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COEFFICIENTS OF ASSOCIATION OF PRIORITY RISK FACTORS OF ARTERIAL HYPOTONYM IN ADOLESCENTS AND THEIR COMPARATIVE EPIDEMIOLOGICAL DESCRIPTION

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Abstract
A cross-sectional population-based survey was conducted on a random sample of adolescents and young adults in the Fergana Valley of Uzbekistan. A total of 1,465 individuals (1,130 adolescents and 32 young men) were examined. The epidemiological program utilized standardized survey, biochemical, and instrumental methods to identify risk factors (RF) for arterial hypotension (AH).
The population analysis demonstrated a relatively high prevalence of RF in adolescents and young men, as well as a correlation between AH and age and the 15 epidemiological risk factors in the study region.
These results highlight the importance of conducting epidemiological studies of adolescents and young men to improve targeted AH prevention.

Keywords: Epidemiology, population aged 14-17 and 18-22, arterial hypotension, risk factors.

Introduction

Improvement of healthcare delivery primarily requires a fundamental reform of preventive theory and practice. To date, such efforts cannot be considered satisfactory. Evidence for this includes the epidemic-like increase in the prevalence of diseases and disease-related disability and mortality within the population, overcrowded hospitals, and the excessive burden placed on emergency medical services. All of these phenomena represent the “cost” of inadequate implementation of preventive science and practice at the primary level of healthcare [13,14,15,17,18].
Large-scale epidemiological studies conducted in recent years have convincingly demonstrated and translated into practical recommendations that the professional scope of the modern clinician must allocate a substantially broader role to preventive activities. Only under such conditions can effective tools be developed to halt the epidemic of numerous diseases, particularly cardiovascular disorders, through interventions that are efficient, safe, and cost-effective, and capable of producing sustainable outcomes [19,20,21,22,23].
It should also be acknowledged that the earliest “epidemiological campaigns” against chronic non-communicable diseases began in the 1930s. From the 1960s onward, standardized investigation methods were introduced into epidemiological research. By the 1980s, the principal risk factors for cardiovascular and other chronic non-communicable diseases were clearly identified, and in the

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1990s, preventive programs were implemented across various countries, yielding substantial positive results [8,11,12].

There is a justified rationale for retrospectively reviewing the evolution of chronic non-communicable disease epidemiology. Following the principle that "there is value in looking back at the past," we attempted to analyze the strengths and limitations of epidemiological research specifically in relation to arterial hypotension, and only thereafter proceeded with the implementation of the present study. This approach was driven by several considerations:

1. the vast majority of epidemiological studies have focused on ischemic heart disease, arterial hypertension, and related coronary conditions;
2. epidemiological investigations have predominantly been conducted among adult populations, while adolescents have been underutilized as epidemiological targets;
3. approximately 95% of available epidemiological findings date back to the mid- and late twentieth century, limiting their applicability to contemporary populations and creating an urgent need for new epidemiological data;
4. studies specifically devoted to the epidemiology of arterial hypotension are extremely scarce, have begun to lose their relevance, and have not been conducted either in Uzbekistan or among adolescent populations;
5. based on existing epidemiological evidence, no preventive programs targeting arterial hypotension in adolescents have been developed or implemented in clinical practice.

These scientific observations and literature findings served as the primary rationale and impetus for planning the present investigation. Expert reviews and conclusions confirming the scientific relevance, novelty, insufficient prior investigation, and practical applicability of the proposed research topic were obtained from specialists and the Coordinating Council under the Ministry of Health of the Republic of Uzbekistan. Subsequently, the dissertation study was conducted in strict accordance with the "gold standard" principles of epidemiological research, resulting in the full achievement of the anticipated outcomes.

The study was designed and carried out with distinctive methodological features that differentiate it from related investigations, the majority of which have been conducted abroad [1,2,3].

In particular, students of the Kosonsoy Industrial-Economic College of Namangan region were selected as the study population. This unorganized adolescent population reflects the demographic characteristics of the entire Fergana Valley and is considered highly suitable for screening-based epidemiological studies. According to its epidemiological characteristics, the population fully complies with World Health Organization (WHO, 2003) requirements for a modern representative sample, as it is minimally affected by migration processes, maintains reliable accessibility to screening centers, includes a sufficient number of adolescents to ensure statistically robust epidemiological inferences, has not previously been subjected to epidemiological investigations, and allows for straightforward verification of participants and study area.

Materials and Methods

The study was conducted in three consecutive stages. The first stage involved a questionnaire-based survey of the adolescent population. During the second stage, adolescents diagnosed with arterial hypotension (AH) underwent in-depth comprehensive specialized examinations. The third stage

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consisted of assessing the degree of association between identified risk factors and arterial hypotension using advanced biostatistical analysis methods.

The sample size was determined using a special calculation formula in accordance with World Health Organization (WHO, 2003) criteria and was set at 1,500 individuals, representing an unorganized adolescent population aged 15–22 years. Using absolute selection through a sampling method, 1,465 adolescents from this representative population were fully examined, corresponding to a coverage rate of 97.8%.

