Prevalence of Modifiable Cardiovascular Risk Factors in the Population of Rural Locality of LevanjskaVaroš: Cross-Sectional Study

Zastupljenost promjenjivih čimbenika kardiovaskularnog rizika u stanovnika ruralnog lokaliteta Levanjska Varoš: presječna studija

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─── **Summary** ───

Introduction: The etiology of cardiovascular diseases accounts for a significant portion of global morbidity and mortality, emphasizing the importance of prevention. Preventing cardiovascular diseases involves estimating the prevalence and modifying modifiable factors that contribute to their development. The modifiable factors are diabetes, hypertension, dyslipidemia, tobacco smoking, alcoholism, physical inactivity, inadequate diet, obesity, and low educational attainment. Therefore, this study aims to examine the prevalence of modifiable cardiovascular risk factors among residents of the rural locality of LevanjskaVaroš.

Participants and methods: A cross-sectional study was conducted in January and February 2022 through a questionnaire involving 124 participants. The participants engaged in the study are residents of LevanjskaVaroš. The study used a questionnaire designed specifically for it with questions about participants' general characteristics (age, gender) and specific questions about the prevalence of modifiable risk factors, family history, and participant's health behaviors (physical activity, weight status) and habits (dietary habits, alcohol, and tobacco consumption).

Results: A significant portion of the participants has a positive family history (N = 75, 60.5%), with 30 participants suffering from diabetes mellitus, 63 participants reporting diagnosed dyslipidemia, and 82 participants reporting arterial hypertension. The highest level of therapeutic adherence was observed in participants with diabetes (N=28, 93.3%). A significant number of participants do not consume the recommended number of daily meals (N=89), and 55 participants are categorized as obese based on their body mass index values. A significant number of participants, 74 (59.7%), engage in moderate physical activity lasting 30 to 60 minutes daily, and a substantial number of participants (N=76, 61.3%) report that they do not consume tobacco products. Also, a significant number of participants report that they do not drink alcohol above recommended levels (N=80, 64.5%).

Conclusion: The assessment of cardiovascular health among residents of Levanjska Varoš has revealed a high prevalence of modifiable cardiovascular risk factors. The study emphasizes the importance of conducting a more thorough assessment and examination of the causal link of the high prevalence of cardiovascular risk, with a recommendation to incorporate the factor of educational attainment to develop effective public health strategies.

Keywords: risk factors; cardiovascular risk; rural population

─── **Sažetak** ───

Uvod: Značajan udio globalnog morbiditeta i mortaliteta odnosi se na etiologiju kardiovaskularnih bolesti,

pri čemu je značajna prevencija. U prevenciji oboljenja procjenjuje se zastupljenost i modificiraju promjenjivi čimbenici koji doprinose razvoju kardiovaskularnih bolesti. Pritom se u promjenjive čimbenike ubrajaju dijabetes, hipertenzija, dislipidemija, pušenje duhanskih proizvoda, alkoholizam, manjak tjelesne aktivnosti, neadekvatna prehrana, pretilost i niska razina obrazovanja. Stoga je cilj ovoga istraživanja ispitati zastupljenost promjenjivih čimbenika kardiovaskularnog rizika u stanovnika ruralnog lokaliteta Levanjska Varoš.

Ispitanici i metode: Presječno istraživanje provedeno je anketnim upitnikom na 124 ispitanika tijekom siječnja i veljače 2022. godine. U istraživanju su sudjelovali domicilni stanovnici Levanjske Varoši. U ispitivanju je korišten upitnik kreiran za potrebe istraživanja. Upitnik je sadržavao pitanja o općim karakteristikama ispitanika (dob, spol), te specifična pitanja o prevalenciji promjenjivih čimbenika rizika, obiteljskoj anamnezi i zdravstvenom ponašanju sudionika (fizička aktivnost, status uhranjenosti), te navikama (prehrambene navike, konzumacija alkohola i duhana).

