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Obesity and hypercholesterolemia in open urban population (simultaneous epidemiological study)

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Objective. *To study the prevalence of obesity and hypercholesterinemia in men of working age of open urban population in Tyumen.*

Materials and methods. *According to the results of simultaneous epidemiological study, we established the levels and prevalence of excessive body mass, abdominal obesity and hypercholesterinemia based on the representative sample of men of working age of moderately urbanized Siberian city (Tyumen).*

Results. *Body mass index, waist circumference and total cholesterol characteristics in population are shifted to the right within the normal distribution, which determines the high prevalence of overweight, abdominal obesity and total cholesterol in the open male population of moderately urbanized Siberian city.*

The prevalence of overweight in the male population aged 25–64 years standardized by age in Tyumen was 26 %, the prevalence of abdominal obesity was 42.6 %, and the prevalence of hypercholesterolemia was 42.7 %. Men aged 25–64 years of open population of moderately urbanized Siberian city had increased overweight at the age of 35–44 years, hypercholesterolemia — 35–44 and 45–54 years, abdominal obesity — increased in three youngest age categories.

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Conclusion. *Thus, the results of obtained prevalence of obesity and hypercholesterinemia in various age groups of Tyumen are extremely unfavorable and should be used for primary preventive cardiovascular diseases programs in men of working age of Tyumen and other moderately urbanized Siberian cities.*

Key words: *epidemiological study, open population, men, body mass index, waist circumference, obesity, hypercholesterolemia.*

Introduction

Nowadays, the role of hypercholesterolemia (HC) in the development of chronic noncommunicable diseases, including coronary heart disease, has been proven. The level of lipids in the blood depends on age, gender, external and internal environment factors, for example, nutrition, physical activity, hormonal status and other factors. A number of studies have shown direct correlation between body weight and all-cause mortality. However, the analysis of forty cohort studies by A. Romero-Corral A. et al. showed the correlation between cardiovascular mortality and obesity with a body mass index over 35 kg/m^2, while obesity did not correlate with mortality rate [1].

Abdominal (central) type of obesity with the predominant fat deposition in the abdominal region is the most dangerous. The central, abdominal or visceral type of obesity, when white fat is predominantly located in the mesentery and omentum, is a predictor of diabetes mellitus (T2DM) development of cardiovascular disease (CVD) compared with other obesity types with another fat location and brown fat involvement [2]. Vague first described the concept of the leading role of visceral obesity in the development of impaired glucose tolerance, T2DM and atherosclerosis. Subsequently, the number of epidemiological studies demonstrated the association between visceral obesity, insulin resistance and hyperinsulinemia [3, 4, 5, 6].

Men more often have central ("android") type of obesity with relative body weight that is considered coronary heart disease (CHD) risk factor among men [7]. The results of Paris prospective study on the analyzing various metabolic syndrome (MS) components contribution to sudden death showed that only the presence of abdominal obesity is accompanied by significant risk increase, comparable to the syndrome itself [8].

The objective was to study the prevalence of obesity and hypercholesterinemia in men of working age of open urban population in Tyumen.

Materials and methods

Population-based screening was performed on unorganized population using selective method. Representative sample was formed from adult (25–64 years old) male population of the Central Administrative District of Tyumen city, stratified by age, who were selected using computer program with random number tables based on the electoral lists. Initially, the information was verified with the Tyumen Regional Address Office. The sample included 1000 people — 250 of each age group (25–34, 35–44, 45–54, 55–64 years), the response amounted to 85.0 %.

The study was conducted according to the standards of Good Clinical Practice and Helsinki Declaration principles. Study protocol was approved by the Ethics Committee. All participants signed up written informed consent.

Overweight was determined using traditional Quetelet index II or body mass index (BMI), calculated by the formula: weight (kg) / height^2 (m^2). People with BMI ⩾ 30.0 were considered overweight or obese. For the analysis of abdominal obesity (AO), we used metabolic syndrome criteria IDF (2005) — waist circumference (WC) ⩾ 94 cm for men of European race. The level of total cholesterol (TC) ⩾200 mg/dl (5.17 mmol/l) was considered as hypercholesterinemia (HC).

Statistical analysis was done using IBM SPSS 21.0 Statistics software and Microsoft Excel spreadsheets.

We checked the correspondence of results distribution in each experiment to normal distribution by analyzing standardized asymmetry and excess indicators, that should range from –2.0 to +2.0, and using Pearson criterion and Kolmogorov–Smirnov test. The distribution of quantitative indicators was estimated using percentiles. The analysis was performed separately by age categories 25–34, 35–44, 45–54, 55–64 years, and for general population — 25–64 years. The differences in the dynamics were estimated using paired t-test and analysis of variance on repeated measures. The value of $p < 0.05$ was considered statistically significant. Categorical variables results are presented as percentage (in percent) by four decades of life: 25–34, 35–44, 45–54, and 55–64 years. The comparative analysis with other epidemiological studies data was done by indicators standardization using direct method of standardization. When pro-

cessing the data in order to standardize the indicators, the age structure from 25 to 64 years was used. Statistical significance of differences between groups was assessed using Chi-square Pearson test with Bonferroni correction.

