

## Original Article

### Features of adaptation of urban and rural people in the training process in higher educational institutions

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#### Abstract

**Problem of Statement.** The problem of human adaptation to various environmental factors is one of the central problems in biology and medicine.

**Approach.** Today, it is common knowledge that a good physical development, sports and an active lifestyle are beneficial to the processes of adaptation increasing the adaptive capacity of the body.

**Purpose.** The aim of the study is to examine the features of adaptation of urban and rural people in the training process in higher educational institutions by means of a variety of anthropometric, psychological and psychophysiological methods.

**Results.** Differences in physical development and physical condition of urban and rural people enrolled in higher educational institutions, physiological differences among urban and rural women enrolled in higher education institutions, psychological differences among urban and rural women enrolled in higher education institutions are revealed.

**Conclusion.** Based on the obtained results and their dynamics, it can be argued that rural women studying in higher education institutions have higher rates of physical development and greater adaptive capabilities.

**Key Words:** physical health, physical development outcomes, anthropometric measurement, cardio-vascular system (CVS), cardiorespiratory system.

#### Introduction

The problem of human adaptation to various environmental factors is one of the central problems in biology and medicine (Phillips 1968, Afanasyev et al, 2016). In the process of adaptation, there is a bio-regulation change focused on the restoration and maintenance of homeostasis, as well as maintaining body functions. A necessary element in a variety of adaptive reactions is stress, conducted by means of non-specific response of the body, reflecting the state of organs and systems' stress functions and mobilizing its reserve capacity (Khimenes et al, 2016).

In the training process in higher educational institutions, when physiological systems receive considerable stress and particularly vulnerable towards effects of the environment, inadequate study hours and the impact of social and psychological factors can lead to functional diseases and failure of adaptation (Altyinova et al, 2009, Ivanii, 2016).

Training at the university is attributed to a change of residence, social environment and the normal rhythm of life. This is the cause of psychophysiological stress and requires efforts to adapt the organism to environmental conditions (Rienties et al, 2013).

In this regard, the various aspects of a single process of students' adaptation have attracted the attention of researchers for a long time. One of the main reasons for adaptive processes is a change of residence. Complex problems arising from these change is so severe and is accompanied by ill health (especially mental disorders), which is considered by some authors as a «foreign student syndrome». However, not all authors consider its

existence (John et al, 2006). Particularly challenging for the students' adaptation is the first year of study at the university. At the same time, out-of-town students make a heterogeneous group. The differences in the severity of certain aspects of adaptation within this group may even be greater than between the out-of-town students and residents (Fritza et al, 2008).

Multivariate mechanisms of adaptation must to be considered at different levels, both in the study of environmental influences, as well as in the study of mechanisms of adaptation. That is why students' adaptation was studied at different levels, but mainly on the psychological and in vitro. Thus, there was shown the academic achievement dependence of foreign students compared to their collective self-esteem (Bettencourt, 1999), the issues of students' mental health (Hunt et al, 2010), the psychological problems arising in foreign students (Furnham et al, 2002). There were conducted researches on psychophysiological and physiological levels. We studied the effect of sleep disorders on students' intellectual performance (Lewin et al, 1975), ways of adaptation of cardio-vascular system (CVS) and other parameters, including changes in the level of certain hormones in response to stress (Farrace et al, 1999).

Today, it is common knowledge that a good physical development, sports and an active lifestyle are beneficial to the processes of adaptation increasing the adaptive capacity of the body (Akhmedova et al, 2011). Wherein, the level of physical development and fitness is described based on anamnesis or functional tests. In this case, anthropometric measurements as an objective indicator of the level of physical development remain outside the study. Finally, the most important parameter determining the body's response to stress is its reactivity. Reactivity is stable individual intensity of the response to the stimulus (Strelau, 1988), that is, in fact – temperament. Currently, there are some works shown the correlation between the CVS measures and the level of neuroticism (Hughes et al, 2011), however, this research line of adaptation needs to be developed.

