institute of Nutrition (NIN) and the ethical clearance was obtained from the Institutional Ethical Review Board. Written informed consent was obtained from the subjects after explaining them the objectives of the study.

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Science (SPSS) software (version 19.0) [22]. Descriptive statistics like mean (SD) anthropometric and bio-chemical parameters and the prevalence of non-communicable diseases among the elderly were calculated by age group. Comparison of mean anthropometric and bio-chemical variables across age groups was done using t-test. Chi-square test was performed to study the association between the prevalence of Metabolic Syndrome and different variables. P value of <0.05 was considered as statistically significant.

Results

The demographic and coverage particulars are presented in Table 2. A total of 112 (Men: 68.8% & Women: 31.3%) free living older adults were covered for the study. Most of the households were either nuclear (56.3%) or extended nuclear families (21%) and the proportion of the literacy among the elderly was about 94%. All the elderly were married and about 82% were living with their spouses. The previous occupation of the majority (59.5%) of the older adults was either government or private service and the source of livelihood among 51% of the elderly was their own income.

Particulars	n	Percent
Gender		
Men	77	68.8
Women	35	31.3
Type of Family		
Nuclear	63	56.3
Extended nuclear	21	18.8
Joint	28	25.0
Literacy status		
Illiterate	7	6.3
Primary	10	9.0
Secondary	10	9.0
10+2	36	32.4
Graduate	39	35.1
Post graduate	9	8.1
Marital status		
Married	112	100.0
Living with spouse	92	82.1
Living alone	20	17.9
Currently working	8	7.1
Past occupation		
Laborers	2	1.8
Service	66	59.5
Business	5	4.5
Others (House wives)	30	27.0

Particulars	n	Percent
Main source of livelihood		
Own income	57	50.9
Support from family	39	34.8
Support from govt/NGO	5	4.5
Others	11	9.8
Smokers	22	19.4
Non-smokers	90	80.4
Alcoholics	28	25.0
Non-alcoholics	84	75.0
Vegetarian	55	49.1
Non-vegetarian	57	50.9
Physical activity	88	78.6
No Physical activity	12	21.4

Table 2: Coverage particulars of older adult population

About 22% of the older adults were smokers (both current and past) with the mean duration of smoking 19.4 years. Similarly, one fourth of the study subjects were alcoholics (both current and past) with the mean duration of consumption of alcohol 23.8 years. About 49% of the study subjects were vegetarians and a majority (78.6%) of the older adults were engaged in different physical activities such as walking, yoga and playing games (Shuttle badminton etc.).

Anthropometric measurements

The mean (SD) anthropometric measurements and indices of older adults by age groups are presented in Table 3. In general, all the mean anthropometric measurements and indices except for height and waist hip ratio (WHR) were lower in ≥ 70 years age group as compared to 60-69 years age group. The mean anthropometric measurements such as WC and HC were significantly ($p<0.05$) higher among age group of 60-69 years as compared to ≥ 70 years age group.

Particulars	Age group	n	Mean (SD)	p-value
Height (cms)	60-69	73	159.0 (8.90)	0.167
	≥ 70	38	162.65 (7.07)	
	Pooled	111	160.2 (8.47)	
Weight (kgs)	60-69	73	68.0 (9.91)	0.847
	≥ 70	38	65.3 (10.61)	
	Pooled	111	67.1(10.19)	
BMI* (kg/m^2)	60-69	73	26.8 (3.32)	0.669
	≥ 70	38	24.6 (3.67)	
	Pooled	111	26.0 (3.59)	
WC$^{\beta}$ (cms)	60-69	73	93.6 (8.40)	0.402
	≥ 70	38	90.4 (10.23)	
	Pooled	111	92.5 (9.15)	
HC† (cms)	60-69	73	99.2 (7.37)	0.419
	≥ 70	38	92.7 (8.24)	
	Pooled	111	97.0 (8.23)	
WHR‡	60-69	73	0.95 (0.77)	0.555
	≥ 70	38	0.98 (0.07)	
	Pooled	111	0.96 (0.08)	

BMI*: Body Mass Index; WC$^{\beta}$: Waist Circumference; HC† : Hip Circumference; WHR‡: Waist Hip Ratio

Table 3: Mean (±SD) of anthropometric parameters of urban older adults

Biochemical parameters and Blood Pressure

In general, all the mean (SD) biochemical parameters were higher among 60-69-year-old elderly as compared to elderly of ≥ 70 years. Similar trend was observed with respect to diastolic blood pressure (DBP), while, the mean systolic blood pressure (SBP) was higher among ≥ 70 -year-old elderly as compared to elderly of 60-69 years. However, no significant differences in mean biochemical parameters and blood pressure were observed between age groups (Table 4).

