THE PREVALENCE OF THE METABOLIC SYNDROME IN THE ELDERLY POPULATION IN YAKUTIA

G.I. Simonova[1], K.K. Sozonova[3], O.V. Tatarinova[2], S.V. Mustafina[1], V.N. Neustroeva[2], L.V. Shcherbakova[1]

[1]Institute of Internal Medicine SB RAMS, Novosibirsk
[2]Yakutsk Scientific Center, SB RAMS, Government of the Sakha Republic (Yakutia), Yakutsk
[3]Geriatric Center (Republican Hospital No. 3)

Aim: to study the prevalence of the metabolic syndrome among the elderly and senile population of Yakutsk (including long-lived people), using different definitions of the metabolic syndrome.

Material and methods. Metabolic syndrome prevalence was studied based on the representative sample of 485 individuals (210 males and 275 females), residing in Yakutsk.

Results. The prevalence of MS among the population of Yakutsk aged 60 and over was 21.4% by NCEP ATP III definition (14.3% in aboriginals, 28.2% in non-aboriginals), 22.1% by AACE definition (13.9% and 29.8%, respectfully), 31.5% by AHA definition (22.8% and 39.9%, respectfully), 35.3% by IDF definition (257% and 44.4%, respectfully), 36.5% by JIS definition (28.3% and 44.4%, respectfully), and 51.5% by RSC definition (43% and 59.7%, respectfully). By all definitions, MS prevalence was 1.5 times to twice lower in aboriginal than in non-aboriginal population. Analysis of the MS prevalence (as defined by NCEP-ATP III definition) in the population of Yakutia aged 60 and over showed that alternate manifestations of MS were diagnosed more often in the presence of fasting hyperglycemia or type 2 DM. These manifestations occurred 1.5 to 2 times more often in aboriginal than in non-aboriginal population.

Conclusion. The prevalence of MS among the population of Yakutsk aged 60 and over was 21.4% by NCEP ATP III definition (14.3% in aboriginals, 28.2% in non-aboriginals), 22.1% by AACE definition (13.9% and 29.8%, respectfully), 31.5% by AHA definition (22.8% and 39.9%, respectfully), 35.3% by IDF definition (257% and 44.4%, respectfully), 36.5% by JIS definition (28.3% and 44.4%, respectfully), and 51.5% by RSC definition (43% and 59.7%, respectfully).

By all definitions, MS prevalence was 1.5 times to twice lower in aboriginal than in non-aboriginal population. Analysis of the MS prevalence (as defined by NCEP-ATP III definition) in the population of Yakutia aged 60 and over showed that alternate manifestations of MS were diagnosed more often in the presence of fasting hyperglycemia or type 2 DM. These manifestations occurred 1.5 to 2 times more often in aboriginal than in non-aboriginal population.

Keywords: epidemiology, metabolic syndrome, abdominal obesity.

INTRODUCTION:

Metabolic syndrome (MS) is a considerably prevalent disease in many countries and populations, and the prevalence is tending to grow. Identification of the metabolic syndrome as a discrete entity is of large clinical importance, as far as it is a reversible disease on the one hand, and predecessor to such diseases, as type 2 diabetes mellitus (DM) and atherosclerosis, on the other hand. The prevalence of MS in different populations varies. During the late years, ethnic and regional patterns in the development of MS have been rigorously studied. Hence the study of epidemiological patterns of MS in the elderly, senile, and long-lived population of the city of Yakutsk, and the relationships between those patterns and the ethnic factor, is an important basic & applied research task.

AIM: to study the prevalence of the metabolic syndrome based on different definitions of MS, among the elderly and senile population of Yakutsk, including long-lived people.

