

A.N. Romanova, A.S. Golderova, E.A. Alekseeva, S.D. Efremova

Glucose-Insulin Indicators at Patients with Verified Coronary Atherosclerosis in Yakutia: Ethnicity and Gender Features

The results of glucose-insulin indicators levels study in patients with verified coronary atherosclerosis in comparison with persons without clinical signs of coronary heart disease, depending on ethnic and gender are presented in this article. Among inhabitants of Yakutia coronary atherosclerosis correlated with all studied indicators: since elevated levels of glucose ($r=0.344$, $p<0.01$), C-peptide ($r=0.713$, $p<0.01$), insulin ($r=0.566$, $p<0.01$) and HOMA-IR index ($r=0.581$, $p<0.01$). In comparison groups ethnic differences were characterized by higher levels of insulin ($p=0.004$) and HOMA-IR index ($r=0.026$) in native women, while in non-native men and women were higher glucose levels ($p=0.000$). Gender differences were also obtained in comparison groups: insulin and HOMA-IR index levels ($p=0.000$) in native women, also C-peptide ($r=0.004$) and insulin ($r=0.000$) levels in non-native women were higher unlike men.

Keywords: insulin resistance, coronary atherosclerosis, Yakutia.

Introduction

Insulin resistance is an independent risk factor for cardiovascular disease. Hyperinsulinemia is the earliest and a permanent marker of insulin resistance. Insulin resistance and hyperinsulinemia have both direct and indirect atherogenic effects of blood vessels, contribute to the development of endothelial dysfunction, dyslipidemia, numbers of hormonal, metabolic, procoagulant and inflammatory disorders, activation sympathoadrenal system.

Saturated fatty acids in an excess of from food caused structural changes of cell membranes phospholipids and impaired expression of genes controlling insulin signal transduction in cell, i.e. cause to the development of insulin resistance. Inactivity is decelerating of triglycerides (TG) lipolysis and utilization in muscle and adipose tissues, reduction of glucose transporters translocation in muscles, which leads to the development of insulin resistance [7, 12].

As a result of decrease the sensitivity of target cells to action of insulin is disrupted glucose of insulin-dependent uptake tissues (liver, muscle and adipose tissue) and created the preconditions for development of hyperglycemia. However, due to a compensatory increase of β -cell pancreatic insulin secretion the glucose concentration in blood serum for a long time can remain of normal. With a powerful lipotropic action the hyperinsulinemia promotes weight gain due to accumulation of adipose tissue mainly in upper body and abdominal cavity (omentum and mesentery).

Hyperinsulinemia also promotes the disruption of blood fibrinolytic activity through the mechanism of synthesis in adipose tissue of plasminogen activation inhibitor, thereby slowing the rate of fibrin cleavage. Insulin resistance is increases of blood platelets adhesion and aggregation, which, according to some authors, is one of the major triggers of hemorheological disorders that contribute to thrombosis and microcirculatory disturbances [1, 3, 4, 9].

Material and methods

This study included results of a survey 939 urban and rural residents of Yakutia aged 45-64 years. The main group included 396 men (189 native, mean age of 54.34 ± 0.44 yr and 207 non-native, mean age 54.76 ± 0.43 yr) and 60 women (28 native, mean age 53.39 ± 1.28 yr and 32 non-native, mean age 55.81 ± 1.01 yr) with verified

coronary atherosclerosis according to selective coronary angiography, who referred by the hospital examination in cardiology department of the Republican Hospital No.1-National Medical Center of Yakutsk.

The comparison groups are formed of 212 men (108 native, mean age 51.28 ± 0.57 yr and 104 non-native, mean age 51.09 ± 0.52 yr) and 271 women (145 native, mean age 51.19 ± 0.43 yr and 126 non-native, mean age 51.37 ± 0.47 yr) without clinical signs of coronary heart disease (CHD) to base on results of the complex medical examination during the expedition trips in areas of the Republic of Sakha (Yakutia). The study period: 2007-2010. Yakutians are considered to be representatives of native nationality, non-native nationality – Russians, Ukrainians and Belarusians living in Yakutia constantly.

