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## GENDER AND AGE CHARACTERISTICS OF THE PREVALENCE OF HYPERCHOLESTEROLEMIA IN THE POPULATION

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The purpose of the study was to assess the distribution of hypercholesterolemia in the population according to gender and age characteristics. Cholesterol-metry was conducted among 2013 random residents; 887 men and 1126 women were involved in the study. After appropriate clarifications and on a voluntary basis, blood was taken from the respondents to study the content of cholesterol. According to the results of cholesterol-metry, the normal level of cholesterol was found in 21.4±0.9 % of city residents, its elevated level was correspondingly in 28.3±1.0 % ( $t=5.04$ ;  $P<0.001$ ), weak high level observed in 30.6±1.0 % ( $t=1.63$ ;  $P>0.05$ ) and very high level in 19.7±0.9 % ( $t=8.07$ ;  $P<0.001$ ) has been done. In our observation, 1013 out of 2013 residents had a level of cholesterol higher than 6.5 mmol/l, which indicates a high risk of cardiovascular and other diseases in the urban population. The prevalence of cholesterol is age-related, with a higher rate in women than in men. Men have less high cholesterol indicators than women. Thus, relevant studies conducted at the population level allow to identify risk groups due to hypercholesterolemia and to organize monitoring on them. At the same time, it is necessary to expand research on the identification of risk factors that play a role in the formation of hypercholesterolemia, which is very important for the effective prevention of hypercholesterolemia.

**Key words:** hypercholesterolemia, cardiovascular diseases risk, obesity, population

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## ГЕНДЕРНІ ТА ВІКОВІ ХАРАКТЕРИСТИКИ ПОШИРЕННЯ ГІПЕРХОЛЕСТЕРИНЕМІЇ У ПОПУЛЯЦІЇ

Метою дослідження було оцінити розподіл гіперхолестеринемії у популяції за статеві-віковими ознаками. Холестеринметрія проводилася серед 2013 випадкових мешканців, у дослідженні взяли участь 887 чоловіків та 1126 жінок. Після відповідних роз'яснень та у добровільному порядку у респондентів брали кров для дослідження вмісту холестерину. За результатами холестеринметрії нормальний рівень холестерину виявлено у 21,4±0,9 % жителів міста, підвищений рівень відповідно у 28,3±1,0 % ( $t=5,04$ ;  $P<0,001$ ), незначно високий рівень відзначений у 30,6±1,0 % ( $t=1,63$ ;  $P>0,05$ ) і дуже високий рівень 19,7±0,9 % ( $t=8,07$ ;  $P<0,001$ ). У нашому спостереженні у 1013 з 2013 жителів рівень холестерину перевищував 6,5 ммоль/л, що свідчить про високий ризик серцево-судинних та інших захворювань у міського населення. Поширеність гіперхолестеринемії залежить від віку, причому у жінок вона вища, ніж у чоловіків. Чоловіки мали нижчі показники холестерину, ніж у жінок. Отже, відповідні дослідження, що проводяться на популяційному рівні, дозволяють виявити групи ризику гіперхолестеринемії та організувати моніторинг за ними. У той же час, необхідно розширити дослідження щодо виявлення факторів ризику, які відіграють роль у формуванні гіперхолестеринемії, що є дуже важливим для ефективної профілактики.

**Ключові слова:** гіперхолестеринемія, ризик серцево-судинних захворювань, ожиріння, населення.

Currently, more than 80 % of deaths worldwide are caused by 4 groups of chronic non-communicable diseases (NCDs): cardiovascular diseases (CVDs), malignant tumors, diabetes, and respiratory diseases [2]. The seriousness of the NCDs problem is that it causes serious damage to the world's countries, being a medical and social problem. Even the trend of COVID-19 cannot cover up the problem of NCDs due to its importance. NCDs account for two-thirds of premature deaths, and 80 % of these cases occur in high- and middle-income countries of the world [9].

As most authors have noted, a positive solution to the problem is almost only possible with taking appropriate measures against the leading factors directly involved in the formation of NCDs. One of the most important risk factors for CVDs is hypercholesterolemia (HCS) [9]. HCS is a widespread and socially important pathological condition. HCS is also a leading risk factor for overweight (BW) and obesity, which in turn play an important role in the development of NCDs [4, 14, 10].

