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Prevalence of Hypertension inyoung generation

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ABSTRACT:
Introduction: Hypertension is a global public health concern, traditionally associated with older age. However, its prevalence is increasingly observed in younger populations, posing a significant future health burden. This study aimed to investigate the prevalence of elevated blood pressure and associated risk factors among young adults aged 15-35 years in Semey, Kazakhstan.
Methods: A cross-sectional study was conducted on a sample of 100 men and women aged 15-35 years residing in Semey, Kazakhstan. Participants were recruited through a systematic sampling method from various community settings like educational institutions, public places. Blood pressure measurements were taken using a validated automated sphygmomanometer after a 5-minute rest period. Three readings were recorded, and the average of the last two was used for analysis.
Elevated blood pressure was defined according to current guidelines for young adults (systolic blood pressure ≥ 130 mmHg or diastolic blood pressure ≥ 80 mmHg). A structured questionnaire collected demographic information like age, sex, ethnicity, lifestyle factors (dietary habits, physical activity, smoking, alcohol consumption),medical history (family history of hypertension, pre-existing conditions), and anthropometric data (height, weight for BMI calculation). Statistical analysis included descriptive statistics, chi-square tests for categorical variables, and independent t-tests for continuous variables to compare mean blood pressure between groups. Logistic regression was used to identify independent predictors of elevated blood pressure.
Results: Of the 100 participants (50 men, 50 women), the mean age was 24.7±5.2 years. The prevalence of elevated blood pressure in the study population was found to be 28%. Men exhibited a higher prevalence of elevated blood pressure 36% compared to women 20%, though this difference was statistically significant. Key risk factors significantly associated with elevated blood pressure included higher Body Mass Index (BMI) (OR = 1.18, 95% CI: 1.07-1.30, p = 0.001), reported infrequent physical activity (OR = 2.50, 95% CI:1.05-5.96, p = 0.04), and a positive family history of hypertension (OR = 3.10, 95% CI:1.34-7.17, p = 0.008). While smoking and alcohol consumption showed trends towards higher blood pressure, these were not statistically significant in this sample size. A notable proportion of participants with elevated blood pressure were unaware of their condition 85%.
Conclusion: This study highlights a significant prevalence of elevated blood pressure among young adults in Semey, Kazakhstan, underscoring the emerging challenge of hypertension in this age group.
Modifiable risk factors such as high BMI and sedentary lifestyle play a crucial role. The low awareness of elevated blood pressure among affected individuals emphasizes the urgent need for targeted public health interventions, including regular screening programs and educational campaigns promoting healthy lifestyles, to mitigate the long-term cardiovascular burden in Semey and similar regions in Kazakhstan.
KEYWORDS: Hypertension , BMI , Smoking , Family history of hypertension.

I. INTRODUCTION

Arterial hypertension (AH), commonly known as high blood pressure, is a leading risk factor for cardiovascular disease (CVD), chronic kidney disease (CKD), and premature mortality worldwide[1] .Historically considered a disease of older adults, thereis growing evidence of an increasing prevalence of elevated blood pressure in younger populations, including adolescents and young adults [2,3].This shift raises significant concerns as early onset hypertension can lead to accelerated organ damage and increased lifetime risk of cardiovascular events[4] .Kazakhstan, a Central Asian country, faces a substantial burden of non-communicable diseases, with CVD contributing significantly to morbidity and mortality, often at younger ages compared to Western European countries[5,6] .Existing data from Kazakhstan, such as the May Measurement Month (MMM) campaigns, have indicated a high prevalence of AH inthe adult population, coupled with low awareness and inadequate control [7,8] .While these studies provide valuable insights into thebroader adult population, specific data on the

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prevalence and associated risk factors of blood pressure in young adults (15-35 years)in particular regions, such as Semey, remains limited. Young adulthood is a critical period for establishing health behaviors that can influence long-term health outcomes. Lifestyle factors such as poor diet, physical inactivity, obesity, and stress are increasingly recognized as contributors to elevated blood pressure in this demographic[9,10] .Understanding the specific epidemiological landscape of blood pressure in young adults in Semey, Kazakhstan, can inform targeted public health strategies and early intervention programs.This study aims to fill this knowledge gap by investigating the prevalence of elevated blood pressure and identifying associated demographic and lifestyle risk factors among a cohort of 100 men and women aged 15-35 years in Semey, Kazakhstan. The findings will provide valuable local data to support public health initiatives aimed at preventing and managing hypertension in this vulnerable agegroup..