Rezultati: Značajan udio ispitanika ima pozitivnu obiteljsku anamnezu (N = 75, 60,5%), pri čemu 30 ispitanika boluje od dijabetesa melitusa, 63 ispitanika navodi dijagnosticiranu dislipidemiju, a 82 ispitanika navode arterijsku hipertenziju. Najviša razina terapijske adherencije evidentirana je u ispitanika koji boluju od dijabetesa (N=28, 93,3%). Značajan udio ispitanika ne konzumira preporučeni broj dnevnih obroka (N=89) a 55 ispitanika kategorizirano je kao pretilo s obzirom na vrijednosti indeksa tjelesne mase. U umjerenu tjelesnu aktivnost u trajanju od 30 – 60 minuta dnevno uključuje se značajan udio ispitanika, njih 74 (59,7%). Također, značajan udio ispitanika navodi da ne konzumiraju duhanske proizvode (N=76. 61,3%), a značajan udio ispitanika navodi da ne konzumira alkohol iznad preporučenih vrijednosti (N=80. 64,5%).

Zaključak: Procjenom kardiovaskularnog zdravlja stanovnika Levanjske Varoši uočena je visoka prevalencija promjenjivih čimbenika kardiovaskularnog rizika. Provedenim istraživanjem utemeljena je potreba sveobuhvatnije procjene i ispitivanja uzročno-posljedične veze visoke prevalencije kardiovaskularnog rizika, pri čemu je preporuka uključiti čimbenik razine educiranosti s ciljem kreiranja učinkovitih javnozdravstvenih strategija.

Ključne riječi: čimbenici rizika; kardiovaskularni rizik; ruralno stanovništvo

Introduction

Cardiovascular diseases (CVD), including heart and blood vessel diseases, are associated with significant morbidity and mortality on a global scale. In 2021, the number of deaths among individuals with CVD reached 20.5 million, accounting for 1/3 of all global fatalities, with more than 3/4 occurring in low and middle-income countries.[1,2] The World Health Organization estimates that the annual mortality rate due to CVD will reach 23.6 million by the year 2030.[3]

Given the correlation between numerous factors and cardiovascular diseases, there is no universal approach to prevention; hence, efforts are directed toward minimizing the impact of factors associated with CVD. Risk factors for CVD are categorized into non-modifiable factors such as age, gender, ethnicity, and positive family history, and modifiable factors such as diabetes, hypertension, dyslipidemia, smoking, alcoholism, physical inactivity, inadequate diet, obesity, and low educational attainment.[4,5] Although age is considered a non-modifiable risk factor for CVD, it is possible to decrease the risk of age-related CVD by avoiding or minimizing modifiable risk factors. Avoiding and reducing the impact of modifiable risk factors is equally important at a younger age as it reduces the later risk of CVD.[6] Regular physical activity, proper nutrition, weight regulation, and non-smoking reduce the risk of CVD by over 80% and diabetes by over 90%.[7]

Men are at a higher risk of developing CVD compared to women up to the age of 50. In contrast, the risk becomes equalized as women enter menopause due to hormonal changes characterized by a decline in estrogen levels.[8] Having a family history of CVD is an independent risk factor for cardiovascular disease if a father or a brother experienced CVD before the age of 55 and a mother or a sister before the age of 65.[9,10]

In the context of residency, the cardiovascular health of individuals living in rural communities is worse than that of their more urban-dwelling counterparts.[11] Rural populations face additional challenges in ensuring optimal cardiovascular health, encompassing individual factors, social determinants of health, and healthcare accessibility. Individual factors include a higher prevalence of risk factors such as physical inactivity, obesity, and hypertension; social determinants include lower rates of household income, lower education attainment, and employment rates, and healthcare accessibility includes challenges of distance from secondary and tertiary healthier facilities, which is in correlation with the rate of survival from acute cardiac complications.[11,12]

Multiple studies have confirmed the global effect of modifiable risk factors on cardiovascular disease

and mortality.[4,13] Continuing with the assessment of the consistency and variations in the prevalence of cardiovascular modifiable risk factors is a precondition for the development of context-specific strategies for prevention.

