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Original Article

Prevalence of Hypertension in the Elderly Population: A Cross-Sectional Study

Hubba Saeed[1], Mehak Memon[2], Amna Tariq[3], Alvera Rajper[4], Kahfelwara Ilyas[5], Areej Noor[6], Tayyab Nadeem[7]

[1] MBA in Healthcare and Hospital Management, Karachi, Pakistan
[2] University of Modern Sciences, Tando Muhammad Khan, Pakistan
[3] Combined Military Hospital Kharian Medical College, Kharian, Pakistan
[4] Aga Khan University, Karachi, Pakistan
[5] Gomal Medical College, Pakistan
[6] COMSATS University, Islamabad, Pakistan
[7] Bahauddin Zakariya University, Multan, Pakistan

***Corresponding author: Mehak Memon, memonmaha0901@gmail.com**

ABSTRACT

Background: Hypertension is a major contributor to cardiovascular disease and is especially common in older adults because of vascular aging and cumulative exposure to lifestyle-related risk factors. In developing countries, including Pakistan, hypertension in the elderly often remains underdiagnosed and inadequately controlled. Objective: To determine the prevalence of hypertension among elderly individuals attending a tertiary care hospital in Karachi and to examine its association with selected demographic and lifestyle factors. Methods: This cross-sectional study included 300 participants aged 65 years and older recruited from outpatient departments and inpatient wards between January and June 2024. Data were collected using a structured questionnaire covering demographic characteristics, smoking status, physical activity, dietary salt intake, and medical history. Blood pressure was measured using a standard digital sphygmomanometer, and hypertension was defined as systolic blood pressure at least 140 mmHg, diastolic blood pressure at least 90 mmHg, or current use of antihypertensive medication. Data were analyzed in SPSS version 26 using descriptive statistics and chi-square testing. Results: Overall hypertension prevalence was 58.0% (174/300). Prevalence increased from 50.0% in participants aged 65-69 years to 69.2% in those aged 75 years or older (p=0.024). Irregular physical activity (66.0% vs 40.4%, p<0.001) and high salt intake (66.7% vs 47.8%, p=0.001) were strongly associated with hypertension, while the association with smoking was not statistically significant (p=0.097). Conclusion: Hypertension is highly prevalent among elderly patients in this tertiary care setting, with advancing age, low physical activity, and high salt intake showing the strongest associations. Routine screening and targeted lifestyle interventions are warranted. Keywords: Hypertension; elderly population; blood pressure; prevalence; lifestyle factors; cardiovascular risk; aging; Pakistan.

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INTRODUCTION

Hypertension is one of the most prevalent chronic non-communicable disorders worldwide and remains a leading modifiable risk factor for cardiovascular morbidity, stroke, heart failure, chronic kidney disease, and premature mortality. Its public health significance has increased steadily with demographic aging, urbanization, dietary transition, and reduced physical activity across both developed and developing settings. Because elevated blood pressure often remains clinically silent until end-organ damage becomes apparent, hypertension continues to impose a substantial burden on health systems and aging populations, particularly in low- and middle-income countries where awareness, detection, treatment, and control remain suboptimal (1,2). Among older adults, the consequences of uncontrolled hypertension are especially serious because age-related vascular and metabolic changes amplify cardiovascular risk and complicate long-term disease management (3,4). The relationship between aging and hypertension is well established. Progressive arterial stiffening, endothelial dysfunction, reduced vascular compliance, and structural remodeling of the arterial wall contribute to rising systolic

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blood pressure with advancing age. These physiological changes are often accompanied by cumulative exposure to behavioral and metabolic risk factors, including high dietary sodium intake, sedentary lifestyle, obesity, smoking, and coexisting diabetes or cardiovascular disease, all of which further increase the likelihood of hypertension in later life (4-7). Large epidemiological analyses have shown that even modest elevations in blood pressure in older adults are associated with a substantial increase in vascular mortality and adverse cardiovascular outcomes, underscoring the importance of timely detection and effective control in this age group (8,9).