MATERIAL AND METHODS:

This paper presents data from the project "Epidemiology and risk-factors for some of the chronic non-infectious diseases in the elderly and senile (including long-lived people) in Yakutsk" conducted by the Yakutsk Scientific Center SB RAMS (Director: M.I. Tomskii, Dr.Med.Sc. (MD); Principal investigator: O.V. Tatarinova). The study was conducted under methodological guidance of the Institute of Internal Medicine SB RAMS, Novosibirsk (Supervisor: Yu.P. Nikitin, member of the Russian Academy of Medical Sciences) (government contract no. 274). The design of this work is a cross-sectional population study.

We studied the population of Yakutsk aged 60 and over. As of January 1, 2005, the number of people aged 60 and over was 18 320 in Yakutsk. For the purposes of population study, we made representative sample, based on Yakutsk electoral lists, using computer random number generation. The study sample made 7.6% of the total population of Yakutsk. The size of the sample for the study of MS was calculated using M/Blend formula (2000) and included 491 persons (95% CI ± 4% around 30% estimated prevalence). 485 respondents were examined. The study was approved by the Ethical Committee of the Yakutsk Scientific Center SB RAMS. All patients gave informed consents for examinations. All the subjects were grouped by sex (males, females), age (60-69; 70-79; 80-89; 90 and over), ethnicity (aboriginal: Yakuts; non-aboriginal: Russians, Ukranians, Byelorussians, Poles, and Germans).

We assessed social and demographic data, measured blood pressure, performed anthropometry (body height, body weight, waist circumference (WC)), fasting biochemical tests, more specifically, triglycerides (TG) levels, high-density lipoprotein cholesterols (HDL-C), low-density lipoprotein cholesterols (LDL-C), and blood glucose levels.

Fasting blood was collected by venepunction using vacutainers. Blood analyses were performed in the Biochemistry Laboratory of the Institute of Internal Medicine SB RAMS (Head of the laboratory: Professor Yu.I. Ragino). Total cholesterol (TC), TG, HDL-C, and blood glucose levels were determined using conventional commercial 'Biocon' enzyme assays (Germany) and 'Lab system' analyzers (Finland). LDL-C concentration was calculated using the formula of W.T. Friedewald (provided that TG level was below 4.5 mmol/L). Serum glucose levels were recalculated to plasma glucose values using the formula proposed by the European Society of Cardiology (2007): plasma glucose (mmol/L) = –0.137 + 1.047 × serum glucose (mmol/L).

Using the definitions of RSC (2009), NCEP ATP III (2001), and AACE (2003), type 1 fasting hyperglycemia was established if plasma glucose level was ≥ 6.1 mmol/L. Using the definitions of IDF (2005), AHA/ NHLBI (2005), and JIS (2009), type 2 fasting hyperglycemia was determined if plasma glucose level was ≥ 5.6 mmol/L. DM was established if plasma glucose value was ≥ 7.0 mmol/L (WHO, 1999).

WC values corresponded to type 1 abdominal obesity (AO_1: WC ≥102 sm. in males and ≥ 88 sm. in females), type 2 AO (AO_2: WC ≥94 sm. and ≥80 sm., respectfully), or type 3 AO (AO_3: WC ≥94 sm. in Caucasian males, ≥ 90 sm. in Asian males, and ≥ 80 sm. in females).

The prevalence of MS was studied using the recommendations of NCEP ATP III (2001) [9], RSC (2009), IDF (2005) [11], AHA/NHLBI (2005) [6], AACE (2003) [11], JIS (2009) [11].

Statistical analysis was done using two-sample methods (Mann-Whitney U-test, paired Student t-test), analysis of contingency tables (Fisher's exact test), correlation analysis (Spearman correlation coefficient), and multinomial linear regression. Sample normality was tested using Kolmogorov-Smirnov test. The results were considered significant if $p < 0.05$. In case of incomparability of the data the values were standardized for one or two characteristics. SPSS (ver. 11.5) software was used.

