

# STRESS UNDER MODERNIZATION IN INDIGENOUS POPULATIONS OF SIBERIA

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## ABSTRACT

**Objectives.** Arterial blood pressure and serum blood glucose concentration, and the level of anxiety, as determined by the Spielberger test, as physical and psychological markers of stress under “modernization”, were studied in groups of native Siberians: the Khanty and the Mansi.

**Results.** The fraction of respondents with a high level of anxiety is 64% of the total sample. The average values of systolic and diastolic blood pressure are higher among natives living in large than in small “national” settlements ( $p < 0.05$ ). The arterial blood pressure of town dwellers is even higher. The same patterns are seen in the blood serum glucose concentrations in female samples. The average arterial blood pressure (in males and females) and the blood serum glucose concentration (in females) increases as people diverge from “traditional” lifestyles.

**Conclusions.** The results demonstrate that “modernization” and urbanization have a serious stressing influence on the aborigines of North Siberia.

**Keywords:** Stress, Modernization, Arctic indigenous populations, Arterial blood pressure, Blood glucose, Anxiety

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## INTRODUCTION

The health consequences of “modernization” in native northerners have been actively studied in all circumpolar regions (1). The focus of our investigation is autochthonous people of Siberia – the Khanty and Mansi.

Khanty and Mansi people live in the sub-arctic regions of Western Siberia, in the Lower Ob River basin. Due to their linguistic, cultural and anthropological proximity to each other, they are often pooled as Ob Ugrians. The Ob Ugrians are an ethnic minority of the Western Siberian region, representing only 1.44% of the total population of the Khanty-Mansiysk Autonomous District). A predominant part of the Western Siberia population is comprised of migrants from various regions of the former Soviet Union. In all, the Khanty and Mansi populations are 22520 and 8470, respectively (2).

Until the middle of the 20th Century, all modifications of the Ob Ugrians traditional lifestyle occurred rather smoothly. But, in 1963, huge oil deposits were found in the Khanty-Mansiysk Autonomous District, setting off the “oil boom” in Western Siberia, which strongly affected the aborigine population. The traditional Khanty and Mansi social system is oriented not only towards maintaining relationships between people, but also towards maintaining a balance with the extremely vulnerable nature of the sub-arctic taiga and tundra. Industrial development and urbanization had destructive effects on both the environment and the high-latitude aborigine’s native society structure.

Nowadays, the Ob Ugrian land-using system is considerably deformed. Of all the traditional trades, including river fishing, hunting and reindeer breeding, the first two do not ensure a full employment. Reindeer breeding is an exception, but the number of domestic deer and their grazing territories are reduced for various reasons. The development of the oil and gas industries in the region led to a contraction of productive territories for traditional economies, and to a deterioration of the ecological environment (3). A significant part of the native population is unemployed and has practically no chance of earning a living.

A series of parameters, including demographic characteristics (4,5,6), testify to the passing of the Mansi and Khanty populations through a period of abrupt “modernizing” changes. In this article,

we consider physical and psychological markers of a “modernizing” stress influence.

Stress is a general, non-specific response of an organism to irritation. Considerable quantities of epinephrine and hydrocortisone are ejected into the blood in stressful situations. Under their influence, the blood serum glucose concentration increases. Chronic stress can lead to glucose intolerance and then to diabetes mellitus. The hormonal shift can also result in a “background” arterial blood pressure increase (7,8), leading to arterial hypertension and hypertensive disease.

Increases of mean values of arterial blood pressure and of the glucose content in blood serum can be considered as indirect stress indicators. Results of psychological research provide a direct evaluation of the influence of stress under modernization. Using these it is possible to trace changes in both individual and socio-psychological characteristics.

## MATERIAL AND METHODS

We conducted our research in Khanty and Mansi communities of the Berezov region (Khanty-Mansi Autonomous District). Ethnic origins, trade engagements and the social status of the subjects were obtained from questionnaires. The total number of people examined is shown in Table I.

**Table I.** Characteristics of the studied populations.

Research method	Rural population	Urban population
ABP measurements	380	136
Blood glucose measurements	216	115
Psychological testing	57	92

The settlements were subdivided, by convention, into small (with populations < 500) and large ones (with a registered population ranging from 500 to 3000). All of these settlements have “National” (or “Indigenous”) status. The data was mainly collected from the three settlements of Tegi, Wanzetour and Ustrem. The populations of these settlements, as well as the numbers of native adults examined, are shown in Table II.