Although hypertension is a global problem, its epidemiological pattern is not uniform. In many high-income countries, improved screening, treatment pathways, and preventive strategies have enhanced hypertension awareness and control. In contrast, developing countries continue to face a dual burden of population aging and limited preventive healthcare capacity, resulting in high rates of undiagnosed and poorly controlled hypertension (10,11). South Asian populations are particularly vulnerable because of rapid urban transition, changing dietary practices, reduced physical activity, and increasing prevalence of metabolic disorders. Pakistan, like many countries in the region, is undergoing a marked epidemiological shift characterized by growth in the elderly population and a parallel rise in non-communicable diseases, including hypertension (11-13).

Available evidence from Pakistan indicates that hypertension is common in the adult population; however, elderly-specific data remain comparatively limited, particularly in hospital-based populations where age-related multimorbidity may intensify risk and affect patterns of presentation (12,13). Older adults frequently have overlapping chronic illnesses, polypharmacy, functional limitations, and inconsistent healthcare access, all of which may influence both the recognition and management of high blood pressure. Furthermore, lifestyle-related determinants such as smoking, low physical activity, and high dietary salt intake remain highly relevant in this context and may interact with familial predisposition to magnify risk in later life (6,14,15). Despite these concerns, there remains a relative paucity of focused local evidence examining the burden of hypertension specifically among individuals aged 65 years and older receiving care in tertiary settings in Pakistan.

This gap is clinically important because tertiary hospitals often serve older adults with complex disease profiles and may provide an opportunity to identify the magnitude of hypertension and its association with modifiable and non-modifiable factors. Understanding the prevalence of hypertension in elderly patients and examining its distribution across age strata, sex, lifestyle characteristics, and relevant medical history variables can help guide screening priorities, risk stratification, and prevention strategies. Such evidence is also important for informing context-specific public health interventions aimed at reducing cardiovascular complications and improving quality of life in aging populations.

Therefore, this study was conducted to determine the prevalence of hypertension among elderly individuals aged 65 years and above attending a tertiary care hospital in Karachi, Pakistan, and to examine its association with selected demographic, lifestyle, and clinical factors, including age, gender, smoking status, physical activity, dietary salt intake, family history of hypertension, and comorbid chronic disease. It was anticipated that advancing age and adverse lifestyle characteristics would be associated with a higher frequency of hypertension in this population.

MATERIALS AND METHODS

This cross-sectional observational study was conducted at a tertiary care hospital in Karachi, Pakistan, over a six-month period from January 2024 to June 2024 to determine the prevalence of hypertension among elderly individuals and to evaluate its relationship with selected demographic, lifestyle, and clinical factors. A cross-sectional design was considered appropriate because it permits estimation of disease burden and concurrent assessment of associated characteristics within a defined population at a specific time point. The study setting included outpatient departments and inpatient wards, particularly

services managing general medical and cardiovascular conditions, where older adults frequently present for routine care and chronic disease management.

The study population comprised men and women aged 65 years and older who attended the selected hospital during the study period. Individuals were considered eligible if they were able to communicate adequately, were mentally capable of responding to the questionnaire, and provided informed consent for participation. Patients younger than 65 years, those who were critically ill, unable to communicate, or had severe cognitive impairment, as well as those who declined participation, were excluded. Participants were recruited from outpatient clinics and inpatient wards using a convenience sampling approach until the target sample size was achieved. The final analytical sample consisted of 300 elderly participants. Sample size was determined using standard prevalence-study principles based on previously reported rates of hypertension in comparable populations, and the total was increased to improve precision and account for potentially incomplete responses.