RESULTS AND DISCUSSION:

The prevalence of MS in the residents of Yakutsk aged ≥60 was high, by all definitions used, and varied from 21.4% to 51.5%. Using NCEP ATP III definition, MS prevalence was 21.4%, 14.3% in aboriginal patients and twice higher (28.2%) in non-aboriginal patients (Table 1). In aboriginals, the prevalence of MS 9.8% in males and 19.1% in females (p_{M-F}=0.04), in non-aboriginals, 21.6% and 31.9%, respectfully (p_{M-F}=0.09). MS prevalence in aboriginal males and females was reliably lower than in non-aboriginals (p_{A-NA}=0.02 in males, p_{A-NA}=0.02 in females).

Based on AACE definition of MS, which unlike the above mentioned definitions assigns the priority role to AO, the prevalence of MS in the population has increased to 22.1% (Table 1). In aboriginals it was lower than in non-aboriginals (13.9% and 29.8%, respectfully; p_{A-NA}=0.001). In aboriginal males and females the

rates were 5.7% and 22.6%, respectfully (p_{M-F}=0.002), while in non-aboriginals 17% and 36.9%, respectfully (p_{M-F}=0.001). Ethnic differences between males and females were the same as with NCEP ATP III definitions.

When AHA/NHLBI criteria for MS were used (these criteria differ from the definitions of NCEP ATP III and AACE by blood glucose level (≥5.6 mmol/L)), the prevalence of MS was 31.5% (Table 1), 22.8% in aboriginals and 39.9% in non-aboriginals (p_{A-NA}=0.001). In aboriginal population, gender difference in the MS prevalence was statistically insignificant: 18% and 27.8% (p_{M-F}=0.07). Gender difference in non-aboriginal population was large: 30.7% in males and 45.0% in females (p_{M-F}=0.03). Both in males in females, the ethnic differences in the MS prevalence have remained.

Based on IDF definition, which is more strict in all aspects, the prevalence of MS was 35.3% (Table 1), 25.7% in aboriginals and 44.4% in non-aboriginals (p_{A-NA}=0.0001). MS prevalence rates in aboriginal males and females were 17.2% and 34.8%, respectfully (p_{M-F}=0.002), the same rates for non-aboriginals were 35.2% and 49.4%, respectfully (p_{M-F}=0.03). Prevalence of MS, compared between males and females, was lower among aboriginals than in non-aboriginals.

The prevalence of MS by JIS definition, which takes into account ethnic factor (WC ≥90 sm. for Asian males), was 36.5%, 28.3% in aboriginals and 44.4% in non-aboriginals (Table 1). Although MS had slightly higher prevalence in aboriginal males, the rest of statistical differences were the same as with the IDF definition.

RSC definition takes into consideration glucose level (>6.1 mmol/L), WC (94/80 sm.) and, unlike all the above mentioned definitions, LDL-C values. Based on RSC definition, the total prevalence of MS was 51.5% (Table 1), respectfully 43.0% and 59.7% in aboriginals and in non-aboriginals (p=0.0002). The prevalence rates were 28.7% and 58.3% in aboriginal males and females, respectfully (p=0.052), and 48.9% and 65.6% for non-aboriginal males and females (p=0.01). Ethnic differences remained only among males, while in females ethnicity-specific differences were statistically insignificant (p_{A-NA}=0.21).

All in all, the lowest MS prevalence was determined based on NCEP ATP III definition (21.4%) and the highest prevalence (51.5%) – based on RSC definition. By all definitions, MS was less prevalent in aboriginal than in non-aboriginal population. The higher prevalence of MS by the RSC definition can be explained by that it incorporates LDL-C values. This could explain also the absence of difference in the MS prevalence between aboriginal and non-aboriginal females.

The prevalence of MS by NCEP ATP III (2001) definition in patients with fasting hyperglycemia (defined as ≥5.6 mmol/L) was 43.3% (31.7% in aboriginals; 51.1% in non-aboriginals, p_{A-NA}=0.019), and 67.6% if fasting hyperglycemia was defined as ≥7.0 mmol/L (40% in aboriginals and 79.2% in non-aboriginals, p_{A-NA}=0.033).