The diagnosis of HCS was possible only by biochemical examination in clinical and laboratory conditions. Therefore, at the population level, the main questions such as the spread of HCS depending on the socio-economic and behavioral-ethnic conditions of the regions, the detection and assessment of the causes of HCS, the state of awareness and motivation of the population on the prevention of HCS and other social problems of HCS – hygienic aspects – are little studied [1].

A high level of CS (above 7.8 mmol/l) has an aggravating effect on the body's systems and creates conditions for the development of various diseases, including dangerous diseases such as atherosclerosis, heart attack, angina pectoris, ischemic heart disease (IHD), and stroke. It is known that HCS, together with arterial hypertension (AH), is one of the 3 strongest risk factors for the development of cardiovascular diseases (CVDs) [8].

According to many experts, the successful fight against and prevention of diabetes, obesity and other pathological conditions that contribute to the high global level of morbidity of the world population, its disability and death is related to HCS as a serious independent risk factor for health [6, 10]. In addition to what has been said, extensive studies should be conducted on the prevalence of HCS in regions with different socio-economic conditions and national ethnic characteristics, the detection and assessment of HCS and its risk factors. The results of these studies will allow for the development of rational complex measures for the prevention of HCS, which will accelerate the pace of positive resolution of the CVDs problem [5, 15].

Until recently, lack of appropriate methodology has limited large-scale studies on HCS at the population level. As a result, HCS has been understudied from a socio-behavioral point of view, and without relevant indicators, the possibility of developing rational preventive measures was practically impossible. The advent of portable devices that allow determination of the amount of CS in the blood of people in mobile conditions in a few minutes has created the necessary conditions for conducting population-level studies on HCS.

**The purpose** of the study was to assess the distribution of hypercholesterolemia in the population according to gender and age characteristics.

**Materials and methods.** Detection of CS in blood (CS-metry) was conducted among 2013 random residents (887 men and 1126 women) involved in the study.

After appropriate clarifications and on a voluntary basis, blood was taken from the respondents to study the content of cholesterol. The blood test was carried out on site using a portable device “Accutrend Plus” (“Roche Diagnostics GmbH”, Germany) – portable and easy-to-use biochemical analyzer for quantitative determination of glucose, cholesterol, triglycerides and lactate in capillary blood. Test system has high measurement accuracy (from  $\pm 3\%$  to  $\pm 5\%$  compared to laboratory methods). Cholesterol measurement time – up to 180 seconds. The result was reported to the patients in 1–2 minutes. The amount of CS is displayed on the screen of the device for one minute by taking blood from the finger.

We used the following classification of CS level: normal –  $<5.0$  mmol/l, elevated –  $5.0$ – $6.4$  mmol/l, weakly high –  $6.5$ – $7.8$  mmol/l and very high –  $>7.8$  mmol/l. The European Society of Cardiology has specified a desirable upper level of CS for countries with high cardiovascular mortality as  $<5.0$  mmol/l [10]. A similar recommendation for the desired level of general CS is reflected in the recommendations given by the All-Russian Scientific Society of Cardiologists [14].

The study was conducted in compliance with international ethical principles (Declaration of Helsinki, 1964). Informed consent was obtained from patients.

All parameters and data were collected in an Excel table and then transferred for processing using the IBM SPSS-20 program. Continuous variables were expressed as mean  $\pm$  median ( $M \pm m$ ). Categorical variables are expressed as actual numbers and percentages. Statistical analysis was performed using the nonparametric Mann-Whitney U-test and Student's t-test. Values were considered statistically significant at  $p < 0.05$ .

**Results of the study and their discussion.** According to the results of CS-metry, the normal level of CS was found in  $21.4 \pm 0.9\%$  of city residents, its elevated level was correspondingly in  $28.3 \pm 1.0\%$  ( $t=5.04$ ;  $P < 0.001$ ), weak high level observed in  $30.6 \pm 1.0\%$  ( $t=1.63$ ;  $P > 0.05$ ) and very high level in  $19.7 \pm 0.9\%$  ( $t=8.07$ ;  $P < 0.001$ ) has been done. A level of CS  $>6.2$  mmol/l is associated with a potential risk for atherosclerosis and its complications (10). In our observation, 1013 out of 2013 residents had a level of CS higher than  $6.5$  mmol/l, which indicates a high risk of cardiovascular and other diseases in the urban