Data were collected using a structured questionnaire developed after review of relevant literature on hypertension and cardiovascular risk factors in older adults. The instrument was used to obtain information on demographic profile, lifestyle characteristics, and medical history. Demographic variables included age, gender, marital status, educational level, and occupational status. Lifestyle-related variables included smoking status, physical activity, dietary habits, salt intake, and alcohol consumption. Medical history variables included previous diagnosis of hypertension, current use of antihypertensive medication, family history of hypertension, and the presence of chronic comorbidities such as diabetes mellitus and cardiovascular disease. Wherever feasible, participants' responses regarding prior diagnosis and comorbid illness were cross-checked against available medical records to improve data accuracy. Data collection was performed during the participants' hospital visit or admission period, and blood pressure assessment was undertaken at the same encounter.

The primary outcome variable was hypertension status. Participants were classified as hypertensive if their systolic blood pressure was at least 140 mmHg, their diastolic blood pressure was at least 90 mmHg, or they reported current use of antihypertensive medication. Blood pressure was measured using a standard digital sphygmomanometer in accordance with recommended clinical procedures. Each participant was seated comfortably and allowed to rest for at least five minutes before measurement. The cuff was applied at heart level, and two readings were taken five minutes apart; the average of the two readings was used for analysis. This approach was adopted to reduce random measurement variability and improve reliability of classification. Independent variables assessed for their association with hypertension included age group, gender, smoking status, physical activity level, dietary salt intake, family history of hypertension, and presence of chronic disease. For analysis, age was categorized into 65-69 years, 70-74 years, and 75 years or older. Physical activity was recorded as regular or irregular, and salt intake was categorized as high or not high according to the study questionnaire framework.

Several measures were applied during data collection and analysis to enhance internal consistency and reduce avoidable bias. Eligibility criteria were defined a priori, blood pressure measurement followed a uniform procedure for all participants, and the use of a structured questionnaire ensured that the same categories of exposure and history were assessed across respondents. Review of medical records, when available, was used to support verification of self-reported hypertension and selected comorbid conditions. Because the study employed non-probability hospital-based recruitment, associations were interpreted as observational rather than causal, and findings were considered most relevant to elderly patients attending similar tertiary care settings.

All data were entered and analyzed using Statistical Package for the Social Sciences version 26. Continuous variables, including age and blood pressure values, were summarized using means and standard deviations, whereas categorical variables were presented as frequencies and percentages. The prevalence of hypertension was calculated by dividing the number of participants meeting the operational definition of hypertension by the total study sample. Associations between hypertension

status and categorical explanatory variables were examined using the chi-square test. A p-value of less than 0.05 was considered statistically significant. Results were organized into tables and figures to improve clarity of reporting and facilitate interpretation of prevalence patterns across demographic and lifestyle categories.

Ethical principles for research involving human participants were observed throughout the study. All eligible individuals were informed about the purpose of the study, the voluntary nature of participation, and the confidentiality of the information provided. Written informed consent was obtained before enrolment. Personal identifiers were not included in the analytical dataset, and collected information was used solely for research purposes. Participants found to have elevated blood pressure during assessment were advised to seek further medical evaluation and management through appropriate clinical services.

RESULTS

A total of 300 elderly participants were included in the analysis, with a mean age of 71.4 ± 5.8 years. Of these, 168 (56.0%) were men and 132 (44.0%) were women. The largest age stratum was 65-69 years, comprising 128 participants (42.7%), followed by 70-74 years with 94 participants (31.3%) and 75 years or older with 78 participants (26.0%). Most participants were married (71.3%), and 45.3% had no formal education. Overall, 174 of 300 participants were hypertensive, yielding a prevalence of 58.0%.