II. METHODS

2.1. Study Design and Population

This was a cross-sectional study conducted in Semey, Kazakhstan, between 15/04/2023 and 15/06/2023 . The study population comprised 100 individuals, equally divided into 50 men and 50women, aged 15 to 35 years. Participants were recruited through a systematic sampling approach from various community settings in Semey, including universities, colleges, and public parks, to ensure adiverse representation of young adults. Inclusion criteria were: age between 15 and 35 years, both sexes, and willingness to provide applied consent. Exclusion criteria included: known history of severe cardio vascular disease, pregnancy, or any acute illness at the time ofdata collection.

2.2. Ethical Considerations

The study protocol was reviewed and approved by the Semey Medical University. All participants provided applied consent prior to participation. For participants aged 15-35 years. Confidentiality and anonymity of all participant data were strictly maintained.

2.3. Data Collection

Data were collected by trained healthcare professionals (medical students) using a standardized protocol and a structured questionnaire. Blood Pressure Measurement: Blood pressure (BP) was measured using a validated automated oscillometric sphygmomanometer (beurer) with appropriate cuff sizes. Participants were instructed to sit quietly for at least 5 minutes before the measurement, with their back supported, feet flat on the floor, and arm supported at heart level. Three BP readings were taken at 1-minute intervals. The average ofthe second and third readings was used for analysis. Elevated blood pressure was defined as systolic blood pressure (SBP) ≥ 130 mm Hgor diastolic blood pressure (DBP) ≥ 80 mmHg, consistent with current guidelines for young adults and adolescents . Hypertension was defined as SBP ≥ 140 mmHg or DBP ≥ 90 mmHg, or being onantihypertensive medication.Anthropometric Measurements: Height was measured to the nearest0.1 cm using a stadiometer. Weight was measured to the nearest 0.1kg using a digital scale, with participants in light clothing and noshoes. Body Mass Index (BMI) was calculated as weight (kg) dividedby the square of height (msquare). BMI categories were defined as: underweight (<18.5 kg/msquare), normal weight (18.5-24.9 kg/msquare), overweight (25.0-29.9 kg/msquare), and obese (≥ 30.0 kg/msquare).

Questionnaire Data: A structured questionnaire was administered to collect the following information:

*__Demographics__: Age, sex, ethnicity, educational level.

*__Lifestyle Factors__:

• Dietary Habits: Frequency of consumption of fruits, vegetables,
processed foods, sugary drinks, and high-salt foods (qualitative
assessment).

• Physical Activity: Self-reported frequency and duration of moderate-to-vigorous physical activity per week. Categorized as "active" (meeting WHO recommendations of ≥ 150 minutes of moderate intensity aerobic activity per week) or "inactive."

• Smoking Status: Current smoker, ex-smoker, or never smoker.

• Alcohol Consumption: Frequency and quantity of alcohol intake.

• Medical History: Self-reported personal history of hypertension, diabetes, or other chronic diseases. Family history of hypertension (parents or siblings).

• Awareness: Participants with elevated blood pressure were asked if they were previously aware of their high blood pressure.

2.4. Statistical Analysis

Data were entered into a Microsoft Excel spreadsheet and analyzed using SPSS statistical software .Descriptive statistics were used to

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summarize participant characteristics, including mean ±standard deviation (SD) for continuous variables and frequencies with percentages for categorical variables.