Encouraging community engagement to safeguard personal health, individualized approaches for each patient, and timely interventions are critical factors in primary and secondary prevention. Assessing an individual's behavioral risk is crucial for personal well-being and the overall demographic and epidemiological situation. The differences in the prevalence of risk of cardiovascular risk factors by place of residence justify the need to assess the prevalence of modifiable cardiovascular risk factors in rural areas to develop appropriate treatment and prevention strategies for CVD.[4] Therefore, this study aims to examine the prevalence of modifiable cardiovascular risk factors in the population of the rural locality of Levanjska Varoš.

Participants and methods

Sample description

A convenience sample of 124 participants was involved in a cross-sectional study in January and February 2021. The participants engaged in the study were residents of the rural locality of LevanjskaVaroš. The inclusive criteria were defined according to the European Guidelines on cardiovascular disease prevention in clinical practice: a minimal chronological age of 40 for males and 50 or menopause for females.[14] According to the criteria,the population was 412, with a minimum sample of 121, a margin of error of 7.5, a confidence level of 95%, and a population proportion of 50%, calculated with a Sample size calculator.The data was collected through a questionnaire developed for this study as a part of preventive action in LevanjskaVaroš. The Ethics Committee of the Faculty of Dental Medicine and Health of the University of Josip Juraj Strossmayer approved this study (IRB: 2158/97-97-10-24-09). The study was conducted following the Helsinki Declaration. All participants gave their written consent for this study.

Methods

The questionnaire contained two sections of questions. The first section included questions about participants' general characteristics (age, gender). The second section contained specific questions about the prevalence of modifiable risk factors, family history, and participants'behaviors and habits following scientific literature and World Health Organisation (WHO) criteria of weight status, dietary

habits, physical activity, alcohol, and tobacco consumption.[15]

The whole sample was included in the assessment of the prevalence of diagnosed diabetes mellitus, dyslipidemia, and hypertension. Therapeutic adherence to the therapeutic regime was assessed in participants with a diagnosis of diabetes mellitus, dyslipidemia, and hypertension.

Assessment of their weight status according to body mass index (BMI) included measuring their height and weight (usinga weighing machine with thaliometer Detectosolo®). BMI was calculated from the obtained values and classified according to the BMI criteria: ≤24.9=normal body weight; 25-29.9=pre-obesity; ≥30=obese and classified.[16] Nutritional habits included the number of daily meals, habits of consumption of fish and fish products, consumption of cured meat and products or/and foods with red meat, everyday water intake (recommended intake of 2 and more than 2 L), and consumption of coffee daily with a daily tolerable amount of one cup of 1.5 to 2.0 dcl.[17,18]

When asked about everyday physical activity, it was possible to choose one of the three answers of daily physical activity: 30–60 minutes of moderate-intensity physical activity, 120 minutes daily of moderate-intensity physical activity, 150 – 300 minutes daily of moderate / 75 – 150 minutes of vigorous-intensity physical activity. The third answer is that150 – 300 minutes daily of moderate activity is equivalent to 75 – 150 minutes daily of vigorous physical activity and is recommended as sufficient according to the WHO criteria.[15] Also, one question assessed the prevalence of recreational sports activities.

Tobacco consumption was determined by three categories: smoker, former smoker, and non-smoker, whereas a smoker is defined as a participant who smokes cigarettes regardless of the number of cigarettes smoked per day.[19] When assessing the frequency of consumption of alcohol above the daily tolerable intake, the participants had options to choose one of the following answers: daily, once a week, once a month, or less than once a month (rare occasions). In addition to the question about the frequency of alcohol consumption, it was explained, with the help of a visual diagram, that the tolerable daily intake (grams) of alcohol is 20g for men and 10g for women, where 10g was equal to an approximately 0.125 l of wine or 0.25 l of beer or 0.03 l of hard liquor.[20]

Statistical analysis

The Kolmogorov-Smirnov test was used to examine the normality of the distribution. Categorical

data were described using absolute and relative frequencies. The χ^2 test was used in responses for categorical variables to explore differences. Descriptive statistics for nominal variables were presented with proportions and percentages, and numerical variables with the median. The statistical significance was defined at $P < 0.05$. The analysis was conducted using the statistical software IBM SPSS 25, developed in Chicago, USA, in 2017.

