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The Nexus of Metabolic Syndrome and Quality of Life Among Elderly: Unrevealing Keys to Healthy Aging

Allah Wadhayo Kalo[1], Mujtaba Shah[2], Mushtaq Chanar[3], Ammara Ghuman[4], Sadaf Ujjan[5], Mamoona Khalid[6]

[1]Assistant Professor of Community Medicine, Bilawal Medical College (BMC) for Boys, LUMHS, Jamshoro
[2]Assistant Professor of Medicine, LUMHS, Jamshoro
[3]Assistant Professor of Community Medicine, Bilawal Medical College (BMC) for Boys, LUMHS, Jamshoro
[4]EMBA Health Management, WMO Gastroenterology Department of Liaquat University Hospital Hyderabad
[5,6]Lecturer of Community Medicine, Bilawal Medical College (BMC) for Boys, LUMHS, Jamshoro

Author`s Contribution

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Address of Correspondent
Dr. Allah Wadhayo Kalo
Assistant Professor of Community Medicine, Bilawal Medical College (BMC) for Boys, LUMHS/Jamshoro
assistantprofessorkalo@gmail.com

ABSTRACT

Objective: To determine the correlation between metabolic syndrome and quality of life (QoL) among elderly with insights into healthy aging.

Methodology: A Comparative Cross-sectional study was conducted at general wards of Civil Hospital Hyderabad, from March 2024 to August 2024 on elderly individuals aged 65 years and above, both gender with ability to comprehend and respond to study questionnaires. All the individuals were assessed for metabolic syndrome, defined as the presence of at least three out of five components including elevated fasting blood glucose, raised blood pressure, elevated triglyceride, low high-density lipoprotein (HDL) and increased waist circumference. The (QoL) was assessed using the World Health Organization WHOQOL-BREF quality of life tool. Data analysis was done using SPSS version 26.

Results: The mean age of the 370 elderly individuals in the study was 59.81 years, with a standard deviation of 7.92 years. Out of the 370 study participants, 58.1% (215 individuals) were male, and 41.9% (155 individuals) were female. A higher prevalence of metabolic syndrome found among elderly individuals around 73.0%. Overall 52.7% cases reported a good QoL, followed by average QoL 25.4% and poor QoL 21.9%. The metabolic syndrome was significantly more prevalent among elderly individuals with poor (76/81) and moderate (84/94) QoL compared with those with good, representing metabolic syndrome strongly linked to poor QoL (p=0.001).

Conclusion: The study revealed an important nexus between metabolic syndrome and QOL, representing that the metabolic syndrome is related to poor QOL among older adults, with increasing metabolic burden corresponding to a decline in QOL.

Key words: Metabolic syndrome, quality of life, Aged population.

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Introduction

The population aging is one of the most substantial changing population patterns of the 21st century, with the elderly people growing rapidly globally and carrying increased attention to the age-related health challenges. In these metabolic syndrome (MetS) is a condition that is categorized based on a combination of metabolic irregularities, including hypertension, a large waist circumference, impaired glucose metabolism, atherogenic dyslipidemia, and abdominal obesity, which collectively rise the risk of developing cardiovascular disease and diabetes, predominantly among obese adults.[1] It affects the peoples across the world, and its increasingly prevalent with advancing age, influencing around 22.7% of Brazilians, 24.3% of Europeans, and reported in around 34.2% of Americans.[2,3] Such varying estimates are partially associated with the use of different diagnostic criteria for the syndrome, along with socio

demographic factors like age, sex, ethnicity, and socioeconomic background.[2]

According to the raised risk of cardiovascular disease in the Asian populations, a lower waist circumference reference value has been established for the groups of this population. The waist circumference-based obesity is anticipated approximately 46–68% of the Pakistani population, and with a significant association between arm fat and insulin resistance (IR).[4] Lipid profile abnormalities usually observed, with hypertriglyceridemia stated in around 27–54% of the population, whereas the decreased high-density lipoprotein (HDL) levels are approximately in 68–81%.[4] Additionally, around half of the population was identified as being at increased risk of metabolic syndrome and the hypertension.