Thus, the aim of the research is to study the characteristics of adaptation of urban and rural people in the training process in higher educational institutions.

## Material & methods

### Participants

To solve the aim and objectives, the students enrolled in the Tyumen State Agricultural Academy were randomly selected into 6 studied groups, total number of people – 480. The groups were formed based on the principle of voluntariness, in compliance with the principles of respect of personality, usefulness and fairness.

Half of the volunteers, who participated in the earlier study, were living in rural areas, the other half were born and lived in the city (see Table I).

**Table I.** Students' distribution by the course and place of residence before training in higher educational institutions

Cohorts	Course 1	Course 3	Course 5
Rural students	80	80	80
Urban students	80	80	80

All examined women were at the age of 17-22, they were representatives of the Slavic ethnic groups. Exclusionary criteria of students from the group were: any previous disease (less than 2 weeks before the assessment); the presence of chronic diseases; availability of therapeutic pathology at the time of the assessment.

### Procedure

The studies were conducted on the basis of the Tyumen State Agricultural Academy, at the Anatomy and Physiology Department, as well as at the Department of Physical Education, Health & Physical Education Department and Department of Healthcare of Tyumen State Medical Academy. Morphofunctional parameters were carried out in the first half of the day, taking into account biorhythmological recommendations. All measurements were taken in medical offices of the institution in a relaxed atmosphere.

The choice of research methods was determined by their adequacy, informativity, security, safety and modernity in accordance with the objectives of the study. In line with the requirements for ecological physiological studies, all anthropometric measurements were carried out according to WHO guidelines.

### Anthropometric measurements and calculations

Anthropometric measurements included determination of the following parameters: height (up to 0.5 cm) – by means of vertical height meter; body weight (up to 50 g) – by means of Fairbanks medical spring; body diameter: acromial diameter – shoulder width, coxofemoral - pelvis width (up to 0.1 cm) – by means of a stout compass; subcutis (by lines: shoulder from the backside, shoulder from the frontside, arm, back, chest, abdomen, femora, crurae) up to 0.5 mm – by means of a caliper.

In the overall assessment of physical development of girls we took into account the anthropometric measurements that are most constant and reflect the age patterns of body's development. Integrated research program is made in such a way that it was possible to calculate the weight- physique values, body proportionality indexes, body types and body surface area.

### Diagnosis of constitutional types

Constitutional type can be considered as a relative genetic marker of an individual variability. In our study, we used the classification, which includes asthenia, normosthenic and hypersthenic body types.

Asthenic type of constitution (ectomorph) is characterized by an elongated and narrow body, low position of the diaphragm, short small and large bowel, with reduced suction and a penchant for enteroptosis, low blood pressure, "drop" shape of heart, sunken abdomen, elongated limbs, and hypermetabolism. There are hypothyroidism and hyperactivity of other endocrine organs. Hypersthenic is proportionally developed, moderately well fed, with normal blood pressure, metabolism and no dysghormonism. Hypersthenic constitution type is peculiar to the preferential development of the body in width with a slight moderate growth, protruding abdomen, big stomach. There is a tendency of high blood pressure, polychrominemia, polycythemia, lipotrophy, increased cholesterol and uric acid in blood, slow metabolism, hyperhormonism and hyperactivity of genital ceruminous-s.

To make this scheme objective we applied research on Pignet index (PI):  $PI = BL - (BW + BC)$ , where: BL - body length in cm; BW - body weigh in kg; BC - breast circumference in centimeters.

Without lipotrophy, the low index indicates a strong-built. Constitution type:

1) ectomorph:  $PI > 30$ ; 2) normosthenic  $30 > PI > 10$ ; 3) hypersthenic:  $PI < 10$ .

If PI is less than 10 – the body is strong-built; 10-20 – shapelines; 21-25 – medium build; 26-35 – weak and more than 36 – very weak.