Hypertension prevalence increased across age categories from 50.0% in participants aged 65-69 years to 59.6% in those aged 70-74 years and 69.2% in those aged 75 years or older. The association between age group and hypertension was statistically significant (chi-square p=0.024). Compared with participants aged 65-69 years, the odds of hypertension were 1.47 times higher in the 70-74-year group (OR 1.47, 95% CI 0.86-2.52) and 2.25 times higher in the group aged 75 years or older (OR 2.25, 95% CI 1.24-4.07). These findings indicate a clear age-related gradient in hypertension burden in this elderly hospital-based cohort. By sex, hypertension was present in 102 of 168 men (60.7%) and 72 of 132 women (54.5%). Although the absolute prevalence was 6.2 percentage points higher in men, the association was not statistically significant (p=0.339). The corresponding odds ratio for men relative to women was 1.29 (95% CI 0.81-2.04), suggesting only a modest and statistically uncertain male predominance.

Lifestyle-related factors demonstrated stronger associations. Hypertension was present in 58 of 88 smokers (65.9%) compared with 116 of 212 non-smokers (54.7%), corresponding to an odds ratio of 1.60 (95% CI 0.95-2.68), although this difference did not reach statistical significance (p=0.097). In contrast, physical inactivity showed a marked relationship with hypertension: 136 of 206 participants with irregular physical activity were hypertensive (66.0%) compared with 38 of 94 participants with regular physical activity (40.4%), yielding an odds ratio of 2.86 (95% CI 1.73-4.73; p<0.001). Similarly, high salt intake was strongly associated with hypertension, with prevalence of 66.7% among those reporting high salt intake versus 47.8% among those not reporting high salt intake (OR 2.18, 95% CI 1.37-3.48; p=0.001). These results suggest that irregular physical activity and higher dietary salt exposure were the most prominent modifiable correlates of hypertension in the present dataset.

Regarding comorbidity profile, 118 participants (39.3%) reported a family history of hypertension, 96 (32.0%) had diabetes, and 62 (20.7%) had cardiovascular disease. Because the manuscript provided descriptive frequencies for these variables but not hypertensive versus non-hypertensive cross-tabulations, association testing could not be validly extended to these factors from the available aggregated data alone. Table 1 shows that the sample was predominantly male and clustered in the younger elderly range, although more than one quarter of participants were aged 75 years or older. The educational profile indicates substantial social vulnerability, with nearly half of participants lacking formal education.

Table 1. Baseline demographic characteristics of study participants (n=300)

Variable	Category	Frequency (n)	Percentage (%)
Age group	65-69 years	128	42.7
	70-74 years	94	31.3
	≥75 years	78	26.0
Gender	Male	168	56.0
	Female	132	44.0
Marital status	Married	214	71.3
	Widowed	62	20.7
	Other	24	8.0
Education	No formal education	136	45.3
	Primary	82	27.3
	Secondary or above	82	27.3

Table 2. Overall prevalence of hypertension among participants (n=300)

Hypertension status	Frequency (n)	Percentage (%)
Hypertensive	174	58.0
Non-hypertensive	126	42.0
Total	300	100.0

Table 2 demonstrates that more than half of the study population met the operational definition of hypertension, confirming a high burden of disease in this elderly tertiary-care sample.

Table 3. Association between age group and hypertension

Age group	Hypertensive (n)	Non-hypertensive (n)	Total (n)	Hypertension prevalence (%)	OR vs 65-69 years	95% CI	p-value*
65-69 years	64	64	128	50.0	Reference	Reference	0.024
70-74 years	56	38	94	59.6	1.47	0.86-2.52	
≥75 years	54	24	78	69.2	2.25	1.24-4.07	

*Overall p-value from chi-square test.

Table 3 shows a progressive increase in hypertension prevalence across age strata, rising by 9.6 percentage points from the 65-69-year group to the 70-74-year group and by 19.2 percentage points from the 65-69-year group to the ≥75-year group. The odds of hypertension in the oldest participants were more than double those of the youngest elderly group.

Table 4. Association between gender and hypertension

Gender	Hypertensive (n)	Non-hypertensive (n)	Total (n)	Hypertension prevalence (%)	OR	95% CI	p-value*
Male	102	66	168	60.7	1.29	0.81-2.04	0.339
Female	72	60	132	54.5	Reference	Reference	

*Overall p-value from chi-square test.