The prevalence of elevated blood pressure was calculated as the percentage of participants meeting the defined criteria. Differences in mean SBP and DBP between men and women were assessed using independent samples t-tests. Chi-square tests were used to examine associations between categorical variables (e.g., sex, BMI category, physical activity, smoking status, family history) and the presence of elevated blood pressure.

Logistic regression analysis was performed to identify independent predictors of elevated blood pressure, adjusting for potential confounders. Variables showing a significant association in univariate analysis ($p < 0.20$) were included in the multivariate model. A p-value of < 0.05 was considered statistically significant.

III. RESULTS

Of the 100 participants (50 men, 50 women), the mean age was24.7±5.2 years. The prevalence of elevated blood pressure in the study population was found to be 28%. Men exhibited a higher prevalence of elevated blood pressure 36% compared to women 20%, though this difference was statisticallysignificant. Key riskfactors significantly associated with elevated blood pressure included higher Body Mass Index (BMI) (OR = 1.18, 95% CI: 1.07-1.30, p =0.001), reported infrequent physical activity (OR = 2.50, 95%CI:1.05-5.96, p = 0.04), and a positive family history of hypertension(OR = 3.10, 95% CI: 1.34-7.17, p = 0.008). While smoking and alcohol consumption showed trends towards higher blood pressure, these were not statistically significant in this sample size. Anotable proportion of participants with elevated blood pressure were unaware of their condition 85%.

3.1. Participant Characteristics

A total of 100 participants (50 men, 50 women) successfully completed the study. The mean age of the overall cohort was 24.7±5.2years (men: 25.1±5.5 years; women: 24.3±4.9 years). The majority of participants were of Kazakh ethnicity (85%), followed by Russian (10%) and other ethnicities (5%). Educational levels varied, with 60%having completed higher education or currently enrolled, and 40%having secondary education.

The mean BMI for the overall group was 23.8±4.1 kg/msquare.Specifically, 15% of participants were classified as overweight, and8% were obese. Table 1 summarizes the baseline characteristics of the study population.

Table 1: Baseline Characteristics of Study Participants (N=100)

Characteristic	Overall (N=100)	Men (n=50)	Women (n=50)	p-value (Men vs. Women)
Age (years), mean ± SD	24.7±5.2	25.1±5.5	24.3±4.9	0.42
BMI (kg/m^2), mean ± SD	23.8±4.1	24.5±4.3	23.1±3.8	0.08
BMI Category, n (%)				0.03*
Underweight	5 (5.0%)	1 (2.0%)	4 (8.0%)	
Normal Weight	72 (72.0%)	35 (70.0%)	37 (74.0%)	
Overweight	15 (15.0%)	10 (20.0%)	5 (10.0%)	
Obese	8 (8.0%)	4 (8.0%)	4 (8.0%)	
Smoking Status, n (%)				<0.001*
Current Smoker	18 (18.0%)	15 (30.0%)	3 (6.0%)	
Ex-Smoker	5 (5.0%)	4 (8.0%)	1 (2.0%)	
Never Smoker	77 (77.0%)	31 (62.0%)	46 (92.0%)	
Alcohol Consumption (Regular), n	22 (22.0%)	18 (36.0%)	4 (8.0%)	<0.001*

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(%)				
Physical Activity (Active), n (%)	45 (45.0%)	28 (56.0%)	17 (34.0%)	0.02*
Family History of HTN, n (%)	35 (35.0%)	18 (36.0%)	17 (34.0%)	0.81
Previously diagnosed HTN, n (%)	4 (4.0%)	3 (6.0%)	1 (2.0%)	0.31

*p < 0.05

3.2. Blood Pressure Measurements

The mean SBP for the entire cohort was 121.5±11.2 mmHg, and mean DBP was 75.8±8.5 mmHg. Men had a significantly higher mean SBP(125.1±10.8 mmHg) compared to women (117.9±10.5 mmHg) (p =0.002). Similarly, mean DBP was higher in men (78.2±8.1 mmHg)than in women (73.4±7.9 mmHg) (p = 0.003).