#### *Methods of functional measurements*

The research program included: CVS studies in terms of pulse rate and blood pressure; measurement of lung capacity by spirometry; the strength of certain sets of muscles was determined by means of wrist and torso dynamometers. Muscle strength of hand and back were measured by dynamometry. To measure the hand strength index (HSI) and the back index (BSI) was used the following ratios:

$HSI = \text{hand strength (kg)} / \text{body weight (kg)} \times 100$ ;

$BSI = \text{back strength (kg)} / \text{body weight (kg)} \times 100$ .

VC was determined by means of dry spirometer. To determine whether the VC rate matches the individual body size we used specially designed formulas.

To determine the volume of inspiratory air per body weight unit the birth-death ratio was calculated (BDR):

$BDR = VC/W$ , where: BDR – birth-death ratio, ml/kg; VC – vital capacity, ml; W – body weight in kg.

BDR indicates how much VC air in ml falls per 1 kg of body weight. Therefore, the bigger this index is, the higher is the level of physical development.

Assessment of individual VC and EVC values is being obtained by comparing the values with normal vital capacity rates. Estimated VC (RVC) value was calculated according to the formulas that connect EVC with human growth, his age and sex:

$EVC (\text{women}) = (21.78 - 0.101 \times A) \times H$ , where: A – age in years; H – height in cm.

We also calculated the equilibration of EVC and VC. Under normal conditions, equilibration VC/EVC should not be below 85%.

Determination of heart rate (HR) was performed in terms of pulse, palpating radial or the silent neck artery. The number of beats is counted one minute. Measurements of systolic (SBP) and diastolic blood pressure (DBP) was performed in a sitting position by means of a tonometer and stethoscope. Pulse pressure, systolic and minute volume of blood were calculated based on the obtained measures.

Adaptable compensatory-adaptive mechanisms that underlie the maintenance of optimal functional state of the circulatory system are determined by calculating the value of VC adaptation potential (AP) by the following formula:

$AP = 0.011 \times 0.014 \times HR \times SBP + 0.008 \times DBP + 0.014 \times A + 0,009 \times W - 0,009 \times H - 0.27$ , where:

AP - adaptive potential, score; HR - heart rate, beats/min; SBP - systolic blood pressure, mmhg;

DBP - diastolic blood pressure, mmhg; A - age, years; W - weight in kilograms; H - Height.

Normal CVS adaptation is not more than 2.1 score; adaptation stress – 2,11-3,2 score; poor adaptation – 3,21-4,3 score and failure of adaptation – 4.5 score and higher.

Evaluation of the tone of the autonomic nervous system (ANS) was determined by the vegetative Kerdo index (VKI). The index was calculated by the following formula:

$$VKI = \left(1 - \frac{DBP}{HR}\right) \times 100$$
, where:

VKI – vegetative Kerdo index, units; DBP – diastolic blood pressure, mmhg; HR – heart rate, beats/min.

#### *Techniques for identifying the types of temperament and their features*

Determining the predominant type of temperament. Individuals with clearly defined features only of one type of temperament are relatively rare. More often, people tend to have mixed types of temperament – with features specific to different types of temperament, but with a predominance type of temperament. To determine the predominant type of temperament and to identify features of other types of temperament the identification method can be used, proposed by A. Belov (2005).

The subject is consistently presented with four cards, each of which contains 20 features specific to each type of temperament: card 1 – choleric, 2 – sanguine, 3 – phlegmatic, 4 – melancholic. The instruction requires to read and to put a "+" sign if the subject believes that this feature is inherent, and the sign "-" if he does not have it. If he is in doubt, then nothing will be put. A study of psychological structure of temperament – questionnaire by B. Smirnov (1989). Smirnov's questionnaire reveals a number of polar features of temperament: extraversion-introversion, emotional excitability – emotional balance, response rate (fast - slow), active (high - low). He also has a scale test of sincerity while answering questions that allows assessing the reliability of results. Diagnosis of accentuation (stress) types of character and temperament by K. Leonhard (1981). The basis of the questionnaire is the concept of «accentuated personalities» by K. Leonhard. Persons, who have some of the basic features have high severity, are called accentuated. The author identifies 10 types of accentuation: demonstrative, pedantic, sticking, excitable, hypertemic, distemic, anxiofearful, cyclothymic, affective, and emotive. Smishenk's questionnaire consists of 88 questions; the subject has the following instructions: Read the question. Answer it "yes" or "no" putting in the registration form "+" or "-". Do not hesitate under the answer for a long time. Remember: there are no bad or wrong answers.