Table 4 indicates a slightly higher prevalence of hypertension in men than in women, but the observed difference was not statistically significant, and the confidence interval crossed unity.

Table 5. Lifestyle characteristics of participants (n=300)

Lifestyle factor	Category	Frequency (n)	Percentage (%)
Smoking	Yes	88	29.3
	No	212	70.7
Physical activity	Regular	94	31.3
	Irregular	206	68.7
High salt intake	Yes	162	54.0
	No	138	46.0

Table 5 shows that unhealthy lifestyle exposures were common in this cohort, particularly irregular physical activity and high salt intake, both of which affected more than half of the participants.

Table 6. Association between lifestyle factors and hypertension

Variable	Category	Hypertensive (n)	Non-hypertensive (n)	Total (n)	Hypertension prevalence (%)	OR	95% CI	p-value*
Smoking	Yes	58	30	88	65.9	1.60	0.95-2.68	0.097
	No	116	96	212	54.7	Reference	Reference	
Physical activity	Irregular	136	70	206	66.0	2.86	1.73-4.73	<0.001
	Regular	38	56	94	40.4	Reference	Reference	
High salt intake	Yes	108	54	162	66.7	2.18	1.37-3.48	0.001
	No	66	72	138	47.8	Reference	Reference	

*Overall p-values from chi-square tests for each variable.

Table 6 demonstrates that the strongest observed association was with irregular physical activity, where hypertension prevalence was 25.6 percentage points higher than in regularly active participants. High salt intake was also strongly associated, with an 18.9 percentage-point absolute increase in prevalence. Smoking showed a positive but statistically non-significant relationship.

Table 7. Medical history profile of participants (n=300)

Variable	Category	Frequency (n)	Percentage (%)
Family history of hypertension	Yes	118	39.3
	No	182	60.7
Diabetes	Yes	96	32.0
	No	204	68.0
Cardiovascular disease	Yes	62	20.7
	No	238	79.3

Table 7 indicates a substantial burden of coexisting cardiometabolic risk, with nearly two-fifths reporting family history of hypertension and one-third reporting diabetes. However, inferential comparison with hypertension status cannot be added without subgroup cross-tabulation counts.