The survey was conducted according to standard procedures and include the following obligatory sections: standard poll under Rose's questionnaire (for comparison groups) and the questionnaire developed for assess of objective state; triple of arterial pressure measurement using mercury sphygmomanometer to determine the presence and degree of arterial hypertension; electrocardiogram registration in rest; selective coronary angiography (for main groups of patients with CHD); fasting blood glucose, C-peptid and insulin assays. Selective coronary angiography was spent on angiographic installation «Axiom. Artis BA»(Siemens, Germany) according to the standard method of Judkins. As the contrast material used omnipak.

Biochemical parameters were determined by enzymatic method on an automatic analyzer «Cobasmira plus», La Roshe, Switzerland, using commercial kits «Biocon», Germany. For immunoferment analysis used kits «DGR», Germany (determination of insulin) and «Monobind Inc.», USA (determination of C-peptide). The index HOMA-IR was calculated using the formula of D. Matthews et al., 1985: Fasting serum insulin (mU/ml) x fasting plasma glucose (mmol/l) / 22,5. Evaluation of the results of this study was carried out by the conventional classification.

All studies were carried out with the informed consent of the subjects in accordance with ethical standards of Helsinki Declaration (2000) (the protocol of local committee on biomedical ethics of YSC CMP No.13 of November 27, 2008).

Statistical analysis of research materials made using the program SPSS (version 13). Used of standard evaluation criteria of statistical hypotheses: Student's t-test, Mann-Whitney test. Data are expressed as M - mean $\pm$ m - standard error of mean. To identify the relationship between the studied parameters we used the method of Spearman's correlation analysis. Comparisons were considered statistically significant at $p < 0.05$.

Results and discussion

The mean glucose levels were higher in patients than in persons without CHD (native: Men – 5.39 ± 0.09 vs 4.22 ± 0.05 ; women – 5.07 ± 0.20 vs 4.49 ± 0.11 ; non-native: Women – 6.22 ± 0.45 vs 4.92 ± 0.07 mmol/l, $p = 0.000$, respectively), excluding non-native men (5.50 ± 0.10 vs 5.22 ± 0.07 mmol/l, $p = 0.059$, respectively). In comparison groups the gender differences were characterized by higher levels of glucose in non-native men, unlike women (5.22 ± 0.07 vs 4.92 ± 0.07 mmol/l, $p = 0.009$, respectively). The mean glucose level was higher among native women without CHD, living in city compared to rural women (4.89 ± 0.08 vs 4.32 ± 0.14 mmol/l, $p = 0.000$, respectively). In other groups no significant differences depending on place of residence have been identified (Table 1).

The mean levels of C-peptide, insulin and HOMA-IR index were significantly higher in all patients with coronary atherosclerosis compared with relevant persons without CHD (native: Men – C-peptide 2.53 ± 0.18 vs 0.77 ± 0.17 ng/ml; insulin 19.41 ± 2.08 vs 8.23 ± 0.38 mU/ml; HOMA-IR index 4.75 ± 0.50 vs 1.57 ± 0.08 , $p = 0.000$; Women – C-peptide 2.99 ± 0.29 vs 0.89 ± 0.18 ng/ml, $p = 0.000$; insulin 18.52 ± 2.01 vs 11.75 ± 0.52 mU/ml, $p = 0.002$; HOMA-IR index 4.36 ± 0.62 vs 2.48 ± 0.17 , $p = 0.000$; non-native: Men – C-peptide 2.35 ± 0.12 vs $0.29 \pm$



0.04 ng/ml; insulin 19.15 ± 1.06 vs 7.98 ± 0.27 mU/ml; HOMO-IR index 4.63 ± 0.27 vs 1.83 ± 0.07 , $p = 0.000$; Women - C-peptide 2.78 ± 0.38 vs 0.46 ± 0.06 ng/ml, $p = 0.000$; insulin 21.79 ± 4.75 vs 9.63 ± 0.47 mU/ml, $p = 0.001$; HOMO-IR index 6.25 ± 1.32 vs 2.08 ± 0.12 , $p = 0.000$, respectively) (Table 1).