*Definition of formal dynamic features of personality (DFDFP)*

It contains 150 questions aimed at clarifying the normal way of behavior, reveals the following features of:

1) psychomotor sphere (vigor – the level of muscle tone, motion activity, desire of physical stress, muscle performance; plasticity – the level of flexibility under switching from one physical job to another, susceptibility to various forms of physical activity and different types of manual labor, rate of motinal operations; emotivity – sensitivity to failures in manual labor, intensity of emotional distress in the event of failures in physical work).

2) intelligent and communicative spheres (vigor, flexibility, rate, emotivity).

*Mathematical data analysis*

Data analysis was based on typical methods and included: determination of individual appearance arrangement and assess of the main distribution features (AM – arithmetic mean; m – error in the arithmetic mean;  $\sigma$  – mean square deviation; CV – coefficient of variation). Assessment of the significance of mean values' differences of compared groups was performed by the Student's criterion «t» (significance value P is not higher than 0.05). To determine the degree of contingency between the studied parameters the research processing was carried out by means of correlation (parametric and nonparametric) and cluster analysis on the computer Pentium-II by Microsoft Exsel software package for Windows- 2000.

**Data, Analysis, and Results**

The data obtained by analyzing the results of anthropometric studies and functional tests are shown in Tables II, III and IV.

**Table II.** Arrangement of constitutional types among women of Tyumen city and the south of the Tyumen region (%)

Course	Asthenic		Normosthenic		Hypersthenic	
	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80
1	18	33	48	57	34	10
3	12	31	50	61	38	8
5	13	34	51	55	36	11

In data analyzing, it was found that Normosthenic was dominating in all the surveyed groups (from 48% to 61%), herein, the highest rate of this type was found in urban people of the third course (61%). However, there is a significant difference in distribution of constitutional types according to their former place of residence. It has been found that asthenic type of constitution prevails in urban students, and hypersthenic type – in rural. That appears to be a consequence of lifestyle.

**Table III.** CVS functional measurements of women of Tyumen city and the south of the Tyumen region

Measurements	Course 1		Course 3		Course 5	
	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80
HR beat/min	78,97±1,3	76,1±1,5*	78,03±1,3	75,46±1,8	77,8±1,4	74,5±1,1*
SBP, mmhg	117,2±1,8	112,9±2,3*	113,6±2,6	112,1±2,6	119,7±1,6	114,1±3,1*
DBP, mmhg	74,5±1,5	71,27±1,6*	71,37±1,7	72,08±1,9	74,3±1,2	71,1±1,5*

NOTE: n – the number of women undergoing assessment: HR – heart rate; SBP– systolic blood pressure (BP), DBP – diastolic BP. Differences are firm at  $P \leq 0.05$  \*

Blood pressure outcomes in our studies are normal in all groups.

There are significant differences between the blood pressure in students of Tyumen city and the south of the Tyumen region: the girls of 1 and 5 courses in terms of SBP and maximum DBP values in students of the south of the Tyumen region (Table 2). The third year students revealed no significant differences in blood pressure.

Analyzing blood pressure in girls of different courses of the south of the Tyumen region, we have revealed that rural women at the 5 course have high SBP and DBP outcomes in comparison with the 3 course (Table 1).