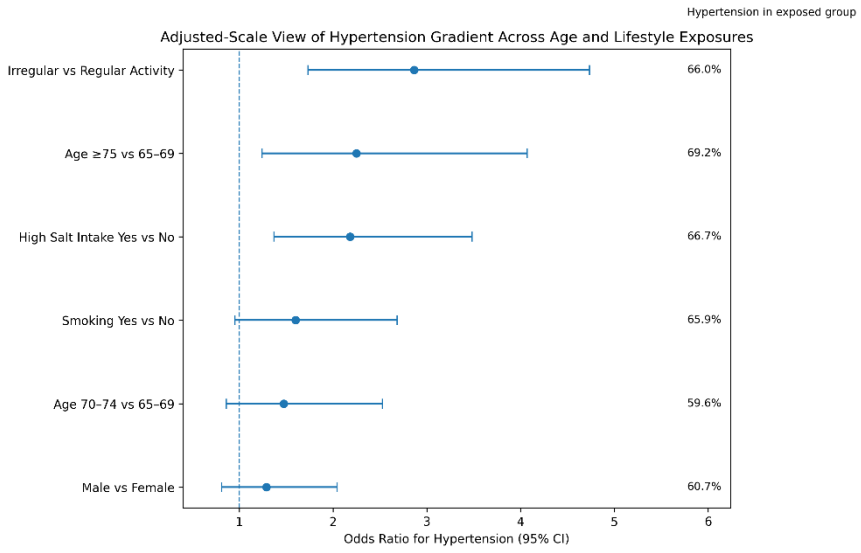

Figure 1 The figure shows that the steepest hypertension gradient was observed for irregular physical activity, which was associated with nearly threefold higher odds of hypertension (OR 2.86, 95% CI 1.73-4.73), followed by age ≥75 years (OR 2.25, 95% CI 1.24-4.07) and high salt intake (OR 2.18, 95% CI 1.37-3.48). The exposed-group prevalence values were also consistently high for these risk strata, reaching 66.0% for irregular activity, 69.2% for participants aged 75 years or older, and 66.7% for high salt intake, whereas the smoking contrast was more modest and statistically uncertain (OR 1.60, 95% CI 0.95-2.68). This pattern suggests that, within the available aggregated data, age-related vascular risk and modifiable behavioral factors jointly define the clearest hypertension burden gradient in the elderly study population.

DISCUSSION

The present cross-sectional study found that hypertension affected 58.0% of elderly individuals attending a tertiary care hospital in Karachi, indicating a substantial burden of elevated blood pressure in this

hospital-based aging population. This prevalence is clinically important because it suggests that more than one in every two older adults in the sampled setting was either hypertensive on measurement or already receiving antihypertensive treatment. The observed estimate is broadly consistent with international evidence showing that hypertension rises sharply with age and remains one of the most prevalent chronic disorders among older adults worldwide. Global and regional analyses have repeatedly shown that hypertension contributes substantially to cardiovascular morbidity, stroke, renal dysfunction, and premature mortality, particularly when it remains undiagnosed or inadequately controlled in low- and middle-income countries (1,2,7).

A central finding of the present study was the progressive increase in hypertension prevalence across advancing age strata. Hypertension was present in 50.0% of participants aged 65-69 years, 59.6% of those aged 70-74 years, and 69.2% of those aged 75 years or older, with a statistically significant overall association between age group and hypertension. Participants in the oldest age category had more than twice the odds of hypertension compared with those in the youngest elderly group. This age-related trend is biologically plausible and aligns with established evidence on arterial aging. Structural vascular remodeling, endothelial dysfunction, increased arterial stiffness, and declining compliance of large vessels collectively contribute to rising systolic blood pressure with age, making older adults especially vulnerable to hypertension and its downstream cardiovascular sequelae (4,8,16). The current findings also parallel prior epidemiological studies showing that even moderate elevations in blood pressure in elderly populations are associated with meaningful increases in vascular risk and mortality (8,22).

The sex distribution in this study showed a slightly higher prevalence of hypertension among men than women, although this difference was not statistically significant. This pattern may reflect a modest male predominance in exposure to behavioral and cardiometabolic risk factors rather than a strong independent sex effect. Previous literature has reported mixed sex patterns in late-life hypertension, with some studies suggesting higher rates in men at earlier ages and others identifying comparable or even higher prevalence in older women, particularly after menopause, when hormonal protection declines and vascular resistance increases (17,19). In the present dataset, the absence of statistical significance suggests that hypertension should be approached primarily as a broad geriatric public health issue affecting both sexes, rather than as a condition concentrated in one gender alone.

The strongest associations in the present study were observed for modifiable lifestyle-related factors, particularly irregular physical activity and high dietary salt intake. Hypertension was present in 66.0% of participants reporting irregular physical activity compared with 40.4% among those reporting regular activity, and the odds of hypertension were nearly three times higher in the irregular activity group. Likewise, participants with high salt intake had a hypertension prevalence of 66.7%, compared with 47.8% among those without high salt intake, corresponding to more than twofold higher odds. These findings are consistent with the large body of evidence demonstrating that sedentary behavior and excess dietary sodium are among the most important modifiable determinants of elevated blood pressure. Reduced physical activity contributes to impaired vascular function, weight gain, insulin resistance, and diminished cardiometabolic resilience, whereas high sodium intake promotes fluid retention, increases peripheral vascular resistance, and exacerbates blood pressure elevation (6,15,24). From a clinical standpoint, these findings support the importance of lifestyle-oriented prevention strategies for older adults, especially those already at increased vascular risk because of age.