Results

The study involved 124 participants, residents of the rural locality of LevanjskaVaroš, comprising 68 females (54.8%) and 56 males (45.16%). The age of the respondents ranged from 40 to 92, with a median of 63 years (IQR 55–71).

A significant number of participants (N = 75, 60.5%) reported a positive family history (p=0.02). In total, 30 (24.2%) participants were diagnosed with diabetes mellitus, 63 (50.8%) participants reported dyslipidemia, and 82 (66.1%) arterial hypertension. The highest therapeutic adherence among participants was observed in those with diabetes, with 28 individuals (93.3%) reporting adherence to their therapeutic regimen, followed by those with arterial hypertension with 92.7% (N=76). The therapeutic adherence level was lower in individuals with dyslipidemia, with a rate of 68.3% (N = 43) (Table 1).

Table 1 Prevalence of Modifiable Risk Factors: Diabetes mellitus, Dyslipidemia and Hypertension
Tablica 1. Zastupljenost promjenjivih čimbenika rizika: diabetes mellitus, dislipidemija i hipertenzija

Risk Factor *Čimbenik rizika*	Yes / *Da* [N (%)]	No / *Ne* [N (%)]	χ^2	P value* *P vrijednost**
Positive family history *Pozitivna obiteljska anamneza*	75 (60.5)	49 (39.5)	5.452	**0.02**
Diabetes mellitus *Diabetes mellitus*	30 (24.2)	94 (75.8)	33.032	**< 0.001**
Therapeutic adherence** *Terapijska adherencija*	28 (93.3)	2 (6.7)	22.533	**< 0.001**
Dyslipidemia *Dislipidemija*	63 (50.8)	61 (49.2)	0.032	0.85
Therapeutic adherence** *Terapijska adherencija*	43 (68.3)	20 (31.7)	8.397	**0.004**
Arterial hypertension *Arterijska hipertenzija*	82 (66.1)	42 (33.9)	12.903	**< 0.001**
Therapeutic adherence** *Terapijska adherencija*	76 (92.7)	6 (7.2)	62.235	**< 0.001**

* χ^2 test **Therapeutical adherence in a population of participants with diagnosed disease/*Terapijsko pridržavanje u populaciji sudionika s dijagnosticiranom bolešću*

The median BMIwas 28.7, with a minimum of 17.5 and a maximum of 45.8. There is a significant difference in the distribution of participants according to the Distribution of Weight Status, with the highest number of participants (N=55, 41.9%) falling under the category of obese, followed by a group of 44 (35.5%) participants categorized as overweight (Table 2).

Table 2 Distribution of Weight Status by Body Mass Index
Tablica 2. Distribucija po kategoriji tjelesne mase prema indeksu tjelesne mase

Weight Status - Body Mass Index *Stanje težine-Indeks tjelesne mase*	M (min – max)	SD
	28.7 (17.5 – 45.8)	5.40
	N (%)	χ^2	P*
Underweight <18.5 *Pothranjenost<18.5*	2 (1.6)	47.613	**< 0.001**
Normal weight 18.5-24.9 *Normalna tjelesna masa 18.5-24.9*	26 (21)		
Overweight 25-29.9 *Prekomjerna tjelesna masa 25-29.9*	44 (35.5)		
Obesity30 and > *Pretilost. 30 i>*	52 (41.9)		

* χ^2 test

A significant number of participants (N=89, 71.8%) reported that they were not following the recommendations and not having three main meals and snacks (p<0.001). In total, 98.4% (N=122) reportedless consumption of fish than recommended (p<0.001). Also, a significant number of participants, 75 (60.5%), reported not consuming cured meat products or/and foods with red meat daily (p=0.02). A significan tnumber of participants (N=100, 80.6%) reported daily coffee consumption above the tolerable amount (more than one cup of 1.5 to 2.0 dcl). In contrast, a significant percentage of participants consumed water in quantities below the recommended levels (N=73, 58.9%) (p=<0.001). A significant number of participants, 74 (59.7%), reported engaging in moderate physical activity daily for 30-60 minutes (p<0.001), while a considerable number reported that they were not engaging in recreational sports activities (N=108, 87.1%) (p<0.001) (Table 4).