population. Indicators of the level distribution in different age groups of the examined city residents show that the distribution of the CS level has a significant age specificity. Thus, the normal level of CS decreases from 25.2±2.4 to 17.6±2.5 % with a strong correlative negative dependence ( $r=-0.92\pm0.06$ ) as the age of the examinees increases ( $t=2.19$ ;  $P<0.05$ ). At the same time, with a similar, but positive, strong correlative dependence, very high level indicators of CS ( $>7.8$  mmol/l) increase from 16.5±2.0 % to 23.5±2.8 % ( $t=2.03$ ;  $P<0.05$ ). The distribution of intermediate indicators of CS does not have a significant age specificity and fluctuates at approximately the same level, that is, from 25.2±2.8 to 33.6±3.1 ( $t=8.98$ ;  $P>0.05$ ).

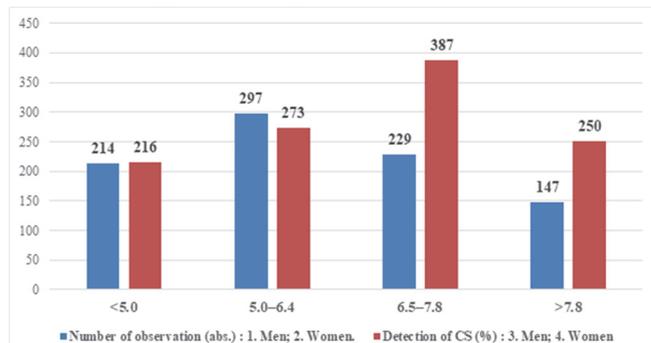


Fig. 1. Distribution of different levels of CS among men (n=887) and women (n=1126). CS levels (mmol/l) are given on the abscissa.

Such an apparent correlation of different CS levels with age is undoubtedly based on a number of reasons that require specific studies to determine. At the same time, it should be noted that as people age, they become less physically active, do not control their body weight, which creates conditions for obesity, which in turn causes an increase in the amount of CS in the blood. This is especially true for women (Fig. 1).

As can be seen in the table, the lower level of CS is typical for men and the higher level for women. Thus, the frequency of the specific weight of CS level  $<5.0$  mmol/l among men is 24.1±1.4 %, while the specific weight of this indicator is reliably low, i.e. 19.2±1.2 % ( $P<0.001$ ) in women. A more pronounced difference is observed in the frequency of specific gravity of XS in the range of 5.0–6.4 mmol/l - 33.5±1.6 and 24.2±1.3 %, respectively ( $P<0.001$ ). The opposite picture is observed in the occurrence frequency of CS level of 6.5–7.8 mmol/l. Thus, it is lower in men than in women, that is, it is 25.8±1.5 % in men and 34.4±1.4 % in women ( $P<0.001$ ). The same significant difference – 16.6±1.3 and 22.2±1.2 mmol/l ( $P<0.01$ ) is observed in the frequency of CS level  $>7.8$  mmol/l. The gender characteristics of the prevalence of HCS are given in more detail in Tables 1 and 2.

Table 1

Age-related prevalence of CS among men

Age groups, age	Number of examinees	Frequency of different levels of CS							
		<5.0 mmol/l		5.0–6.4 mmol/l		6.5–7.8 mmol/l		>7.8mmol/l	
		abs.	%	abs.	%	abs.	%	abs.	%
<20	97	26	26.8±4.5	36	37.1±4.9	21	21.6±4.2	14	14.4±3.6
20–29	128	34	26.6±3.9	47	36.7±4.3	29	22.7±3.7	18	14.1±3.1
30–39	147	37	25.2±3.6	49	33.3±3.9	38	25.9±3.6	23	15.6±3.0
40–49	145	35	24.1±3.6	47	32.4±3.9	39	26.9±3.7	24	16.6±3.1
50–59	137	31	22.6±3.6	46	33.6±4.1	37	27.0±3.8	23	16.0±3.2
60–69	131	29	22.1±3.6	41	31.3±4.1	36	27.5±3.9	25	19.1±3.4
≥70	102	22	21.6±4.1	31	36.4±4.6	29	28.4±4.5	20	19.6±3.9
Total	887	214	24.1±1.4	297	33.5±1.6	229	30.6±1.0	147	16.6±1.3