Results

The analysis showed normal distribution of body mass index in men aged 25–64 years. The pattern of BMI distribution was confirmed by test results (p>0.05). BMI distribution extreme deciles were 22.5 and 34.0. The standardized mean BMI in the open male population aged 25–64 was 26.9 (table 1).

Table 1. **Body mass index in open urban male population aged 25–64 years**

Age, years	BMI						
	M	m	Percentile, %				
			10	25	50	75	90
25–34	25.2	±4.1	20.2	22.4	25.2	28.6	31.5
35–44	27.4***	±4.5	22.9	24.9	27.4	30.9	34.4
45–54	27.5	±4.4	23.1	25.1	27.5	31.1	34.8
55–64	27.9	±4.4	24.1	25.2	27.9	31.2	34.8
25–64	27.2	±4.4	22.5	24.4	21.2	30.5	34.0
ASV	26.9						

Comment: Significance of differences between two subsequent age groups is signed up with (*): *** p <0.001; ASV — age-standardized variable.

Statistically significant increase of mean BMI was observed only in men aged 35–44 years, then the indicator remained stable. Data on percentile distribution of BMI in all male age groups repeated the dynamics of mean values (table 1).

The analysis showed normal distribution of waist circumflex (WC) in men aged 25–64 years. The pattern of WC distribution was confirmed by test results (p> 0.05). WC distribution extreme deciles were 80 and 107 cm. The standardized indicators of WC percentile distribution were 80.4–105.4 cm. Age-standardized mean WC in 25–64 years male population was 92.0 cm.

Mean WC values directly correlated with age. The data on percentile WC male distribution in all age groups had the same dynamics as mean values. Mean waist circumference significantly increased with age, increasing by 1.1 times each analyzed age period (table 2). Waist circumference significantly correlated with abdominal (central) type of obesity increase in each subsequent age group.

The distribution of TC parameters was close to normal that was confirmed by the results of normality test (p> 0.05). 10 % and 90 % cut-off points for TC distribution in open male population aged 25–64 years were 4.0 and 6.5 mmol/L, respectively.

Table 2. **The levels of abdominal obesity — waist circumflex in open urban male population aged 25–64 years, cm**

Age, years	WC						
	M	m	Percentile, %				
			10	25	50	75	90
25–34	87.1	±9.9	74	79	87	93	100
35–44	92.5***	±9.7	80	86	92	99	106
45–54	95.4**	±9.2	85	89	94	102	108
55–64	97.2*	±9.2	88	91	97	104	112
25–64	93.4	±10.1	80	86	93	101	107
ASV	92.0						

Comment: Significance of differences between two subsequent age groups is signed up with (*): * p <0.05; ** p <0.01; *** p <0.001; ASV — age-standardized variable.

Mean total cholesterol among men aged 25–64 in Tyumen was 5.0 mmol/l (standardized indicator). The growth rate of this indicator was not the same in men of different age; the level of TC in the population increased by 1.1 times during all analyzed age period. Thus, average level of TC increased significantly with age from the third to fourth and from fourth to fifth decades of life, with lower rates in 25–34 and 35–44-years age categories (4.6 and 5.0 mmol/l, respectively) compared with general population indicator — 25–64 years (5.1 mmol/l). The values of 90 % cut-off points of TC distribution also had unidirectional age dynamics: the indicator tended to increase during all age range, significantly increasing from the third to the fourth and then from fourth to fifth decades of life (table 3).

Table 3. **The level of total cholesterol in open urban male population aged 25–64 years, mmol/l**

Age, years	TC						
	M	m	Percentile, %				
			10	25	50	75	90
25–34	4,6	±0,9	3,4	4,0	4,6	5,3	5,9
35–44	5,0***	±0,8	4,0	4,5	5,0	5,6	6,1
45–54	5,3***	±0,9	4,1	4,7	5,3	6,1	6,7
55–64	5,5	±0,9	4,4	4,9	5,5	6,2	6,7
25–64	5,1	±0,9	4,0	4,6	5,1	5,9	6,5
ASV	5,0						

Comment: Significance of differences between two subsequent age groups is signed up with (*): *** p <0.001; ASV — age-standardized variable.

Thus, population characteristics of body mass index, waist circumference, and total cholesterol in open male population of Tyumen city aged 25–64 years were shifted to the right within the normal distribution, which determined the high prevalence of BMI, AO, HC.