A significant percentage of participants identified themselves as non-smokers regarding tobacco consumption (N=76, 61.3%). Also, a significant number of participants reported that they did not consume alcohol (N=80, 64.5%) (p=0.001), while in a group of participants who drank alcohol, a significant percentage of participants who consumed alcohol once a month or less than once a month (p<0.001).

Table 3 Nutritional Habits
Tablica3. Prehrambene navike

Nutritional habits *Prehrambene navike*	Yes/Da [N (%)]	No/Ne [N (%)]	χ^2	P value* *P vrijednost*
Three main meals and snacks *Tri glavna obroka i međuobroci*	35 (28.2)	89 (71.8)	23.516	**< 0.001**
Consumption per week - Fish and fish products *Tjedna konzumacija – Riba i riblji proizvodi*	2 (1.6)	122 (98.4)	116.129	**< 0.001**
Everyday consumption of cured meat products or/and foods with red meat *Svakodnevna konzumacija suhomesnatih proizvoda i/ili namirnice s crvenim mesom*	49 (39.5)	75 (60.5)	5.452	**0.02**
Everyday coffee consumption of more than one cup daily *Svakodnevna konzumacija kave više od jedne šalice dnevno*	100 (80.6)	24 (19.4)	46.581	**< 0.001**

Everyday water consumption *Svakodnevna konzumacija vode*	Category *Kategorija*	N (%)		
	Less than 500 mL *Manje od 500 mL*	5 (4)		
	500 ml to 999 mL *500 ml do 999 mL*	27 (21.8)	83.871	**<0.001**
	1 – 1.9 L	73 (58.9)		
	2 and more than 2 L *2 iviše od 2 L*	19 (15.3)		

* χ^2 test

Table 4 Prevalence of Physical Activity
Tablica 4. Zastupljenost tjelesne aktivnosti

	Category *Kategorija*	N (%)	χ^2	P value* *P vrijednost*
Aerobic physical activity *Aerobna tjelesna aktivnost*	30 – 60 minutes of moderate physical activity daily *30 – 60 minuta umjerene tjelesne aktivnosti dnevno*	74 (59.7)	43.565	**< 0.001**

	Category *Kategorija*	N (%)	χ2	P value* *P vrijednost**
	120 minutes of moderate physical activity daily *120 minuta umjerene tjelesne aktivnosti dnevno*	15 (12.1)		
	150 – 300 minutes of moderate physical activity daily or 75-150 of vigorous physical activity daily *150 – 300 minuta umjerene tjelesne aktivnosti dnevno ili 75 – 150 minuta intenzivne tjelesne aktivnosti dnevno*	35 (28.2)		
Recreational sports activities *Rekreativne sportske aktivnosti*	Yes	16 (12.9)	68.258	**< 0.001**
	No	108 (87.1)		

* χ² test

Table 5 Prevalence of Tobacco and Alcohol Consumption
Tablica 5. Zastupljenost konzumacije duhanskih proizvoda i alkohola

	Category *Kategorija*	N (%)	χ2	P value* *P vrijednost**
Tobacco consumption *Konzumacija duhanskih proizvoda*	Smoker *Pušač*	29 (23.4)	44.823	**< 0.001**
	Former smoker *Bivši pušač*	19 (15.3)		
	Non-smoker *Nepušač*	76 (61.3)		
Alcohol consumption *Konzumacija alkohola*	Yes / *Da*	46 (35.5)	10.452	**0.001**
	No / *Ne*	80 (64.5)		
Frequency of alcohol consumption *Učestalost konzumacije alkohola*	Daily *Svakodnevno*	13 (28.3)	27.957	**< 0.001**
	Once a week *Jednom tjedno*	2 (4.3)		
	Once a month or less than once a month (rare occasions) *Jednom mjesečno ili rjeđe (rijetke prilike)*	31 (67.4)		

* χ² test

Discussion

Cardiovascular diseases are the leading cause of premature mortality and morbidity worldwide, with 80% originating from lower-income countries. This correlation is the primary reason for assessing the prevalence of modifiable cardiovascular risk factors in the rural locality of LevanjskaVaroš. The mentioned locality is classified in the bottom quartile among below-average ranked local self-government units. This classification is defined based on income thresholds, unemployment rates, levels of education, and the aging index.[21]