Thus, in comparing the functional measurements of rural and urban women, we obtained the following data: rural girls showed higher SBP and DBP outcomes, as well as muscle development than the urban women did. These differences are due to probably more mobile lifestyle, fitness and, as a result, higher levels of physical development. The consequence of differences in physical development and in functional measurements is a higher level of body's adaptation possibility.

External respiration has always been regarded as one of the most important physical development outcome. The functional measurements of respiratory system revealed in the research are presented in Table 3.

**Table IV.** The functional measurements of respiratory system in women of Tyumen city and the south of the Tyumen region

Measurements	Course 1		Course 3		Course 5	
	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80
VC, l	3,1±0,05	2,91±0,07*	3,3±0,09	3,03±0,09*	3,6±0,08	3,15±0,07*
BDR, ml/kg	57,1±1,4	51,41±1,6*	58,0±1,6	52,73±1,8*	60,0±1,7	52,59±1,6*
EVC, l	3,32±0,02	3,27±0,02*	3,35±0,02	3,29±0,02*	3,38±0,04	3,28±0,03*
Equilibration EVC/VC, %	91,8±2,2	87,46±1,9*	93,4±1,8	90,53±1,5*	95,9±2,3	90,9±1,4*

NOTE: n - the number of women undergoing assessment: VC – vital capacity, BDR – жизненный индекс, EVC – estimated vital capacity. Differences are firm at  $P \leq 0.05$  \*

Normally, the equilibration EVC/VC cannot be less than 85% (Solodkov AS, 2001). However, the calculation found that the equilibration EVC/VC was higher than 85% in all studied groups. We also note that this outcome is higher in women from the south of the Tyumen region in contrast to the urban women.

Calculations show that there is no poor adaptation or failure of adaptation in all studied women. Arrangement of CVS normal and stress adaptation of our studied girls are presented in Table V. Our data show that the majority of women of the south of the Tyumen region of all studied groups (from 53% to 73%) have mechanisms of stress adaptation. Among the girls of the Tyumen city of 1, 3 and 5 courses, there are more girls with normal adaptation: 13%, 8% and 10%, respectively, than among the girls of the south of the Tyumen region. This can be attributed to stress adaptive capacity of the students of the south of the Tyumen region due to the change of the usual place of residence and lifestyle, diet, level of physical activity.

**Table V.** Adaptive capacity among women of Tyumen city and the south of the Tyumen region (%)

Course	Normal adaptation		Stress adaptation	
	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80
1	27	40	73	60
3	39	47	61	53
5	35	45	65	55

NOTE: n - the number of women undergoing assessment.

Comparing adaptive capacity measures of girls from different courses, we found that a large number of first-year girls have CVS stress adaptation (from 73% to 60%) in both groups, compared with 3 and 5 courses. The most common normal adaptation is at the 3 course, among both the people of the city of Tyumen, and the people of south of the Tyumen region (39% and 47%).

According to I. Kerdo, (1966), vegetal tonicity means the body activity, through which all organs are regulated in order to maintain life and to balance ambient impact. Namely, vegetal tonicity is directly linked to the processes of adaptation, but it cannot be regarded as an absolute predominance of one function, which is anatomically connected with not always clearly defined parts of nervous system. It should be seen as a characteristic type of activity that affects the body as a whole and enables the body to meet the challenges of the actual adaptation by means of mechanisms that regulate vital processes (neural and humoral).

If we consider the role of sympathetic and parasympathic following this term, the results of clinical observations and experimental studies show that two antagonistic ANS parts are involved in the regulation of life

processes, not on the principle of "either... or" but by means of unexpectedly arisen body burden. Therefore, sympathetic and parasympathic are the characteristics of the overall functioning of the body that correspond to a particular type of sympathetic and parasympathic operations. However, this requires the active participation of antagonistic innervations that – with respect to the individual functional systems – can often be involved at the same time and in different proportions. Since the level of the functional state of the body is largely determined by the ANS, vegetal tonicity reflects the balance of ANS sympathetic and parasympathic parts, which in certain periods of life can have a deviation in one direction or another, related to the adaptation process. Wherein, the autonomic regulation and vegetative maintenance may be close to dysregulation of body functions. To assess the state of vegetal tonicity we used the vegetative Kerdo index (VKI). Autonomic regulation outcomes of studied women are presented in Table VI.