Table 2

Age-related prevalence of CS among women

Age groups, age	Number of examinees	Frequency of different levels of XS							
		<5.0 mmol/l		5.0–6.4 mmol/l		6.5–7.8 mmol/l		>7.8mmol/l	
		abs.	%	abs.	%	abs.	%	abs.	%
<20	133	32	24.1±3.7	35	26.3±3.8	42	31.6±4.0	24	18.0±3.3
20–29	158	37	23.4±3.4	40	25.3±3.5	50	31.6±3.7	31	19.6±3.2
30–39	168	35	20.8±3.1	41	24.4±3.3	59	35.1±3.7	33	19.6±3.1
40–49	182	35	19.2±2.9	47	25.8±3.3	62	34.1±3.5	38	20.9±3.0
50–59	177	31	17.5±2.9	41	23.2±3.2	62	35.0±3.6	43	24.3±3.2
60–69	172	26	15.1±2.7	40	23.3±3.2	61	35.5±3.7	45	26.2±3.4
≥70	136	20	14.7±3.0	29	21.3±3.5	51	37.5±4.2	36	25.5±3.8
Total	1126	216	19.2±1.2	273	24.2±1.3	387	34.4±1.4	250	22.2±1.1

Based on the analysis of the questionnaires of those examined, the following can be noted. The proportion of housewives is quite high – 334 out of 1126 people (29.7±1.4 %). Also, 216 women with children worked part-time in different spheres of labor activity (19.2±1.2 %;  $t=5.71$ ;  $P<0.001$ ). 157 women were retired (13.9±3.0 %;  $t=3.40$ ;  $P<0.001$ ), and 89 women were temporarily unemployed (7.9±0.8 %;  $t=4.69$ ;  $P<0.001$ ). In other words, out of 1126 women who took part in the survey, 796 (70.7±1.4 %) either did not work at all or worked only a few hours a day, that is, their labor process was not distinguished by physical activity. At the same time, out of 887 men who took part in the survey, only 68 were pensioners

(7.7±0.9 %), 72 were temporarily unemployed during the survey period (8.1±0.9 %;  $t=0.31$ ;  $P> 0.05$ ). Another 747 men worked full-time in various spheres of labor activity (84.2±1.2 %), 338 of them worked in construction work, drivers, laborers, etc. worked in professions that require physical activity. The given data suggest that one of the reasons for the widespread detection of CS among urban residents may be insufficient physical activity and, as a result, overweight and obesity.

First of all, it should be noted that the high level of CS among men is directly correlated with their age. For example, for the level of CS of 6.5–7.8 mmol/l, the correlation coefficient is  $X=+0.91\pm 0.05$ , and the indicator is  $<21.6\pm 4.2$  depending on the age of men, 28.4±4, increases to 5 % ( $t=61.10$ ;  $P<0.05$ ). The correlation coefficient is significantly higher ( $X=+0.95$ ;  $P<0.004$ ) in the comparison of men's age at  $>7.8$  mmol/l. If the frequency of the indicated level of CS among men under the age of 20 was 14.4±3.6 %, this indicator reaches 19.6±3.9 % in the  $\geq 70$ -year-old group ( $t=0.92$ ;  $P>0.05$ ).

The picture is the same among women. There is a positive correlation between women's age and the level of CS in the blood of 6.5–7.8 mmol/l, that is, as age increases, the level of CS increases ( $X=+0.88\pm 0.09$ ), and the CS indicator itself It increases from 31.6±4.0 to 37.5±4.2 % ( $t=1.02$ ;  $P>0.05$ ). Large differences in indicators were obtained when comparing the CS levels of women, corresponding to the significantly higher value of the correlation coefficient ( $r=+0.97\pm 0.02$ ). Among women, as age increases, CS level increases from 18.0±3.3 to 25.5±3.8 % ( $t=1.73$ ;  $P>0.05$ ).

Our population-level studies found that higher CS levels were characteristic of older age groups in men and women. The other observations also show that the amount of CS increases with age. Thus, in the 25–44-year-old population, this indicator was 17 %, and in the 45–64-year-old population, this indicator increased twice (34.7 %) [7]. It is possible that this is due to the higher prevalence of CS-dependent diseases such as CVDs, arterial hypertension and diabetes among the elderly population. However, the cause of such dependence has not been specified. It is possible that due to the physiological and exchange processes in the elderly organism, the absorption process of CS slows down and it accumulates in the blood. This consideration calls for clinical studies [8].