Considering the results of global studies revealing that 70% of cardiovascular disease (CVD) cases in high-income countries, along with similar percentages in middle-income countries and a slightly higher percentage (80%) in low-income countries, are associated with modifiable risk factors, it is imperative to advocate for interventions aimed at mitigating cardiovascular risk.[4]

The prevalence of positive family medical histories is significantly represented, indicating the need for continuous preventive monitoring. This is

due to the correlation between a positive family history and premature coronary heart disease, where a positive family history serves as an independent risk factor for cardiovascular heart disease.[10] Given that the risk of premature cardiovascular disease increases linearly with the number of affected family members, targeting young individuals may prove effective in the prevention of premature mortality.[10]

Hypertension has been confirmed as the primary metabolic risk factor for CVD, followed by diabetes, dyslipidemia, and obesity.[4] The prevalence of hypertension in the adult population of Croatia surpasses the global average, standing at 48%, while the worldwide prevalence is 32% in women and 34% in men.[22,23] The results of this study indicate a high prevalence of hypertension at 66.1%. However, the generalization of these results to the locality is limited due to the convenience sampling method employed in the study.

The therapeutic adherence to the treatment regimen for diabetes mellitus, dyslipidemia, and arterial hypertension is lowest in dyslipidemia at 68.3%. This finding highlights the necessity for additional assessment of factors associated with therapeutic adherence. Factors such as the level of formal education, knowledge, motivation, and skills should be further examined to maximize the effectiveness of therapies.[24] By the general factors, in future assessment, it is recommended to assess their beliefs regarding perceived risk, medication harms, treatment duration, and number of medications since those are important modifiable determinants of non-adherence to treatment.[25] Also, according to Weisser et al., a combination of substances in one single pill might increase therapeutic adherence and lead to a better clinical outcome in patients suffering from hypertension and dyslipidemia, which are lower in this study.[26]

There is a high prevalence of irregular meal habits, with 71.8% of participants consuming less than three main meals and snacks. This is significant due to the correlation between irregular meal habits and the highly prevalent condition of obesity, which affects 41.9% of the participants.[17]Additionally, irregular meal-derived total energy intake patterns are less favorable for maintaining body weight and optimal cardiometabolic health. The high prevalence of obesity and overweight observed in this study mirrors the national trend, as Croatia has the highest proportion of overweight and obese females (58%) and males (73%).[27]

Fish consumption is notably low, with only 1.6% of participants reporting weekly fish intake. This is indicative, as a minimal fish intake of 175 g (approximately two servings) per week has been associated with a lower risk of major CVD events and total mortality among high-risk individuals. It is noteworthy that high-risk individuals are highly prevalent in this sample.[18] Due to the geographical location and low developmental level of Levanjska Varoš, it is notable to consider cost and availability as a possible cause of the low level of fish consumption. Furthermore, health and nutritional beliefs and habits should be considered in further studies since they are recognized as the most common barriers to fish consumption.[28]

Inadequate water intake may lead to dehydration, triggering low-grade inflammation in the human body. This inflammation is associated with malnutrition and the progression of chronic diseases, including CVD.[29] The study suggests that each additional cup of daily water consumption is linked to a 3% lower risk of death from CVD.[29] Therefore, promoting adequate hydration is crucial, especially since 84.7% of participants in this study have reported water consumption below the recommended levels.

Notably, 80.6% of participants have reported daily coffee consumption. While studies lack consensus on the correlation between coffee consumption and cardiovascular mortality, some suggest that moderate coffee intake may mitigate cardiovascular risk.[30] It is essential to assess their daily habits further, including data on the quantity of coffee consumed.