Particulars	Age group	n	Mean	p-value
HDL (mg/dL)	60-69	74	36.8 (9.84)	0.029
	≥ 70	38	36.3 (7.24)	
	Pooled	112	36.7 (9.00)	
Total Cholesterol (mg/dL)	60-69	74	159.7 (37.31)	0.785
	≥ 70	38	148.6 (38.05)	
	Pooled	112	155.9 (37.77)	
Triglycerides (mg/dL)	60-69	74	131.3 (71.63)	0.159
	≥ 70	38	95.4 (52.54)	
	Pooled	112	119.0 (67.67)	
Blood glucose (mg/dL)	60-69	74	133.8 (49.84)	0.357
	≥ 70	38	131.6 (32.43)	
	Pooled	112	133.0 (44.51)	
SBP† mm Hg	60-69	74	135.3 ((17.55)	0.263
	≥ 70	38	137.8 (14.89)	
	Pooled	112	136.2 (16.66)	
DBP* mm Hg	60-69	74	83.1 (8.93)	0.558
	≥ 70	38	82.0 (8.20)	
	Pooled	112	82.7 (8.66)	

SBP†: Systolic Blood Pressure; DBP*: Diastolic Blood Pressure

Table 4: Mean (±SD) bio-chemical parameters and blood pressure among the urban older adults

Components of metabolic syndrome

The prevalence of various non-communicable diseases among the urban older adults is presented in Table 5. In general, about 23% of the older adults had lower HDL levels. While about 11% and 24% elderly had higher cholesterol and triglycerides, respectively. Similarly, the proportion of the older adults with diabetes and hypertension was 62.2% and 79.3%, respectively. Likewise, majority of the older adults had central/visceral obesity (76.6%) and higher BMI (85.6%) values. The prevalence of overall obesity was significantly ($p<0.05$) higher among 60-69-year-old elderly as compared to elderly of ≥ 70 years. Similarly, the overall prevalence of metabolic syndrome among urban elderly was about 54%, and the prevalence was relatively higher in 60-69 years' age group as compared to older adults of ≥ 70 years.

Particulars	Age group	n	percent	p-value
HDL (Low HDL)	60-69	74	19.2	0.143
	≥ 70	38	31.6	
	Pooled	112	23.4	
Total Cholesterol (≥200mg/dL)	60-69	74	11.0	0.944
	≥ 70	38	10.5	
	Pooled	112	10.8	
Triglycerides (≥ 150mg/dL)	60-69	74	31.5	0.015
	≥ 70	38	10.5	
	Pooled	112	24.3	
Blood glucose (≥ 100mg/dL)	60-69	74	54.8	0.027
	≥ 70	38	76.3	
	Pooled	112	62.2	
Hypertension	60-69	74	79.5	0.950
	≥ 70	38	78.9	
	Pooled	112	79.3	
Central Obesity	60-69	74	87.7	0.000
	≥ 70	38	55.3	
	Pooled	112	76.6	
BMI (≥ 23 kg/m^2)	60-69	74	90.4	0.045
	≥ 70	38	76.3	
	Pooled	112	85.6	

Particulars	Age group	n	percent	p-value
Metabolic Syndrome	60-69	74	58.9	0.155
	≥ 70	38	44.7	
	Pooled	112	54.1	

Table 5: Prevalence (%) non-communicable diseases, the components of Metabolic Syndrome among the urban older adults

The association between the prevalence of Metabolic Syndrome and different variables is presented in Table 6. In general, the prevalence of MS was significantly ($p<0.001$) associated with obesity, where the elderly with central obesity and overweight/obese had high prevalence of MS. However, no significant association was observed between the prevalence of MS and variables such as gender, age group, literacy status and lifestyles in this pilot study ($p>0.05$).