The level of standardization of the study was ensured by taking into account the recommendations of WHO experts (2000) and the methodological guidelines of the Russian State Research Center for Preventive Medicine (GNITsPM) [11,15,16]. A wide range of epidemiological, clinical, biochemical, instrumental, and specialized (additional) examination methods were applied. Relevant risk factors were identified and systematically evaluated. In total, investigations were carried out across 30 diagnostic domains, with an overall volume of 31,955 individual assessments. The obtained data were analyzed and evaluated using modern standard statistical software packages.

Thus, a fully standardized and harmonized cross-sectional epidemiological study was successfully conducted, the results of which are suitable for international comparative analysis. This investigation represents one of the first comprehensive studies in Uzbekistan specifically dedicated to the epidemiology of arterial hypotension in the adolescent population and was completed in its entirety.

Results

Within the examined adolescent population, fifteen priority risk factors were identified, and their degrees of association with the development, clinical course, and complication profile of arterial hypotension (AH) were comparatively assessed. The analysis demonstrated that among adolescents aged 15–17 years, the identified risk factors contributed to the formation and progression of arterial hypotension with statistically significant strong (2 risk factors), moderate (4), and weak (6) associations, as well as statistically non-significant associations (3 risk factors). These factors played a substantial role in disease exacerbation. Among the listed risk factors, inappropriate medication use, chronic excessive food intake, and excess body weight showed statistically non-significant association coefficients with arterial hypotension ($P>0.05$); however, they cannot be disregarded in preventive practice.

The development or complication-related exacerbation of arterial hypotension in adolescents was recorded in 13.3% of cases and was found to be directly associated with insufficient daily intake of fruits and vegetables (strong association, $P<0.001$) and irregular dietary patterns ($P<0.001$). The overall risk of arterial hypotension development and complicated clinical course among adolescents reached 40.0% and was directly associated with smoking, hypercholesterolemia syndrome (HCS), hypertriglyceridemia (HTG), cardiovascular autonomic dysfunction, physical inactivity, and blood group I.

According to the arterial hypotension mathematical model, the presence of risk factors such as multimorbidity (MM), alcohol consumption, and socio-economic and psychological stress increased the risk of arterial hypotension development and complicated course in adolescents by 27.7% ($P<0.01$). In 20.0% of cases, a weak and statistically non-significant risk of arterial hypotension developed under the influence of excess body weight (EBW), irregular meal organization, and

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inappropriate medication use. Thus, early identification and elimination of the "epidemiological pathway" risk for arterial hypotension among adolescents aged 15–17 years may significantly enhance medical and social effectiveness.

In the young adult population (18–22 years), risk factors associated with the development and clinical course of arterial hypotension were also analyzed. Unlike adolescents, this population exhibited statistically significant strong (5), moderate (5), and weak (3) associations with arterial hypotension. Additionally, two risk factors—excess body weight and chronic excessive food intake—demonstrated statistically non-significant and weak associations, under the influence of which the probability of arterial hypotension development was identified in 13.3% of cases ($P>0.05$).

In this young adult population, the risk of arterial hypotension onset or relapse with complications was observed in 33.3% of cases and was associated with multimorbid syndrome, irregular dietary habits, insufficient daily fruit and vegetable intake, physical inactivity, and psychological stress ($P<0.001$). A moderate risk of arterial hypotension among young adults reached 33.3% and was found to develop under the influence of inappropriate medication use, blood group I, heredity, socio-economic factors, and alcohol consumption ($P<0.01$).

The analysis further indicated that in young adults, arterial hypotension development was associated with a weak risk probability (20.0%) related to smoking, hypercholesterolemia, and hypertriglyceridemia ($P<0.05$). Therefore, based on these epidemiological findings, early implementation of primary and secondary preventive programs in young adults plays a crucial role in eliminating continuous risk trajectories in 13.3% of cases and reducing arterial hypotension morbidity in 86.7% of cases.

Insufficient daily intake of fruits and vegetables, irregular dietary patterns, and multimorbid syndrome were identified as risk factors strongly associated with arterial hypotension in the 15–22-year population. In the presence of these risk factors, the likelihood of arterial hypotension development or relapse with complications increased by 20.0% ($P<0.001$). In this age group, a moderate increase in arterial hypotension risk was also associated with psychological stress, alcohol consumption, socio-economic factors, hypertriglyceridemia, physical inactivity, and blood group I. Under the combined influence of these risk factors, the frequency or relapse rate of arterial hypotension increased by 40.0% ($P<0.01$).

The study results further indicate that in individuals aged 15–22 years, smoking, hypercholesterolemia, and hereditary predisposition to arterial hypotension were weakly associated with arterial hypotension, with a risk probability reaching 20.0% ($P<0.05$).