Assumed the frequent presence of these metabolic risk factors, the prevalence of metabolic syndrome in Pakistan is demonstrated to range from 18% to 46% depending on the definition equivalent to the data seen in other South Asian countries.[4] The south Asian population is the population with a common incidence of diabetes, hypertension and obesity and the life style and sedentary habits makes them more prone to metabolic syndrome.[5]

In elderly individuals, the metabolic syndrome is driven by numerous interconnected, age- associated biological changes rather than a single mechanism. Such alterations progressively impair the ability of muscles to respond to insulin, promoting blood glucose elevation and the compensatory hyperinsulinemia. Simultaneously, multiple age-linked physiologic mechanisms predispose older adults to intra-abdominal obesity, which further compounds IR and influences the broader metabolic syndrome phenotype, including hypertension, dyslipidemia and raised risk of cardiovascular and renal diseases.[6] According to an international study on older adults stated higher prevalence of metabolic syndrome around 40%, with hypertriglyceridemia, waist circumference, and raised blood glucose level contributing to 68.2% of diagnoses, and arterial hypertension component being the most prevalent.[7]

Moreover, it is important to emphasize that metabolic syndrome may lead to variations in self-perceived well-being, subsequently metabolic syndrome has been associated to a decline heath related QoL.[8-10] Remarkably, these alterations in HRQoL may encourage lifestyle changes more than the comorbidities associated with MetS itself. On the other hand, the association between metabolic syndrome and HRQoL is complicated, with previous studies indicating that the relationship may vary for the different components, physical and mental, of HRQoL. Additionally, the findings across the studies are not always consistent, particularly when it comes to the mental health dimension.[9,11]

Latest studies have explored the complex association between metabolic syndrome and quality of life among older adults, showing that it can negatively influence in multiple domain of well-being including physical health, mental health, social functioning, and overall satisfaction with life. Such as, a study found that elderly individuals with metabolic syndrome reported lower levels of physical functioning and higher levels of depressive symptoms compared to those without metabolic syndrome.[12] Moreover, emerging evidence suggests that addressing metabolic syndrome through lifestyle interventions and pharmacotherapy may positively impact quality of life outcomes among the elderly. For example, a randomized controlled trial demonstrated that a combination of dietary modification and exercise led to improvements in both metabolic parameters and quality of life measures among older adults with metabolic syndrome.[13] Beyond medical consequences, metabolic syndrome strongly associated with the (HRQOL) in old age population. Based on advancements in healthcare services contributing to increased life expectancy, researchers have increasingly shifted their focus toward assessing QoL.[14,15] The Health-related (QoL) refers to the magnitudes of QoL influenced by health status. It characterizes the overall perception of and individual for their ability to function and well-being across physical, social and the psychological domains.[15]

Despite the well-established association between metabolic syndrome and cardiovascular disease, its impact on self-reported health-related quality of life (HRQoL) has not been extensively studied. HRQoL is a multidimensional concept encompassing the physical, mental, emotional, and social aspects of health and well-being as perceived by an individual. Understanding the impact of metabolic syndrome on HRQoL among older adults is particularly important, as this population is more susceptible to the adverse effects of chronic health conditions and age-related decline. Therefore, this study was undertaken to investigate the relationship between metabolic syndrome and HRQoL among older adults, with the aim of generating insights that may help identify important factors for promoting healthy aging in this vulnerable population.

Methodology

A Comparative Cross-sectional study was conducted at general wards of Civil Hospital Hyderabad. Study was conducted after taking Ethical approval by Research Ethics Committee (REC) LUMHS. Study was completed during six months from March 2024 to August 2024, with ERC no (LUMHS/REC/-260). The sample size of 370 individuals was calculated by using the software raosoft sample size calculator, with proportion (The prevalence of metabolic syndrome in an elderly population varied from 11% to 43%)[15] based on 95% confidence level and 5% margin of error. A convenience sampling method was utilized. All the elderly individuals aged 65 years and above, both gender with ability to comprehend and respond to study questionnaires and assessments and willingness to participate in the study were included.