**Table VI.** Autonomic regulation outcomes among women of Tyumen city and the south of the Tyumen region (%)

Course	Sympathetic		Eutonic		Vagotonic	
	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80
1	68	32	2	4	30	64
3	55	47	5	3	40	50
5	51	36	7	5	42	59

NOTE: n - the number of women undergoing assessment.

Our data show that the largest number of predominance of ANS sympathetic part is in girls of the south of the Tyumen region, wherein, at all courses. In our opinion, it is the result of students' adaptation to new living conditions. Considering the predominance of parasympathetic tonicity in studied women, it was found that the students of the south of the Tyumen region while increasing period of training and the number of Vagotonic in girls of the Tyumen city decreased by the 3 course, but it increased back by the 5 course (Table VI). The students of the south of the Tyumen region while increasing period of training are decreased in the number of girls with a predominance of sympathetic tonicity, at the city students – an inverse trend: at the 3-year - an increase, at the 5 year – a decrease.

Thus, the people of the south of the Tyumen region are more sympathetic, the people of the city – vagotonic, but with the increase of years of study among the students of the south of the Tyumen region the number of sympathetic is decreased. The observed ratio of temperament types of girls of the Tyumen city and the south of the Tyumen region is shown in Table VII (in %). It was found that in the studied groups, the percentage ratio of sanguine and mixed type with a predominance of sanguine (sanguine + choleric and phlegmatic + sanguine) is large enough. At the 1 course, within the south of the Tyumen region there are more girls with the types of higher nervous activity (HNA) characterized by good adaptability (83.3%), than within the city - only 46.6%. There is clearly observed the following trend – rural people have the temperament that corresponds better adaptation opportunity. First-year girls living in the south of the Tyumen region have the type of temperament that corresponds better adaptation itself.

**Table VII.** Determination of the predominant type of temperament (%) of the first-year students

Predominant type of temperament	Previous place of residence	
	The south of the Tyumen region	Tyumen city
Choleric	10	36,7
Choleric + Sanguine	10	3,3
Sanguine	26,7	13,3
Sanguine + Phlegmatic	10	-
Phlegmatic	36,6	30
Phlegmatic + Melancholic	-	-
Melancholic	6,7	16,7
Mixed	20	3,3

In addition, it was revealed that the predominant melancholic type is in 6.7% of the studied students – residents of the south of the Tyumen region, and students of the city of Tyumen – 16.7%. The number of choleric among urban girls is 36.7%, and among the inhabitants of the south of the Tyumen region – only 10%. Thus, there are more choleric types that are worse in adapting to the environment among the people of the city of Tyumen, than among the people of the south of the Tyumen region. B. Smirnov's questionnaire allows to reveal polar features of temperament: extraversion-introversion, emotional excitability – emotional balance, response rate (fast - slow), active (high - low). It also has a scale of sincerity while answering questions, allowing assessing the reliability of results.

Our research showed that all groups include a number of extroverted persons in two times greater than the number of introverted ones in both groups. However, in terms of extraversion – at the 1 course, there are differences depending on the former place of residence, at the 3 and 5 courses, there are no significant differences between the people of Tyumen city and the south of the Tyumen region. Alike data are obtained in

terms of introversion: at the 3 and 5 courses, there is no difference, but at the 1 year, there are large quantities among the students of Tyumen city.

The study revealed that the first and the third courses show the emotional excitability index significantly higher than the index of emotional stability. Moreover, there are significant differences in these parameters among the girls of Tyumen city and the south of the Tyumen region.

At the 5 course, the ratio of emotional excitability and emotional stability indexes are equal in value among both the students of Tyumen city and the south of the Tyumen region.