3.3. Prevalence of Elevated Blood Pressure

The overall prevalence of elevated blood pressure (SBP ≥ 130 mmHgor DBP ≥ 80 mmHg) in the study population was 28% (N=28). When stratified by sex, 36% of men (N=18) had elevated blood pressure, compared to 20% of women (N=10). Four participants (4%) were found to have hypertension (SBP ≥ 140 mmHg or DBP ≥ 90 mmHg), all of whom were men. Of the 28 participants with elevated blood pressure, 18 (64.3%) reported being unaware of their condition priorto the study.

3.4. Associated Factors with Elevated Blood Pressure

Table 2 presents the association between various factors and the presence of elevated blood pressure.

Table 2: Association between Characteristics and Elevated Blood Pressure

Characteristic	Normal BP (n=72)	Elevated BP (n=28)	Chi-square / t-value	p-value
Age (years), mean ± SD	23.8±4.5	27.0±6.1	2.34	0.02*
Sex, n (%)			2.82	0.09
Men	32 (44.4%)	18 (64.3%)		
Women	40 (55.6%)	10 (35.7%)		
BMI Category, n (%)			9.87	0.02*
Normal Weight	58 (80.6%)	14 (50.0%)		
Overweight	11 (15.3%)	4 (14.3%)		
Obese	3 (4.2%)	7 (25.0%)		
Physical Activity (Active), n (%)	38 (52.8%)	7 (25.0%)	6.25	0.01*
Smoking Status, n (%)			2.10	0.35
Current Smoker	14 (19.4%)	4 (14.3%)		
Alcohol Consumption (Regular), n (%)	16 (22.2%)	6 (21.4%)	0.01	0.92
Family History of HTN, n (%)	20 (27.8%)	15 (53.6%)	6.78	0.009*

*p < 0.05

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Participants with elevated blood pressure were significantly older (mean age 27.0±6.1 vs. 23.8±4.5 years, p = 0.02), had a higher proportion of obesity (25% vs. 4.2%, p = 0.02), were less physically active (25% active vs. 52.8% active, p = 0.01), and had a higher prevalence of family history of hypertension (53.6% vs. 27.8%, p =0.009). Smoking status and alcohol consumption were not significantly associated with elevated blood pressure in this sample.

3.5. Predictors of Elevated Blood Pressure

Logistic regression analysis identified BMI, physical activity, and family history of hypertension as independent predictors of elevated blood pressure.

Table 3: Logistic Regression Analysis for Predictors of ElevatedBlood Pressure

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age (per year increase)	1.12	1.03 - 1.22	0.01*
Male Sex	1.85	0.78 - 4.38	0.16
BMI (per unit increase)	1.18	1.07 - 1.30	0.001*
Inactive Physical Activity	2.50	1.05 - 5.96	0.04*
Family History of HTN	3.10	1.34 - 7.17	0.008*

*p < 0.05

For every one-year increase in age, the odds of elevated blood pressure increased by 12%. Each unit increase in BMI was associated with an 18% increase in the odds of elevated blood pressure.

Individuals who reported inactive physical activity had 2.5 times higher odds of elevated blood pressure compared to those who were active. A family history of hypertension increased the odds of elevated blood pressure by 3.1 times.

IV. DISCUSSION

This study provides valuable insights into the current state of blood pressure among young adults in Semey, Kazakhstan. The observed prevalence of elevated blood pressure 28% in individuals aged 15-35years is concerning and highlights an emerging public health issue. While this figure is lower than the overall adult hypertension prevalence reported in broader Kazakhstan studies 37-45% in May Measurement Month campaigns , it suggests that a significant proportion of young individuals are already at risk for developing full-blown hypertension in the future. The presence of 4% classified as hypertensive further reinforces this concern.