All the elderly individuals with severe cognitive impairment or dementia, inability to provide informed consent or participate in the study, presence of debilitating diseases or conditions that significantly affect mobility or communication and those who did given consent to take a part of study were excluded. Written informed consent was obtained from each study participant. Individuals were given full information regarding the study and its purpose, and any questions they had were answered both verbally and through a sheet of information. After providing written informed consent, metabolic parameters, including blood pressure, body mass index (BMI), waist circumference, fasting blood glucose, triglycerides, and HDL cholesterol levels, were measured, and the research volunteers were given a self-structured research questionnaire to complete in the presence of the investigator with the full support of the researcher on the spot. The metabolic syndrome was defined as where an individual was classified as having the condition if at least 3 of 5 parameters were met: fasting glucose ≥100 mg/dL, blood pressure ≥130/85 mmHg, triglycerides ≥150 mg/dL, HDL-C <40 mg/dL (men)/<50 mg/dL (women), and waist circumference ≥90 cm (men)/≥80 cm (women). Each parameter was scored as present or absent, and patients meeting ≥3 criteria were classified as having metabolic syndrome. BMI was defined as dividing weight in kilograms by the square of height in meters (kg/m²) of an individual and based on this value, individuals are classified as having normal weight if their BMI falls between 18 and 24.9 kg/m², overweight if their BMI ranges from 25 to 27.9 kg/m², and obesity if their BMI is 28 kg/m² or higher. Quality of life (QoL) scores were assessed using the World Health Organization WHOQOL-BREF quality of life tool.

The data were analyzed using SPSS version 26. For categorical variables, frequency and percentage were calculated, while for continuous variables, the mean and standard deviation were analyzed. The Chi-square test was applied to compare variables, and a p-value < 0.05 was considered the level of significance.

Results

The mean age of the 370 elderly individuals was 59.81 years, with a standard deviation of 7.92 years, with male predominance (58.1% male vs. 41.9% female), and were mostly married (97.8%), reflecting a largely stable family structure. Mostly cases resided in urban areas (67.3%), and a remarkable finding was the high rate of illiteracy, affecting more than three-quarters of participants (77.3%), corresponded with an equally high proportion (78.9%) reporting no formal occupation reflecting a socioeconomically vulnerable population, 61.1% were classified as poor. Particularly, excess body weight was nearly universal, with 61.4% participants as obese and an additional 32.2% overweight; encouragingly, however, physical activity was reported by nearly all participants (98.1%). The medication use (92.7%) and history of comorbidities (92.7%) were both remarkably high, along with a substantial history of smoking (37.0%) collectively indicating a substantial underlying burden of chronic disease risk, likely compounded by low literacy, limited occupational engagement, and socioeconomic disadvantage. Additionally, overall mean of FBS level, systolic/diastolic blood pressure, triglyceride level, high-density lipoprotein (HDL) and waist circumference presented in table I.

The metabolic syndrome was identified in 73.0% (270 participants) of the study population, while 27.0% (100 participants) did not have metabolic syndrome, and according to QOL, 52.7% reported having a good quality of life, 25.4% reported a moderate quality of life, and 21.9% reported a poor quality of life. Figure 1 & 2.

Among individuals with poor quality of life (n=81), 76 had metabolic syndrome, and among those with moderate quality of life (94), 84 had metabolic syndrome much higher than the 56.4% seen among those with good quality of life, reflecting that the metabolic syndrome is strongly associated to poor QOL in this elderly population. Table II