It should be emphasized that excess body weight, chronic excessive food intake, and inappropriate medication use demonstrated an interrelationship with arterial hypotension; however, these associations were very weak and statistically non-significant. Under their influence, the probability of arterial hypotension development was low and did not exceed 20.0%. In other words, approximately one in five individuals aged 15–22 years with excess body weight, chronic overeating, or inappropriate medication use may be at risk of arterial hypotension development or relapse.

To further substantiate and deepen the interpretation of these epidemiological conclusions, chi-square tests and correlation coefficients (r++) were applied to comparatively assess the associations between arterial hypotension and the fifteen identified risk factors (Table 1).

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Table 1 Comparative assessment of the strength of associations between arterial hypotension and risk factors in the adolescent population

No.	Risk factors for arterial hypotension	r++ value	χ^2
1	Low intake of fruits and vegetables	0.52	47.3
2	Irregular dietary pattern	0.45	42.4
3	Multimorbid syndrome	0.42	42.0
4	Psychological stress factor	0.39	40.2
5	Alcohol consumption	0.34	38.6
6	Socio-economic factors	0.32	36.3
7	Hypertriglyceridemia	0.30	34.5
8	Physical inactivity (hypodynamia)	0.29	32.9
9	Blood group I	0.27	31.8
10	Smoking	0.26	30.5
11	Hypercholesterolemia	0.24	29.7
12	Family history (hereditary predisposition)	0.23	28.1
13	Excess body weight	0.21	24.6
14	Chronic excessive food intake	0.20	15.4
15	Inappropriate medication use	0.17	10.8

As shown in Table 1, the prevalence of arterial hypotension in the 15–22-year adolescent population increases primarily in association with low fruit and vegetable intake, irregular dietary patterns, and multimorbid syndrome. To a lesser extent, arterial hypotension in adolescents is associated with psychological stress, alcohol consumption, socio-economic factors, hypertriglyceridemia, physical inactivity, and blood group I, and is accompanied by clinical progression and continuum-related complications. Smoking, hypercholesterolemia, and hereditary predisposition demonstrate relatively weaker associations. The lowest degree of association with arterial hypotension is observed for excess body weight, chronic excessive food intake, and inappropriate medication use.

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Table 2 Relative risk indicators for the development of arterial hypotension associated with major risk factors

No.	Risk factors	Relative risk of arterial hypotension
1	Low fruit and vegetable intake (MSMKIQ)	29.0
2	Irregular dietary pattern (NMOT)	27.0
3	Multimorbid syndrome (MM)	25.8
4	Psychological stress (RZXO)	23.1
5	Alcohol consumption	21.9
6	Socio-economic factors (IIXO)	20.7
7	Hypertriglyceridemia (GTG)	18.4
8	Physical inactivity	17.0
9	Blood group I	14.6
10	Smoking	13.9
11	Hypercholesterolemia (GXS)	12.3
12	Cardiovascular autonomic dysfunction (YuQTKOA)	10.5
13	Excess body weight (OTV)	8.0
14	Chronic excessive food intake (SOOI)	5.2
15	Inappropriate medication use (DDTQQ)	4.4

The data presented in Table 2 confirm that the relative risk of arterial hypotension is most frequently observed in the presence of low fruit and vegetable intake, irregular dietary patterns, and multimorbid syndrome. Approximately twofold lower relative risk is identified in adolescents exposed to psychological stress, alcohol consumption, socio-economic factors, hypertriglyceridemia, physical inactivity, and blood group I. A 3.6-fold lower relative risk of arterial hypotension is observed in association with smoking, hypercholesterolemia, cardiovascular autonomic dysfunction, and excess body weight. The lowest relative risk (2.6-fold lower) is confirmed for chronic excessive food intake and inappropriate medication use. Thus, all fifteen identified risk factors independently contribute to the development, clinical course, and complication profile of arterial hypotension in adolescents.

Conclusion

Stage IV of the proposed program is implemented continuously throughout the entire adolescent period and is completed by transferring recommendations to institutions and specialists responsible for adult healthcare. At this stage, all fifteen confirmed risk factors for arterial hypotension are subjected to continuous monitoring and are addressed individually within the three defined adolescent risk groups. Preventive (primary prevention), therapeutic (secondary prevention), and complication-reducing (tertiary prevention) measures are ensured on an ongoing basis.

Risk factors requiring constant monitoring in adolescents include low fruit and vegetable intake, irregular dietary patterns, psychological stress, alcohol consumption, socio-economic factors, hypertriglyceridemia, hypercholesterolemia, physical inactivity, smoking, blood group I, cardiovascular autonomic dysfunction, excess body weight, chronic excessive food intake, and inappropriate medication use. Only when the operational effectiveness of the program is ensured can

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these risk factors be identified and eliminated at an early stage, resulting in a 93.0% reduction in arterial hypotension incidence and complete interruption of the disease continuum in adolescents. The program recommended for practical implementation is founded precisely on this systematic approach and undoubtedly possesses substantial scientific and practical value.

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