By literature data, 8814 individuals aged >20 were examined during the NHANES project (2002), to study the prevalence of MS in the USA, using NCEP-ATP III (2001) definition [9]. The prevalence of MS was 24% in females and 22% in males. In another project (ENSANUT, 2006), 45 446 adults of Mexican origin aged >20 were examined, to study the prevalence of MS and its components, using NCEP ATP III (2001), AHA/NHLBI (2003), and IDF(2005) definitions [12].

The prevalence of MS (including 3 to 5 components) by NCEP ATP III (2001) and AHA/NHLBI (2003) definitions exceeded 40%. By NCEP ATP III (2001) definition, MS was found in 36.8% (95% DI 34.6-39.0) of adult population (42.2% in females and 30.3% in males) [12]. In 2006, the DECODE study presented data on comparative prevalence of MS in 20 European countries, using various MS definitions [14]. The prevalence of MS among 5554 females and 4715 males aged 30 to 80 was 23% in females and 26% in males.

The prevalence of MS in Russia judged by the data from strong epidemiological studies is poorly studied. Studies in the city of Cheboksary in 2007-2008 [1] were conducted by practitioners, but were based on cluster samples that included younger age-groups; this hinders the comparison with our results.

In Yakutia, the prevalence of MS among the aboriginal population was studied based on the results of cross-sectional epidemiologic sampling study among aboriginal non-working urban and rural populations of the Sakha Republic (Yakutia). Total of 1055 representatives of the aboriginal population (Yakuts, Evens, Evenki) aged 20-69 were studied. In the age group of 60-69, the prevalence of MS defined by IDF (2005) definition was 13.7%. [2]. Unfortunately, we could not compare our results with the other authors' data on Yakutia, as the available publications [2,4] had data on MS prevalence (as defined by IDF (2005) definition) only for the ages of 20 to 69 (Osakovskii V.L.) or had data from hospital study, rather than population study (Romanova A.N.).

We attempted to compare the results from Yakutia with the same data from Novosibirsk [3], but were able to do the comparison only for the age range of 60 to 69 and using only 4 definitions of MS (NCEP ATP III (2001), AHA/NHLBI (2003), JIS (2009), RSC). In the table 2, the data for Yakutia are presented for urban population regardless of ethnicity. MS prevalence in Novosibirsk population was higher, based on 3 above mentioned definitions, except RSC definition. This difference was true for both genders and for females. In males, the prevalence of MS in both cities was comparable (Table 2).

CONCLUSIONS:

1. The prevalence of MS among the population of Yakutsk aged 60 and over was 21.4% by NCEP ATP III definition (14.3% in aboriginals, 28.2% in non-aboriginals), 22.1% by AACE definition (13.9% and 29.8%, respectfully), 31.5% by AHA definition (22.8% and 39.9%, respectfully), 35.3% by IDF definition (257% and 44.4%, respectfully), 36.5% by JIS definition (28.3% and 44.4%, respectfully), and 51.5% by RSC definition (43% and 59.7%, respectfully).
2. By all definitions, MS prevalence was 1.5 times to twice lower in aboriginal than in non-aboriginal population.
3. Analysis of the MS prevalence (as defined by NCEP-ATP III definition) in the population of Yakutia aged 60 and over showed that alternate manifestations of MS were diagnosed more often in the presence of fasting hyperglycemia or type 2 DM. These manifestations occurred 1.5 to 2 times more often in aboriginal than in non-aboriginal population.

Table 1.