One more case is worth noting. In many studies, HCS has been shown to be more common in men than women, especially at high levels [3, 11, 12]. Experts attribute this condition to the fact that men smoke a lot and drink alcohol, which causes excessive accumulation of CS in the body. Our indicators show a different picture. Thus, if we summarize the data on CS levels of 6.5–7.8 mmol/l and more than 7.8 mmol/l, their number will be equal to 376 men and 647 women, respectively, which is 42.4±1.7 and 57.5±1.52 % ( $t=6.65$ ;  $P<0.001$ ) of those examined. It may be related to physical and socio-behavioral characteristics and feeding behavior. Some studies showed the similar data. Thus, according to the study of Interepid (2012), this indicator was recorded in 41.4 % of the population, and it was more common among women than men (45.5 and 36.3 %) [13]. But in Kazakhstan, the gender differences in CS were not detected [1].

## Conclusion

Thus, the conducted studies show that the high level of CS is widespread among the urban population. The prevalence of CS is age-related, with a higher rate in women than in men. Men have less high CS indicators than women. Thus, relevant studies conducted at the population level allow to identify risk groups due to HCS and to organize monitoring on them. At the same time, it is necessary to expand research on the identification of risk factors that play a role in the formation of HCS, which is very important for the effective prevention of HCS.

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## INFLUENCE OF BEHAVIORAL FACTORS ON HEALTH INDICATORS OF SCHOOL STUDENTS AT THE REGIONAL LEVEL

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The article analyzes the state of health of schoolchildren aged 10–15 in Kremenchuk and investigates the influence of behavioral risk factors. It was established that the movement activity of schoolchildren is insufficient, 19.2 % have an increased BMI. Detected violations of food behavior, manifested in the replacement of a "healthy snack" with sweets in 30.8 % or refusal of snacks in 12.2 %. 12.8 % of schoolchildren note insufficient duration of night sleep, which leads to overtiredness. It has been established that children 13–15 years are significantly less engaged in physical education; do not follow the rest regime, reducing the time of night sleep; they use fruits, vegetables or yogurts for snacks much less often, preferring snacks and sweets. It was found that 56.4 % of children get sick more than once a year, the influence of behavioral risk factors on the frequency of colds was proven: children who did not do physical education were 3 times more getting colds than those who did active lifestyle; "unhealthy" snacking on sweets and snacks increased the risk of frequent colds by 2 times.

**Key words:** children and teenagers, health, behavioral risk factors.

## I.A. Голованова, О.М. Лесько, Н.О. Обревко, Н.О. Ляхова, І.В. Бєлікова ВПЛИВ ПОВЕДІНКОВИХ ФАКТОРІВ НА ПОКАЗНИКИ ЗДОРОВ'Я ШКОЛЯРІВ НА РЕГІОНАЛЬНОМУ РІВНІ

В статті проаналізовано стан здоров'я школярів 10–15 років Кременчука та досліджено вплив поведінкових факторів ризику. Встановлено, що рухова активність школярів недостатня, у 19,2 % виявлений підвищений ІМТ. Виявлені порушення харчової поведінки, що проявляється в заміні «корисного перекусу» на солодощі у 30,8 % або відмові від перекусів у 12,2 %. 12,8 % школярів відмічає недостатню тривалість нічного сну, що призводить до перевтоми. Встановлено, що діти 13–15 років достовірно менше займаються фізкультурою; не дотримуються режиму відпочинку, скорочуючи час нічного сну; значно рідше використовують для перекусів фрукти, овочі або йогурти, віддаючи перевагу снекам та солодощам. З'ясовано, що 56,4 % дітей хворіє більше, ніж 1 раз на рік, доведено вплив поведінкових факторів ризику на частоту простудних захворювань: діти, які не займалися фізкультурою, в 3 рази частіше хворіли на простудні захворювання, ніж ті, які вели активний спосіб життя; «некорисні» перекуси солодощами та снеками збільшували ризик частих простудних захворювань в 2 рази.

**Ключові слова:** діти та підлітки, здоров'я, поведінкові фактори ризику.

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The health of children and youth is an integral index of the general well-being of society and an index of social and environmental problems [1]. In modern civilization, the problems of quality of life and preservation of health are a global problem [4, 7, 8]. The prevalence of diseases among children aged 0–17 years in 2016 was 1,777.16 registered cases of diseases per 1,000 children, while in 1994 it was 1,263.5,