The significant ethnic and gender differences in groups of patients have been identified. Among native women without CHD were higher of insulin and HOMA-IR index levels, than men (insulin 11.75 ± 0.52 vs 8.23 ± 0.38 mU/ml; HOMO-IR index 2.48 ± 0.17 vs 1.57 ± 0.08 , $p = 0.000$, respectively). In non-native women without CHD were higher of C-peptide and insulin levels compared with men (C-peptide 0.46 ± 0.06 vs 0.29 ± 0.04 ng/ml, $p = 0.004$; insulin 9.63 ± 0.47 vs 7.98 ± 0.27 mU/ml; $p = 0.000$, respectively).

In both native groups (patients and persons without CHD) and among non-native persons without CHD the significant differences depending on place of residence are revealed.

In rural non-native men with coronary atherosclerosis was significantly higher of C- peptide level compared with urban men (2.63 ± 0.14 vs 2.13 ± 0.17 ng/ml, $p = 0.011$, respectively).

Table 1

Comparative characteristics of the glucose- insulin indicators in the examined groups of men and women, M±m

Groups			Glucose, mmol/l	C-peptid, ng/ml	Insulin, mU/ml	Index of HOMA-IR
1 group CHD (+) Native	Men (n=189)	urban	5.62±0,18	2.41±0.21	16.16±1.09	4.38±0.40
		rural	5.25±0,11	2.60±0.27	21.40±3.26	4.98±0.77
		total	5.39±0,09	2.53±0.18	19.41±2.08	4.75±0.50
		<i>p</i>	$p_{1-3}=0.000$ $p_{m-w}=0.067$	$p_{1-3}=0.000$	$p_{1-3}=0.000$	$p_{1-3}=0.000$
	Women (n=28)	urban	5.55±0.45	3.04±0.46	19.91±3.67	5.49±1.55
		rural	4.81±0.17	2.97±0.38	17.87±2.46	3.83±0.55
		total	5.07±0.20	2.99±0.29	18.52±2.01	4.36±0.62
		<i>p</i>	$p_{1-3}=0.000$	$p_{1-3}=0.000$	$p_{1-3}=0.002$	$p_{1-3}=0.001$
2group CHD (+) Non- native	Men (n=207)	urban	5.69±0.18	2.13±0.17	18.09±1.61	4.47±0.42
		rural	5.35±0.10	2.63±0.14	20.55±1.20	4.83±0.31
		total	5.50±0.10	2.35±0.12	19.15±1.06	4.63±0.27
		<i>p</i>	$p_{2-4}=0.059$	$p_{2-4}=0.000$ $p_{2-c}=0.011$	$p_{2-4}=0.000$ $p_{2-c}=0.060$	$p_{2-4}=0.000$
	Women (n=32)	urban	6.53±0.72	2.89±0.57	22.70±7.27	7.00±1.99
		rural	5.78±0.36	2.57±0.33	20.17±3.41	4.93±0.93
		total	6.22±0.45	2.78±0.38	21.79±4.75	6.25±1.32
		<i>p</i>	$p_{2-4}=0.000$ $p_{1-2}=0.007$ $p_{m-w}=0.052$	$p_{2-4}=0.000$	$p_{2-4}=0.001$	$p_{2-4}=0.000$
3group CHD (-) Native	Men (n=108)	urban	4.20±0.07	0.65±0.14	7.36±0.40	1.37±0.07
		rural	4.23±0.07	0.88±0.29	9.02±0.61	1.76±0.14
		total	4.22±0.05	0.77±0.17	8.23±0.38	1.57±0.08
		<i>p</i>		$p_{3-4}=0.029$ $p_{2-c}=0.066$	$p_{2-c}=0.050$	
	Women (n=145)	urban	4.89±0.08	0.97±0.24	11.67±0.67	2.47±0.15
		rural	4.32±0.14	0.80±0.30	11.84±0.83	2.49±0.31
		total	4.49±0,11	0.89±0.18	11.75±0.52	2.48±0.17
		<i>p</i>	$p_{m-w}=0.072$ $p_{2-c}=0.000$	$p_{2-c}=0.001$	$p_{3-4}=0.004$ $p_{m-w}=0.000$	$p_{3-4}=0.026$ $p_{m-w}=0.000$
4group CHD (-)	Men (n=104)	urban	5.14±0.10	0,28±0.06	7,70±0,37	1,74±0,08
		rural	5.28±0.09	0.30±0.05	8.26±0.40	1.92±0.10
		total	5.22±0.07	0.29±0.04	7.98±0.27	1.83±0.07
		<i>p</i>	$p_{3-4}=0.000$ $p_{m-w}=0.009$			$p_{3-4}=0.000$