Prevalence of MS in the age of 60 and over in the population of Yakutsk

	Population (485)		Aboriginal (237)		Non-aboriginal (248)		p_{A-NA}
	%	95%CI	%	95%CI	%	95%CI	
NCEP ATP III (2001)	21.4	17.9-25.4	14.3	10.3-19.6	28.2	22.8-34.3	0.0002
AACE (2003)	22.1	18.5-26.0	13.9	9.9-19.1	29.8	24.3-36.0	0.0001
AHA (2003)	31.5	27.5-35.9	22.8	17.7-28.7	39.9	33.9-46.3	0.0001
IDF (2005)	35.3	31.1-39.7	25.7	20.4-31.8	44.4	38.2-50.7	0.0001
JIS (2009)	36.5	32.3-40.9	28.3	22.8-34.5	44.4	38.2-50.7	0.0002
RSC (2009)	51.5	47.1-56.0	43.0	36.8-49.5	59.7	53.3-65.7	0.0002

Table 2.

Prevalence of MS among the population of Yakutsk and Novosibirsk aged 60 to 69

	MS definitions	Yakutia				Novosibirsk				p_{Y-N}
		N	n	%	95%CI	N	n	%	95%CI	
Males and females	NCEP ATP III (2001)	150	39	26.0	19.3-33.9	3822	1308	34.2	32.7-35.7	0.037
	AHA (2003)	150	54	36.0	28.5-44.2	3827	1824	47.7	46.1-49.2	0.005
	JIS (2009)	150	62	41.3	33.5-49.6	3826	1998	52.2	50.6-53.8	0.009
	RSC (2009)	150	91	60.7	52.4-68.4	3838	2326	60.6	59.0-62.1	0.988
Males	NCEP ATP III (2001)	64	14	21.9	12.4-34.5	1767	414	23.4	21.5-25.5	0.772
	AHA (2003)	64	20	31.3	20.2-44.4	1769	599	33.9	31.7-36.1	0.664
	JIS (2009)	64	25	39.1	27.1-52.3	1764	685	38.8	36.6-41.1	0.970
	RSC (2009)	64	32	50.0	37.2-62.8	1775	774	43.6	41.3-45.9	0.311
Females	NCEP ATP III	86	25	29.1	19.9-40.1	2055	894	43.5	41.4-45.7	0.008

	(2001)									
	AHA (2003)	86	34	39.5	29.4-50.7	2058	1225	59.5	39.6-43.2	0.0002
	JIS (2009)	86	37	43.0	32.5-54.2	2062	1313	63.7	61.6-65.7	0.0001
	RSC (2009)	86	59	68.6	57.5-78.1	2063	1552	75.2	73.3-77.1	0.165

Note: N – number of subjects; n – number of individuals with MS

REFERENCES:

1. Tokareva Z.N., Evdokimova A.A., Mamedov M.N., et al. Izuchenie rasprostranennosti metabolicheskogo sindroma vo vzrosloy populiatsii: resul'taty issledovaniia Prima [Study of the prevalence of the metabolic syndrome in adult population: results of the Prima study]. Kardiovaskulyarnaya terapiia i profilaktika. 2008. no. 6, vol. 4, pp. 22-25.
2. Osakovskii V.L., Gol'dfarb L.G., Klimova T.M., et al. Metabolicheskii sindrom u aborigennogo naseleniia Yakutii [Metabolic syndrome in the aboriginal population of Yakutia]. Jakutskij medicinskij zhurnal = Yakut medical journal, 2010, no. 2, pp. 98-102.
3. Simonova G.I., Mustafina S.V., Pechenkina E.A. Rasprostranennost' metabolicheskogo sindroma v Sibiri: populyatsionnoe issledovanie v g. Novosibirske [Prevalence of the metabolic syndrome in Siberia: population study in Novosibirsk]. Bulleten' SO RAMN, 2011, no. 5, vol. 31, pp. 100-106.
4. Romanova A.N., Gol'derova A.S., Voevoda M.I., et al. Chastota metabolicheskogo sindroma i ego klinicheskikh variantov u bol'nykh s verifitsirovannym koronarnym aterosklerozom [Incidence of the metabolic syndrome and its clinical variants in patients with verified coronary atherosclerosis]. Jakutskij medicinskij zhurnal = Yakut medical journal, 2011, no. 2, pp. 16-19.
5. Ardern C.I., Janssen I. Metabolic syndrome and its association with morbidity and mortality. J. Appl. Physiol. Nutr. Metab, 2007, vol. 32, pp. 33-45.
6. Sakurai T., Iimuro S., Araki A., et al. Age-associated increase in abdominal obesity and insulin resistance, and usefulness of AHA/NHLBI definition of metabolic syndrome for predicting

cardiovascular disease in Japanese elderly with type 2 diabetes mellitus. J. Gerontology, 2010, vol. 56, no. 2 P