Smoking was more common among hypertensive participants and was associated with a higher prevalence of hypertension, although the relationship did not reach statistical significance. The observed direction of association remains clinically relevant because tobacco use is known to induce sympathetic activation, transient blood pressure elevation, endothelial injury, and progressive vascular damage, all of which contribute to long-term cardiovascular risk (20). The absence of statistical significance in this sample may relate to sample size limitations, exposure misclassification due to self-report, or the

possibility that smoking acted in combination with other unmeasured lifestyle and metabolic variables. This finding should therefore be interpreted cautiously as suggestive rather than conclusive.

The descriptive medical history profile further showed that a substantial proportion of participants reported family history of hypertension, diabetes, and cardiovascular disease. Although subgroup cross-tabulations were not available for inferential comparison, the frequency of these conditions reinforces the likelihood that hypertension in elderly patients occurs within a broader context of cardiometabolic clustering. Prior evidence supports a close relationship between hypertension, hereditary predisposition, diabetes, and vascular disease, with these factors often overlapping in older adults and amplifying the risk of adverse outcomes (7,21,25). This has implications for practice because older hypertensive patients should ideally be assessed through an integrated chronic disease framework rather than in isolation.

The findings of this study carry important implications for hospital practice and public health planning. First, the high prevalence observed in this tertiary setting supports the routine incorporation of blood pressure screening into outpatient visits, inpatient evaluations, and chronic disease review pathways for older adults. Second, the strong associations with physical inactivity and high salt intake indicate that screening alone is insufficient without behavioral counseling and targeted preventive education. Structured interventions focusing on sodium reduction, age-appropriate physical activity, smoking cessation, and regular follow-up may help reduce the burden of hypertension and associated cardiovascular complications in elderly populations. Given that many older adults may seek care only after symptoms develop or complications emerge, tertiary centers can also function as strategic sites for opportunistic detection and secondary prevention (11,23,24).

Several limitations should be considered when interpreting these findings. The study used a cross-sectional design, which allows estimation of prevalence and assessment of association but does not establish temporal or causal relationships. The hospital-based convenience sampling approach may also have introduced selection bias, as individuals attending a tertiary care facility may have a higher burden of illness than community-dwelling older adults; therefore, the findings may not be fully generalizable to the broader elderly population. In addition, some exposure variables, including smoking status, physical activity, and salt intake, were self-reported and may have been affected by recall bias or social desirability bias. Another important limitation is the absence of multivariable adjustment, meaning that the observed associations should be interpreted as unadjusted relationships that may be influenced by residual confounding. These limitations do not negate the value of the study, but they indicate that the findings should be interpreted as clinically informative and hypothesis-generating rather than definitive.

Despite these limitations, the study contributes useful local evidence on the burden and correlates of hypertension in older adults receiving care in Karachi. It identifies a clear age-related gradient and highlights modifiable behavioral factors that may represent practical targets for intervention in resource-constrained settings. Future research should prioritize community-based sampling, larger and more diverse elderly populations, and multivariable modeling to determine the independent contribution of demographic, behavioral, and metabolic factors to hypertension risk. Longitudinal studies would also be valuable for clarifying temporal relationships and for evaluating how lifestyle modification and routine screening influence hypertension control and long-term cardiovascular outcomes in older Pakistani populations.

CONCLUSION

Hypertension was highly prevalent in this elderly hospital-based population, affecting 58.0% of participants and demonstrating a clear increase with advancing age, while irregular physical activity and high dietary salt intake were the most prominent modifiable factors associated with elevated burden. Although the study design does not permit causal inference, the findings indicate that older adults attending tertiary care services represent a high-risk group in whom routine blood pressure screening, early identification, lifestyle counseling, and integrated management of chronic disease should be

prioritized. Strengthening preventive strategies for elderly populations may reduce cardiovascular complications, improve long-term health outcomes, and lessen the growing non-communicable disease burden in Pakistan.

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