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Table I: Mean age of the elderly individuals. (n=370)			
Statistics		**Statistics**	
Mean		59.81±7.92 years	
Genders	Male	215	58.1%
	Female	155	41.9%
Marital status	Married	362	97.8%
	Un-married	08	02.2%
Residential status	Rural	121	32.7%
	Urban	249	67.3%
Educational status	Illiterate	286	77.3%
	Primary	60	16.2%
	High secondary	16	04.3%
	Graduate	04	01.1%
	Postgraduate	04	01.1%
Occupational status	Retired	32	08.6%
	Govt. employee	25	06.8%
	private job	21	05.7%
	Not any	292	78.9%
Socioeconomic status	Poor	226	61.1%
	Middle	136	36.8%
	Upper	08	02.2%
BMI	Normal	24	06.5%
	Overweight	119	32.2%
	Obese	227	61.4%
Physical activity	Yes	363	98.1%
	No	07	01.9%
Adequate fruit and vegetable consumption	Yes	322	87.0%
	No	48	13.0%
Usage of medications	Yes	343	92.7%
	No	27	07.3%
Comorbidities	Yes	343	92.7%
	No	27	07.3%
Smoking history		137	37.0%
FBS		198.76 ± 27.39	
Systolic BP		187.22 ± 18.47	
Diastolic BP		90.38 ± 8.88	
Triglycerides		211.02 ± 26.78	
HDL		38.13 ± 5.80	
Waist		43.75 ± 2.67	

Post-stratification analysis revealed a diverse pattern of associations across the socio-demographic variables. Gender emerged as a significant predictor of metabolic syndrome (p=0.035), but showed no significant association with quality of life (QoL) (p=0.353). In contrast, marital status and residential status were not significantly associated with either metabolic syndrome or QoL (p>0.05). Occupational and socioeconomic status were not significantly associated with metabolic syndrome (p>0.05); however, both demonstrated highly significant associations with QoL (p=0.001). These findings indicate that daily quality of life may be more strongly influenced by occupational and socioeconomic status than by metabolic health. (Tables III & IV)

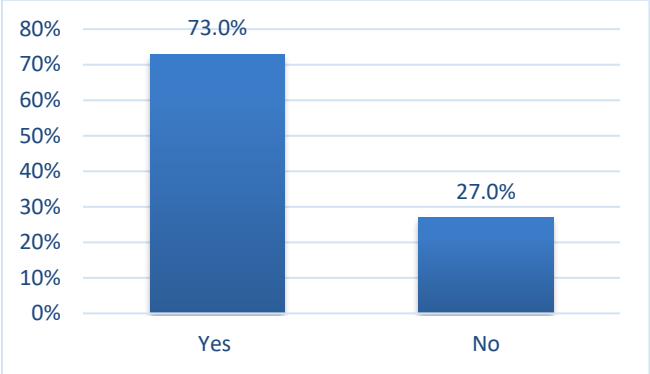


Figure 1. Prevalence of metabolic syndrome among study participants (n=370)

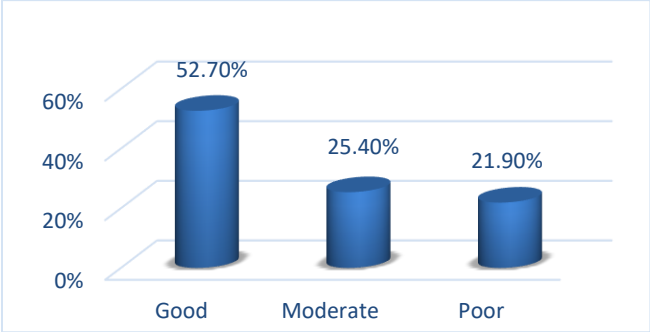


Figure 2. Status of the quality of life of study individuals. (n=370)

Table II: Association of metabolic syndrome with QOL among elderly individuals. (n=370)				
Quality of life	**Metabolic syndrome**		**Total**	p-value
	Yes	**No**		
Good	110	85	195	0.316
	29.7%	23.0%	52.7%	
Moderate	84	10	94	
	22.7%	2.7%	25.4%	
Poor	76	5	81	
	20.5%	1.4%	21.9%	
Total	270	100	370	
	73.0%	27.0%	100.0%	

Discussion

The metabolic syndrome (MetS) is characterized by a cluster of metabolic abnormalities, including raised blood pressure, dyslipidemia, hyperglycemia, and central obesity, which substantially rise the risk of major non-communicable diseases, contributing to an estimated 41 million deaths worldwide every year.[16] This study was conducted on 370 elderly individuals with overall 59.81 ± 7.92 years and predominance (58.1% vs. 41.9% female), to assess the correlation between metabolic syndrome and quality of life among elderly. The age and gender pattern was closely related to the study by Sultana M et al[17] who reported a mean age around 62.5 ± 8.0 years and almost equal gender distribution (198 males, and 202 females).