The moderate-to-vigorous physical activity obtained per week is inversely associated with all-cause mortality, CVD mortality, and CVD incidents.[31] The prevalence of recommended aerobic physical activity of moderate intensity (at least 150 – 300 minutes) is low in this study, with only 28.5%. Notably, 74% engage in only 30-60 minutes of aerobic physical activity, which could be considered low physical activity. In contrast, in the study by Yusuf et al., 18.5% have reported low physical activity.[4]

Tobacco consumption (23.4%) aligns with the findings of Yusuf et al., where 20.6% of participants (sample size N=155,722) have reported current tobacco use.[4] The study suggests that even smoking just one cigarette a day poses a risk for the development of coronary heart disease and stroke, indicating that a safe level of smoking does not exist.[19] Instead of merely reducing smoking, the focus of cardiovascular prevention should be on quitting.

Alcohol is consumed by 35.5% (N=44), with 28.3% consuming alcohol daily and 4.3% once a week. This rate is higher compared to the other studies, where the prevalence of moderate alcohol consumption is 4.2%, and intensive alcohol consumption is 1.9%.[4] The study indicates an increased likelihood of hazardous alcohol use or

alcohol-related harm in rural residences, which is a possible repercussion of the level of alcohol consumption in this study.[32] Therefore, the identification of excessive alcohol consumption presents a major health priority, given the alarmingly high worldwide alcohol consumption and its association as a contributor to mortality and the burden of CVDs.[33]

Tobacco use, high alcohol consumption, low physical activity, and inadequate diet demonstrate the strongest associations with mortality outcomes.[4] Given the high prevalence of these modifiable factors in the sample, indicating a heightened cardiovascular risk, it is essential to pursue further assessment with a representative sample to obtain conclusive results.

Due to the high prevalence of modifiable factors for CVD (hypertension, hyperlipidemia, overweight and obesity, inadequate nutritional habits, and low physical activity), it is indicative to conduct a study with a representative sample. As a result, it is recommended that the participants' knowledge level be examined to determine the existence of specific knowledge gaps that can be addressed through educational programs. Education is recognized as a socio-economic and psychosocial factor with a global impact and also as the most significant single risk factor that correlates with CVD cases and deaths. Therefore, the study's clinical implications indicate the need to implement public health activities that include promoting physical activity, nutrition, and fluid intake per the guidelines, promoting smoking cessation, and assessing the need for additional education among the residents of Levanjska Varoš.

Given the significant occurrence of modifiable risk factors for cardiovascular disease (CVD), such as hypertension, hyperlipidemia, obesity, insufficient nutritional habits, and low physical activity, it is advisable to expand the study to a larger sample. Following the same line of thought, it is recommended to assess the knowledge level of participants to determine the existence of specific knowledge gaps that could be addressed through educational interventions.

Education is recognized as a socio-economic and psychosocial factor with a global impact and is also identified as the most significant single risk factor correlated with CVD cases and deaths.[4] Therefore, the clinical implications of the conducted study emphasize the need to implement public health activities. These activities should include the promotion of physical activity, dietary guidelines, fluid intake, and smoking cessation. Additionally, there is a need to explore the residents' requirements for additional education in LevanjskaVaroš.

Study limitations and recommendations

Although the results indicate a significant representation of modifiable factors, the study's main limitation is that explicit conclusions about the population based on a single measurement are limited. It is, therefore, recommended that a longitudinal study be conducted. Given the results, it is advisable to include laboratory analysis in future studies. Thus, glycosylated hemoglobin should be analyzed compared to statements on treatment adherence in diabetes. It is also recommended that blood pressure values be included in the comparison with adherence to antihypertensive therapy. As it is impossible to exclude the effect of white coat syndrome in a single measurement, blood pressure values were not included in this study as they could lead to bias, which is one of the limitations. It is strongly recommended that blood pressure be measured longitudinally. After the first measurement, further measurements should have been taken, which was not possible in the cross-sectional study.

Conclusion

The residents of LevanjskaVaroš demonstrate a significant prevalence of modifiable CVD risk factors. This study establishes the need for future public health interventions and long-term health assessment. This conclusion is based on the results of the notably high prevalence of positive family history, chronic diseases, obesity, and dietary habits of the examined population, which are dominantly non-compliant with the recommendations. Drawing on these insights and considering a broader study, establishing a local preventive program emerges as a crucial response to address these health challenges.

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