7. Hara K., Matsushita Y., Horikoshi V., et al. A proposal for the cutoff point of waist circumference for the diagnosis of metabolic syndrome in the Japanese population. J Diabetes Care, 2006, vol. 29, no. 5, pp. 1123-1124.
8. Charles M.A The coming of age of the metabolic syndrome. Diabetes Care, 2003, vol. 26, no. 11 P.
9. Charles M.A., Haffner S.M. NCEP-defined metabolic syndrome, diabetes, and prevalence of coronary heart disease among NHANES III Participants Age 50 Years and Older. Diabetes, 2003, no. 52, pp. S1210-S1214.
10. American Heart Association; National Heart, Lung, and Blood Institute. Scientific statement diagnosis and management of the metabolic syndrome. Circulation, 2005, vol. 112, pp. 2735-2752.
11. Day C. Metabolic syndrome, or what you will: definition and epidemiology. J. Diabetes and Vascular Disease Research, 2007, no. 4, pp. 32-38.
12. Rosalba R. Carlos A., Jimenez-Corona A. et al. Metabolic syndrome in Mexican adults. Results from the National Health and Nutrition Survey 2006. Salud publica Mex, 2010, vol. 52, suppl. 1
13. Alkerwi A., Donneau A.-F., Sauvageot **N.,** et al. Prevalence of the metabolic syndrome in Luxembourg according to the Joint Interim Statement definition estimated from the ORISCAV-LUX study. BMC Public Health, 2011, no. 11 P-.
14. The DECODE Study Group; Comparison of different definitions of the metabolic syndrome in relation to cardiovascular mortality in European men and women. Diabetologia, 2006, no. 49, pp. S2837-S2846.

Author information:

Galina Il'inichna Simonova, Professor, MD, Honored scientist of Russian Federation, Head of Laboratory of clinical populational and preventive studies of therapeutic and endocrine diseases of Institute of Internal Medicine SB RAMS

Kolymana Konstantinovna Sozonova, endocrinologist, Geriatric Center (Republican Hospital No. 3)

Olga Viktorovna Tatarinova, Cand.Med.Sc. (PhD), Deputy Chief Doctor of the Republican Hospital No.2 (Center for Emergency Medicine), Senior Researcher of the Yakutsk Scientific Center, SB RAMS, Government of the Sakha Republic (Yakutia), Yakutsk

Svetlana Vladimirovna Mustafina, PhD, Research assistant in Laboratory of clinical

populational and preventive studies of therapeutic and endocrine diseases of Institute of Internal Medicine SB RAMS

Varvara Nikolaevna Neustroeva, researcher, Yakutsk Scientific Center, SB RAMS, neusvn@mail.ru

Shcherbakova Lilia Valeryevna, Research assistant in Laboratory of clinical population and preventive studies of therapeutic and endocrine diseases of Institute of Internal Medicine SB RAMS

Galina Il'inichna Simonova, Professor, MD, Honored scientist of Russian Federation, Head of Laboratory of clinical populational and preventive studies of therapeutic and endocrine diseases of Institute of Internal Medicine SB RAMS

Svetlana Vladimirovna Mustafina, PhD, Research assistant in Laboratory of clinical populational and preventive studies of therapeutic and endocrine diseases of Institute of Internal Medicine SB RAMS

Shcherbakova Lilia Valeryevna, Research assistant in Laboratory of clinical population and preventive studies of therapeutic and endocrine diseases of Institute of Internal Medicine SB RAMS