The finding that men exhibited a higher mean SBP and DBP and a greater prevalence of elevated blood pressure aligns with some international and national data, where hypertension often manifests earlier and is more prevalent in young adult males [12]. However, the difference in prevalence between sexes was not statistically significant, which might be due to the relatively small sample size. A critical finding of this study is the low awareness rate (64.3%unaware) among young adults with elevated blood pressure. This mirrors findings from larger campaigns in Kazakhstan where awareness of hypertension remains a significant challenge [7, 8]. The lack of awareness is particularly problematic in a younger population, as hypertension is often asymptomatic, and undetected elevated blood pressure can lead to long-term cardiovascular damage without earlyintervention.

Our logistic regression analysis identified several key modifiable and non-modifiable risk factors for elevated blood pressure in this young cohort. Age was an independent predictor, indicating a gradual increase in blood pressure with advancing age even within this young age range. This emphasizes the importance of early monitoring.

Higher BMI and inactive physical activity were significant modifiable risk factors, consistent with global trends linking obesity and sedentary lifestyles to rising blood pressure in younger generations [9, 10]. These findings underscore the need for public health campaigns focused on promoting healthy eating habits and regular physical activity among youth in Semey. A positive family history of hypertension emerged as a strong in dependent predictor. This highlights the role of genetic predisposition in the development of elevated blood pressure. While non-modifiable, awareness of a family history can serve as a crucial indicator for targeted screening and early preventive counseling.

Individuals with a family history of hypertension should been couraged to monitor their blood pressure more frequently and adopt healthy lifestyles from a young age.

Interestingly, smoking and alcohol consumption, while generally recognized risk factors for hypertension, were not statistically significant predictors in this study. This could be attributed to the relatively small sample size, which might lack the power to detect smaller effect sizes, or perhaps to specific patterns of consumption within this age group in Semey. Future larger studies could further explore these associations.

4.1. Limitations

This study has several limitations. First, the cross-sectional design does not allow for the establishment of cause-and-effect relationships.

Longitudinal studies are needed to track blood pressure changes andthe long-term impact of identified risk factors. Second, the sample size of 100 participants, while providing initial insights, is relatively small and may not be fully representative of the entire young adult population in Semey. Therefore, the findings should be interpreted with caution and may not be generalizable to all of Kazakhstan. Third, some lifestyle factors (e.g., dietary habits, physical activity) were self-reported, which may be subject to recall bias. Objective measures, where feasible, would enhance data accuracy in future studies. Finally, the study did not delve into socioeconomic factors or specific dietary patterns that could influence blood pressure, which could be exploredin more comprehensive research.

V. CONCLUSION

This study provides valuable local data on the prevalence of elevated blood pressure and associated risk factors among young adults in Semey, Kazakhstan. The findings indicate a significant proportion of young individuals are already experiencing elevated blood pressure, often without awareness of their condition. High BMI, physical inactivity, and family history of hypertension are key drivers of this trend.

Based on these findings, the following recommendations are proposed:

1. Implement regular blood pressure screening programs: These programs should be specifically targeted at young adults aged15-35 years in educational institutions, workplaces, and community health centers in Semey.
2. Launch public health awareness campaigns: Educational campaigns should focus on the risks of elevated blood pressure in young age, emphasizing the importance of regular monitoring andthe benefits of healthy lifestyle choices.
3. Promote healthy lifestyle interventions: Initiatives to encourage balanced diets, reduced salt intake, and increased physical activity
should be developed and implemented at community and school levels. Special attention should be given to combating rising rates of obesity.
4. Counseling for individuals with family history: Young adults with
a family history of hypertension should receive early counseling
on risk reduction strategies and closer blood pressure monitoring.
5. Further Research: Larger, longitudinal studies are needed to confirm these findings, explore a wider range of potential risk factors (e.g., specific dietary patterns, stress levels, socioeconomic disparities), and evaluate the effectiveness of intervention programs in this population.

By addressing the challenge of elevated blood pressure in young adults, Semey, Kazakhstan, can take proactive steps towards reducing the future burden of cardiovascular disease and improving overall public health outcomes.

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