Table III: Metabolic syndrome according to demographic characteristics. (n=370)

Variables		Metabolic syndrome		Total	p-value
		Yes	No		
Gender	Male	148 (40.0%)	67 (18.1%)	215 (58.1%)	
	Female	122 (33.0%)	33 (8.9%)	155 (41.9%)	0.035
Marital status	Married	266 (71.9%)	96 (25.9%)	362 (97.8%)	
	Unmarried	04 (1.1%)	04 (1.1%)	08 (2.2%)	0.139
Occupational status	Retired	23 (6.2%)	09 (2.4%)	32 (8.6%)	
	Govt. employee	18 (4.9%)	7 (1.9%)	25 (6.8%)	
	Private job	11 (3.0%)	10 (2.7%)	21 (5.7%)	0.174
	Not any	218 (58.9%)	74 (20.0%)	292 (78.9%)	
Residential status	Rural	88 (23.8%)	33 (8.9%)	121 (32.7%)	
	Urban	182 (49.2%)	67 (18.1%)	249 (67.3%)	0.941
Socioeconomic status	Poor	159 (43.0%)	67 (18.1%)	226 (61.1%)	
	Middle	103 (27.8%)	33 (8.9%)	136 (36.8%)	0.118
	Upper	8 (2.2%)	0 (0.0%)	8 (2.2%)	

Table IV: QOL of elderly individuals according to demographic characteristics. (n=370)

Variables		QUALITY OF LIFE			p-value
		Good	Average	Poor	
Gender	Male	120 (32.4%)	52 (14.1%)	43 (11.6%)	
	Female	75 (20.3%)	42 (11.4%)	38 (10.3%)	0.035
Marital status	Married	191 (51.6%)	94 (25.4%)	77 (20.8%)	
	Unmarried	4 (1.1%)	0 (0.0%)	4 (1.1%)	0.139
Occupational status	Retired	20 (5.4%)	0 (0.0%)	12 (3.2%)	
	Govt employee	13 (3.5%)	12 (3.2%)	0 (0.0%)	
	Private job	15 (4.1%)	1 (0.3%)	5 (1.4%)	0.174
	Not any	147 (39.7%)	81 (21.9%)	64 (17.3%)	
Residential status	Rural	63 (17.0%)	33 (8.9%)	25 (6.8%)	
	Urban	132 (35.7%)	61 (16.5%)	56 (15.1%)	0.941
Socioeconomic status	Poor	101 (27.3%)	75 (20.3%)	50 (13.5%)	
	Middle	86 (23.2%)	19 (5.1%)	31 (8.4%)	0.118
	Upper	8 (2.2%)	0 (0.0%)	0 (0.0%)	

Chen MZ et al.[18] conducted a similar study to assess the demographic characteristics of frail participants with metabolic syndrome (MetS) and to evaluate the relationship between frailty status and quality of life (QoL) among individuals with MetS. They reported an overall mean age of 70.6 ± 5.0 years, with a slight majority of participants being women (169; 57.9%). Similarly, Laudisio A et al.[19], in a study of 356 older adults, reported a mean age of 79 ± 6 years among participants with MetS and 79 ± 6 years among those without MetS. Women constituted approximately 88 (64%) of the MetS group compared with 106 (48%) of the group without MetS. The observed variations in mean age and gender distribution across studies may be attributed to differences in sample sizes, study populations, and participant selection criteria. In this study overall prevalence of metabolic syndrome in this elderly cohort was (73.0%) which is notably high, exceeding not only the general local adult population estimates (18–46% depending on the criteria of diagnosis and age range) but also numerous elderly-specific estimates internationally, including the 66.81% reported in the Iranian Ardakan cohort.[20] However the Bangladeshi study by Sultana M et al[17] from Noakhali reported almost similar figures around 70% elderly participants were with metabolic syndrome. Another Iranian study found that the national prevalence of metabolic syndrome in the elderly significantly rose, from 46.11–66.38% during 2016 to 54.15–73.98% till 2021 depending on the diagnostic criteria, indicating an annual percentage rise of 2.19–3.26% with the upper end of this range closely matching the 73.0% prevalence observed in this study.[21] Such elevated prevalence likely reflects the compounding effect of the advanced age, overall excess body weight, increasing burden of comorbidities and socioeconomic disadvantage noted within this specific cohort, emphasizing that elderly populations in South Asia may represent a specifically higher risk for MetS compared to general adult populations.