Overweight prevalence was 66.4 % in open male population and significantly increased in third and fourth decades of life (51.4 % — 73.7 %, p<0.001). The prevalence of general population BMI had significant

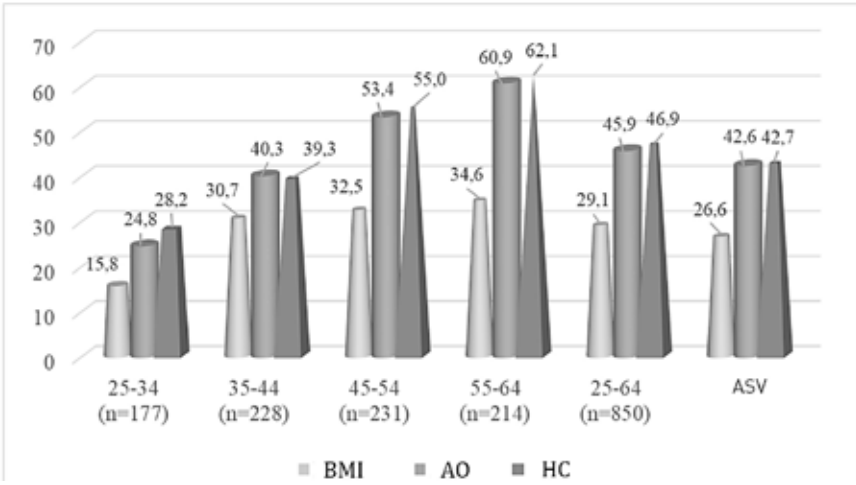

Figure 1. The prevalence of overweight, abdominal obesity, hypercholesterinemia in open urban population of moderately urbanized Siberian city.

differences compared with younger age category — 25–34 years (Figure 1).

Age-standardized prevalence of abdominal obesity rate in the 25–64 years old male population in Tyumen was 42.6 %. An analysis AO prevalence results showed consistent age trend in three age categories. Thus, the indicator increased significantly with age, from the youngest age category, to the fifth decade of life (24.8 % — 40.3 % — 53.4 %, p<0.01, respectively, in age groups 25–34, 35–44, 45–54 years), and increased during studied age period 25–64 years by 2.5 times (figure 1).

High prevalence of HC in open population was established in men aged 25–64 years in 42.7 % of cases. The indicator increased significantly with age from third to fourth and from fourth to fifth decades of life (28.2 % — 39.3 %, p <0.05; 39.3 % — 55.0 %, p<0.001, respectively in age groups 35–44 and 45–54 years). Statistically significant differences in HC by general population indicator were observed in all age categories (figure 1).

Discussion

The results obtained in the open population of moderately urbanized Siberian city showed high average levels of body mass index in men of working age and high prevalence of HC and AO, with a significant increase of all indicators at young age. Unfavorable profile of somatic risk factors in population during simultaneous epidemiological study seems reasonable due to previously obtained data on representative sample of Tyumen men.

Basic epidemiological study in Tyumen has been conducted since the mid-90s. During the period from 1996 to 1997 we obtained data on the high prevalence of CVD risk factors among 25–64-year-old population. The results analysis showed that current situation in Tyumen was caused primarily by atherogenic nutrition, mainly among men of working age, that is associated with conventional behavioral and non-conventional CVD risk factors — chronic social stress factors, low public awareness of CVD risk factors, high prevalence of older people with low health self-esteem, who doubt preventive health measures and healthy lifestyle [9, 10, 11, 12, 13, 14].

According to this study, the prevalence of abdominal obesity in men aged 25–64 years according to different criteria of MS was 42.6 %, that is almost the same as the prevalence of HC in population and was significantly higher than the frequency of obesity despite its localization. At the same time, taking into account the data on percentile distribution of BMI in the population, the prevalence of overweight in men of working age was very high and was aggravated by statistically significant increase at young age.

According to high prevalence of AO in the open population and the results of previous studies on the prevalence of MS in Tyumen population, men with abdominal obesity living in moderately urban Siberian city mostly have classic version of MS prevalence with high incidence of hyperglycemia and less often with low lipoproteins fractions, including TC, that has the worst prognosis for severe cardiovascular system diseases [9].

Conclusion

Thus, the results of obtained prevalence of obesity and hypercholesterinemia in various age groups of Tyumen are extremely unfavorable and should be used for primary preventive cardiovascular diseases

programs in men of working age of Tyumen and other moderately urbanized Siberian cities. Preventive measures include the formation of model for public health regulating in working population, that involves the activities of the population itself, public institutions, and regional legislative and executive authorities with interaction between local governments departments [15].

Findings

1. Body mass index, waist circumference and total cholesterol characteristics in population are shifted to the right within the normal distribution, which determines the high prevalence of overweight, abdominal obesity and total cholesterol in the open male population of moderately urbanized Siberian city.

2. Age-standardized prevalence of BMI in the male population aged 25–64 years in Tyumen was 26%, the prevalence of AO — 42.6%, the prevalence of HC — 42.7%.

3. BMI prevalence increased in 35–44 years age category, HC — in 35–44 and 45–54 years, AO formed consistent age trend in three younger age categories in men aged 25–64 years in open population in moderately urbanized Siberian city.

Conflict of Interest: None declared.

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