Non-native	Women (n=126)	urban	4.94±0.12	0.55±0.10	10.66±0.84	2.33±0.22
		rural	4.91±0.09	0.38±0.06	8.69±0.42	1.86±0.10
		total	4.92±0.07	0.46±0.06	9.63±0.47	2.08±0.12
		<i>p</i>	$p_{3-4}=0.000$	$p_{m-w}=0.004$	$p_{m-w}=0.000$ $p_{c}=0.094$	$p_{m-w}=0.071$

Conclusion. In patients with coronary atherosclerosis increased levels of C-peptide, insulin and HOMA-IR index compared with persons without clinical signs of CHD. Among inhabitants of Yakutia coronary atherosclerosis was closely correlated with elevated levels of glucose ($r=0.344$, $p<0.01$), C-peptide ($r=0.713$, $p<0.01$), index of HOMA-IR ($r=0.581$, $p<0.01$), and insulin ($r=0.566$, $p<0.01$), that consistent with the fact that hyperinsulinemia and insulin resistance are keys starting torque of atherosclerosis [1, 5, 6, 10].

References

1. Mamedov M.N. How to prevent the risk of coronary heart disease and diabetes? (master class in management of patients with metabolic syndrome) / M.N. Mamedov // International Journal of Endocrinology. - 2007. - № 5 (11).
2. Sokolov E.I. Diabetic dyslipidemia in the pathogenesis of coronary heart disease / E.I. Sokolov, N.V. Perova // Cardiology. - 2003. - № 5. - P. 16 - 20.
3. Chazova I.E. The metabolic syndrome: insulin resistance and obesity / I.E. Chazova, V.B. Mychka // Consiliummedicum. - 2004. - № 1.
4. Chubrieva S.Yu. Adipose tissue as an endocrine regulator (review) / S.Yu. Chubrieva, N.V. Glukhov, A.M. Zaychik // Bulletin of the St. Petersburg University. - 2008 - Vol. 1 (11). - P. 32 - 42.
5. Egan B.M. Insulin resistance and cardiovascular disease / B.M. Egan, E.L. Greene, T.D. Goodfriend // Am. J. Hypertens. 2001. - Vol. 14. - P. S116 - S125.
6. Haffner S. Progress in Population Analyses of the Insulin Resistance Syndrome / S. Haffner // Annals of the New York Academy of Sciences. - 1997. - Vol. 827. - P. 1 - 12.
7. Jacob S. Роль жиров пищи в генезе инсулинорезистентности и сахарного диабета 2 типа / S. Jacob // Ожирение. Актуальные вопросы. - 2001. - № 5. - С. 1 - 3.
Jacob S. The role of food fat in the genesis of insulin resistance and type 2 diabetes / S. Jacob // Obesity. Topical issues. - 2001. - Vol. -P. 1 - 3.
8. Lebovitz H.E. Insulin resistance: definition and consequences / H.E. Lebovitz // Exp. Clin. Endocrinol. Diabetes. - 2001. - Vol. 109 (2). - P. S135 - S148.
9. Metabolic syndrome: Pathogenesis, medical care and implications / A.H. Friedlander, J. Weinreb, I. Friedlander, J.A. Yagiela // J. Am. Dent. Assoc. - 2007. - Vol. 138. - P. 179 - 187.
10. Reaven G.M. Role of insulin resistance in human disease / G.M. Reaven // Diabetes. - 1988. - Vol. 37. - P. 1595 - 1607.
11. Standl E. Etiology and consequences of the metabolic syndrome / E. Standl // European Heart Journal. - 2005. - Vol. 7. - P. 10 - 13.
12. Van Dam R.M. Dietary Fat and Meat Intake in Relation to Risk of Type 2 Diabetes in men / R.M. Van Dam, W.C. Willett, E.B. Rimm [et al.] // Diabetes Care. - 2002. - Vol. 25 (3). - P. 417 - 424.