In this study, good QOL was noted in (52.7%) of the cases, followed by average (25.4%) and poor (21.9%). The findings were approximately consistent with patterns observed in other elderly populations, where QOL vary considerably depending on the specific domains evaluated and the population enrolled. Like an Indian

study, for instance, demonstrated somewhat more favorable picture, with a mean quality of life score of 78.59 ± 12.6 and good QOL noted in the majority of elderly cases (64.9%), followed by excellent (19.8%) and fair/average (15.3%), in contrast to this study, where good quality of life was reported by 52.7%. In the comparison of this study, a community-based study on elderly residents of villages in Singur, West Bengal, with a mean age of 68 ± 5.87 years and a female predominance (59%), highlighted that the half of participants reporting good QOL (45.9%) and the majority (54.1%) reporting poor QOL, a remarkably less favorable distribution than observed in this series.

Moreover in this study among individuals with average and poor quality of life, mostly had metabolic syndrome, reflecting that the metabolic syndrome is strongly associated to poor QOL in this elderly population. The finding were similar to a systematic review of 30 studies involving over 62,000 participants, which reported that the metabolic syndrome is generally linked to poorer QOL.[22] Comparable findings were also reported by a Bangladeshi study on elderly cases in Noakhali, where reported that the metabolic syndrome negatively impacted overall quality of life across both genders.[17] Likewise, a similar pattern was observed by a Tehran-based study on health-related QOL and metabolic syndrome components noted that specific components of the syndrome, rather than a uniform effect, were related to the reduced QOL, though the overall direction remained toward impairment.[23] However the, the finding were differ from an Italian study of 356 community-dwelling adults aged 75 and older, which demonstrated that the metabolic syndrome was not significantly linked to associated the worsen health-related QOL overall, and was even related to better quality of life among the oldest men specially.[19] The difference may be attributed to the different social and economic contexts of developing versus developed countries. In the developed countries elderly peoples typically benefit from stronger social security systems, well organized pension schemes, comprehensive and supported healthcare coverage and reputable elderly care support network, may defense the impact of physical comorbidities like metabolic syndrome on overall individual well-being and QOL. It is also recommended that, particularly in developing countries and at the local level where poor socioeconomic status (SES) is a major contributing factor, healthcare policies should prioritize strengthening social security and support systems for older adults. These policies should also promote accessible and affordable screening and management strategies for metabolic syndrome, as this population appears particularly vulnerable to its combined physical and quality-of-life burden.

Additionally, community-based awareness programs are needed to promote healthy lifestyle modifications and routine metabolic screening integrated into primary healthcare services for older adults. Future longitudinal studies are also warranted to determine whether the relationship between metabolic syndrome and quality of life changes over time or with disease progression, particularly across different healthcare and socioeconomic contexts.

Conclusion

Study revealed an important nexus between metabolic syndrome and QOL and reflects that the metabolic syndrome is related to poor QOL among older adults, as the burden of metabolic syndrome rises, the QOL tends to decline. Overall findings suggesting that the healthy aging cannot be achieved through metabolic screening alone, but also requires attention to multiple factors, like body weight, control of chronic diseases, socioeconomic conditions, and overall well-being, which collectively influence the life of older adults. However, the metabolic syndrome as an important factor influencing the QOL, the proper protection of the physical health, the economic stability and social support of this elderly peoples should be addressed together to encourage healthy aging.

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