Variable	n	MS†	Chi-square	p-value
Men	77	53.2	0.147	0.701
Women	35	57.1		
Age group			2.020	0.155
60-69	74	58.9		
≥ 70	38	44.7		
Illiterates	7	71.4	1.413	0.493
Up to 10th Standard	20	60.0		
College and above	84	51.2		
Smokers	22	59.1	0.236	0.627
Non-smokers	90	53.3		
Alcoholics	28	50.0	0.300	0.584
Non-alcoholics	84	56.0		
BMI			13.254	0.000
18.5 -23.0 kg/m2	16	12.5		
≥ 23.0 kg/m2	96	61.5		
Waist Circumference			40.500	0.000
Normal	26	0.0		
Central Obesity	86	70.9		
Vegetarian	55	56.4	0.157	0.692
Non-vegetarian	57	52.6		
Physical activity	72	59.7	2.247	0.134
No Physical activity	40	45.0		

†MS: Metabolic Syndrome

Table 6: The association between the prevalence of Metabolic Syndrome and different variables

Discussion

The current study on prevalence of metabolic syndrome among the free living urban geriatric population, perhaps, was carried out for the first time in Hyderabad metropolitan city. In general, the proportion of older adults of urban Hyderabad with MS was very high (54.1%), where a majority of them had central obesity (76.6%), hypertension (79.3%), diabetes (62.2%) and dyslipidemia according to the IDF criteria. Higher proportion of older adults in Hyderabad had MS as compared to their counterparts in Chennai (37.4% as per IDF), the other metropolitan city of South India while, as per the modified ATP-III and WHO criteria, the prevalence of MS among the older adults in Chennai was 45.9% and 45.5% , respectively[23]. Similarly, the corresponding figures of MS reported for the elderly in Tirupathi, another South Indian city was low (34.6%) [24]. Likewise, Prasad *et al* reported high prevalence of MS (40-65.6%) among urban dwelling elderly of Odissa, an Eastern Indian State [25]. While Sinha *et al* reported the prevalence of MS as 42.1% among the elderly residing in old age homes of Hyderabad [26].

As reported by the Tehran Lipid and Glucose Study (TLGS), the prevalence of MS among urban elderly in Iran was 41.9% [27] and the corresponding figures reported for the urban elderly in Iran and Taiwan was 55.4% [28] and 34.3% [29], respectively. Similarly, a Chinese study reported high prevalence of MS (46.3% to 62.9%) among rural elderly [30]. Hypertension, central obesity and diabetes mellitus are the major contributors for the risk of prevalence of MS in urban geriatric population of Hyderabad and similar contributors were reported for the prevalence of MS by other studies [24,29,31,32]. Thus, it is reiterated here that older

adults with any one of these risk factors should be cautious and adopt healthy lifestyles for the prevention of the increased risk of developing MS. In this present study, the prevalence of MS was higher in 60-69 years age group as compared to the elderly of ≥ 70 years and similar observations were made by Xiao et al. [30]. Similarly, the prevalence of MS was higher among the elderly women as compared to their men counterparts [24-30].

No significant association was reported between the prevalence of MS and the consumption of alcohol and tobacco in any form and the findings are consistent with findings of western studies [27,29,30]. Whereas, Sánchez-Villegas *et al* reported that drinking more than three alcoholic beverages per day was associated with high prevalence of MS [33]. Similarly, in the present study no significant association was observed between the MS and physical activity ($p > 0.05$). The probable reasons could be a majority of the elderly adopted practicing physical activity only after they were diagnosed with one or more non-communicable diseases and irregular or insufficient duration of physical activity.

In general, the prevalence of MS was reported to be higher among the urban elderly as compared to their rural counterparts, which could be attributed to the impact of urbanization. Urbanization significantly impacts the lifestyles through dietary and environmental influences with a consequent adverse effect on human health where the risk of development of lifestyle diseases is expected to be high [34-36].

Conclusion

The prevalence of MS is high among the urban geriatric population of Hyderabad, a South Indian city. Globally MS has taken up a greater dimension in urban geriatric health, where the prevalence of lifestyle diseases such as hypertension, diabetes mellitus, obesity etc. is high. Therefore, it is essential to take appropriate intervention measures like primordial prevention i.e. prevention of the development of risk factors for lifestyle diseases through health and nutrition education (HNE) and behavioral change communication (BCC). Similarly, the community is encouraged to adapt healthy lifestyles such as healthy eating, good sleep pattern, limiting smoking and alcoholism etc. during early stages of adulthood that is essential for prevention and control of metabolic syndrome and promotion of healthy ageing.

Limitations of the study

This study was carried out on pilot mode. Similarly, the information of dietary pattern among the older adults was not collected in the present study.

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