In addition, we examined Khanty and Mansi people living in the town of Khanty-Mansiysk, which is the administrative center of the

**Table II.** Settlement populations and numbers of adults examined.

Settlement	Population				Adult aborigines examined
	Overall		Aboriginal		
	Total	19-59 yrs	Total	19-59 yrs	
Tegi	514	275	426	225	103 (45.8%)
Wanzetour	451	278	280	147	84 (57.1%)
Ustrem	70	31	11	20	17 (85.0%)

autonomous district. The population of Khany-Mansiysk is 35490, but natives amount to only 3.3 percent of these (2).

We studied the arterial blood pressure, blood serum glucose concentrations and psychological indexes of maladaptation in groups of different social status and level of urbanization.

The social status of the people under investigation was determined as follows. The first group includes people engaged in traditional activities (fishermen, hunters) and representatives of the native population who are unemployed and live by a subsistence economy. The second group includes people with so-called “modern” trades (medical workers, school teachers, salesmen and administrators) living in the same settlements. The average ages of the “modern” trades’ representatives and of the people engaged in “traditional” activities are practically identical: 39.8 and 36.7 years, respectively. The third group is comprised of Khanty and Mansi living in Khany-Mansiysk for not less than three years. They are mainly engaged in light industry. The average age of this group is 32.6 years.

The level of anxiety was used as a main psychological indicator of maladaptation under modernization stress. It was determined using the Spielberger scales for personal and situational anxiety. In the process of the Spielberger adaptation test, mean Russian values of situational (35-50 points) and personal (30-45 points) anxiety were determined (9). Higher values should be recognized as a sign of maladaptation.

Arterial blood pressure was measured by the indirect auscultative method during the first half of the day, following the standard procedure (10). Blood serum glucose concentrations were determined with a «Glucometer-GX» device («GLUCOSTIX» reagent strips, from Bayer). The medical examination was conducted in the morning, after an overnight fast.

The investigation was approved by the Russian Association of Indigenous Peoples of the North (RAIPON).

### Statistical analysis

Statistical analyses were performed using t-test for independent samples and Spearman rank order correlation.

## RESULTS

No significant inter-ethnic differences were observed between the samples of the examined Khanty and Mansi, neither in the mean levels of blood pressure and blood serum glucose, nor in the psychological indicators of maladaptation. Therefore, data from the two ethnic groups were pooled.

The average values of systolic and diastolic blood pressure are higher among Ob Ugrians living in large than in small “national” settlements (Table III). The arterial blood pressure of the town-dwellers is even higher, with an especially noticeable increase of the diastolic pressure.

**Table III.** Arterial blood pressure (mm Hg) in Ob Ugrians grouped by settlement size.

Arterial blood pressure		Rural			Urban
		Small settlements	Large settlements	Town	
Males	Systolic	n	53	96	72
		mean	121.94	126.89*	123.85
		SD	12.69	13.71	9.42
	Diastolic	n	53	96	72
		mean	72.74	77.03*	79.03*
		SD	10.19	9.78	8.88
Females	Systolic	n	91	140	64
		mean	116.27	120.82*	118.57
		SD	14.09	14.71	14.20
	Diastolic	n	91	140	64
		mean	72.76	74.70	76.79*
		SD	11.08	10.74	12.65

\* differences with small settlements are significant,  $p < 0.05$

The same patterns are observed for blood serum glucose concentrations (Table IV). In the smaller (n) male samples, the differences between groups are not significant. However, in the more representative female groups, the blood serum glucose concentrations of the residents of small settlements are significantly ( $p < 0.05$ ) lower than those of the inhabitants of the large settlement and the town.

The levels of arterial blood pressure of representatives of the different social groups are shown in Table V. We can compare the indexes of village inhabitants with a predominantly “traditional” life-style with those having a “modern” style of life, and with qualified workers

**Table IV.** Blood serum glucose (mmol/l) in Ob Ugrians grouped by settlement size.

Blood glucose		Rural		Urban
		Small settlements	Large settlements	Town
Males	n	26	16	18
	mean	4.28	4.11	4.36
	SD	0.74	0.75	0.78
Females	n	93	81	97
	mean	4.47	4.73*	4.75*
	SD	0.81	0.77	1.01

\* differences with small settlements are significant,  $p < 0.05$

of the town. Especially noticeable differences are observed in the levels of diastolic pressure: they are significantly ( $p < 0.05$ ) higher in both male and female “modernized” groups than in the group with a “traditional” life-style. The blood pressure levels of the town workers do not differ significantly from those of the “modernized” residents of “national” settlements.

**Table V.** Arterial blood pressure (mm Hg) in Ob Ugrians grouped by life-style.

Arterial blood pressure			Rural		Urban
			Traditional	Modernized	Workers
Males	Systolic	n	34	17	72
		mean	124.17	129.71	123.85
		SD	13.92	12.93	9.42
	Diastolic	n	34	17	72
		mean	71.61	80.00*	79.03*
		SD	9.50	9.16	8.88
Females	Systolic	n	58	37	64
		mean	117.58	124.19*	118.57
		SD	12.87	17.24	14.20
	Diastolic	n	58	37	64
		mean	72.68	77.84*	76.79*
		SD	11.17	11.36	12.65

\* differences with the “Traditional” group are significant,  $p < 0.05$

Blood serum glucose concentration levels show similar intersocial differences in Khanty and Mansi females (Table VI). Significant differences have not found between male samples, probably due to the small sample size.

**Table VI.** Blood serum glucose (mmol/l) in Ob Ugrians grouped by life-style.

Blood glucose		Rural		Urban
		Traditional	Modernized	Workers
Males	n	17	5	18
	M	4.05	4.21	4.36
	SD	0.79	0.55	0.78
Females	n	61	52	97
	M	4.33	4.91*	4.75*
	SD	0.67	0.73	1.01

\* differences with the “Traditional” group are significant,  $p < 0.05$

No significant differences were observed in the level of anxiety (results of the Spielberger test) between the representatives of different Ob Ugrian social groups. However, the fraction of respondents with a high level of anxiety is very large in all of the social groups, accounting for 64% of the total sample.

The correlation analysis also shows the existence of a significant relationship between the increase of the anxiety level and the blood serum glucose concentration in the examined Khanty and Mansi populations (Table VII).

**Table VII.** Spearman rank order correlations for situational and personal anxiety, arterial blood pressure and blood serum glucose concentrations in the sample of Ob Ugrians.

Variable	Systolic ABP	Diastolic ABP	Glucose	Situational anxiety
Diastolic ABP	0.59*	--	--	--
Glucose	0.19	0.17	--	--
Situational anxiety	-0.18	-0.03	0.38*	--
Personal anxiety	-0.07	0.17	0.40*	0.60*

\* correlation is significant,  $p < 0.05$

## DISCUSSION

The results of our research demonstrate that the “modernization” of life-style and urbanization, have a stressing influence on the aborigines of the North Siberian region of Russia.

The mean values of arterial blood pressure become higher as the settlement size increases. Our data are in accordance with those of Vasiljev et al. (11), who observed arterial hypertension in 16% of Northern Khanty living in small “national” settlements, and in 27% of those living in relatively large and ethnically mixed settlements.

Thus, “modernization” and its associated urbanization cause both an increase of the mean level of arterial blood pressure of healthy people and the development of pathological cardiovascular reactions in the form of arterial hypertension and hypertensive disease.

The blood serum glucose concentration also increases as a result of urbanization and as people abandon “traditional” lifestyles. The average level of blood serum glucose concentrations of town-dwellers and of those living in northern “national” settlements and engaged in “modern” trades, is higher than that of the Mansi and Khanty en-

gaged mainly in traditional activities, such as hunting and fishing. As in the case of arterial blood pressure, the frequency of carbohydrate metabolism disorders rises with “modernization”. According to our data, glucose intolerance among the aborigines of northern settlements occurs much more rarely (8.6% of all examined persons) than in the Khanty and Mansi who moved to the town (15%) (12).

It is worth drawing attention to the correlations revealed between the blood serum glucose concentrations and individual anxiety levels (both situational and personal, see Table VII). We suppose that the rise in blood serum glucose concentration can be caused by the action of stressors, although it is impossible to exclude an influence of a shift in diet. This matter requires a further study.

In modern conditions, it is necessary that individual life-styles accord with values and behavioral models of society based on the market economy. It has been convincingly shown that “life-style incongruity” is often accompanied by an increase of arterial blood pressure and, sometimes, even by a depression (13,14,15).

An impossibility, or the lack of desire, for a person to adapt and conform to a “modern” system of values, can adversely affect that person’s physical and psychological health (16,17). S. McGarvey and D. Schendel (18) described increased arterial blood pressure levels in Samoans with non-completed education, or who had no permanent work. The investigation of M. Beiser et al. (19) revealed increased arterial blood pressure levels in Senegalese women who were psychologically oriented towards urban western culture, but who did not have enough knowledge in French to conform to it totally.

The situation seems to be very similar in the Khanty and Mansi groups. The people feel a necessity to adapt themselves to the modernized environment, but they do not have the capabilities to do so. In small “national” Khanty and Mansi settlements, where the traditional life-style has been preserved relatively longer, the transformation of the initial social structure proceeds less tragically. The native populations of larger settlements and the Khanty and Mansi who moved to the town are more exposed to the pressure of “modernization” when the connections to their families and traditional environment are broken, and the cultural adaptation to their new social environment has not yet been completed. These pressures result in the increase of both clinical and psychological manifestations of stress.

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