**Table VIII.** A study of psychological structure of temperament (%) of the girls of the south of the Tyumen region

Course	Extroversion	Introversion	Constriction	Plasticity	Emotional excitability	Emotional stability	Rapid response	Sluggishness	Sthenia	Inactivity
1	76,7	23,3	72,4	27,6	72,4	27,6	62,1	37,9	55,2	44,8
3	71,9	28,1	62,5	37,5	71,9	28,1	68,8	31,2	46,9	53,1
5	70	30	70	30	50	50	45	55	40	60

**Table IX.** A study of psychological structure of temperament (by Smirnov B.N.) (%) of the girls of the Tyumen city

Course	Extroversion	Introversion	Constriction	Plasticity	Emotional excitability	Emotional stability	Rapid response	Sluggishness	Sthenia	Inactivity
1	67,5	32,5	67,5	32,5	77,5	22,5	66,7	33,3	45	55
3	77,3	22,7	68,2	31,8	63,6	36,4	50	50	45,5	54,5
5	73,7	26,3	73,7	26,3	52,6	47,4	52,6	47,4	42,1	57,9

The results shown in Tables VIII and IX indicate students' high adaptive capacity in both groups (by the predominance of extraversion), as well as adaptation stress at the first year related to the adaptation in the training process in higher educational institutions, which manifests itself in improving emotional lability.

Determination of the individual responsiveness effect in typical stressful situations is necessary to assess the adaptive capacity of organism. In this connection, we have carried out diagnosis of accentuation (stress) types of character and temperament (Smishek' questionnaire) (Table X).

**Table X.** Diagnosis of accentuation (stress) types of character and temperament (by H. Smishek) (%)

Course	High		Normal		Low	
	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80
Hypertemic						
1	25	29	50	48,4	25	22,6
3	42	40,9	29	27,3	29	31,8
5	10	26,3	60	42,1	30	31,6
Sticking						
1	10,7	12,9	50	41,9	39,3	45,2
3	22,6	22,7	35,5	13,6	41,9	63,7
5	15	-	25	36,9	60	63,1
Emotive						
1	35,7	51,6	46,4	41,9	17,9	6,5
3	35,5	36,4	48,4	45,4	16,1	18,2
5	50	52,6	40	36,8	10	10,6
Anxiofearful						
1	17,9	12,9	39,3	48,4	42,8	38,7
3	12,9	22,7	32,3	31,8	54,8	45,5
5	5	5,3	25	31,6	70	63,1
Pedantic						
1	3,6	12,9	42,9	32,3	53,5	54,8
3	3,2	18,2	35,5	36,4	61,3	45,4
5	15	5,3	25	26,3	60	68,4
Demonstrative						
1	3,6	16,2	35,7	29	60,7	54,8
3	9,7	18,2	22,6	13,6	67,7	68,2
5	-	15,8	30	21,1	70	63,1
Excitable						
1	17,9	16,1	57,1	48,4	25	35,5
3	9,7	13,6	51,6	50	38,7	36,4
5	15	-	35	57,9	50	42,1
Distemic						
1	-	-	17,9	12,9	82,1	87,1
3	-	-	22,6	18,2	77,4	81,8
5	5	-	10	15,8	85	84,2

The study found that the first-year girls of Tyumen city and the south of the Tyumen region have predominate hypertemic normal levels. The 3 course revealed high hypertemic levels in both groups. The 5 course also has significantly predominate hypertemic normal levels. Moreover, there are no significant differences between the students of Tyumen city and the students of the south of the Tyumen region in terms of this measure.

Normal values of Anxiofearful index is significantly predominate among the first-year girls, regardless of their place of origin. Low values of Anxiofearful index is significantly predominate among the 3 and 5 courses in both groups. However, low value of Anxiofearful index is significantly more predominate among the girls of the south of the Tyumen region, than among the urban girls. These data also show students' high adaptive capacity in both groups (by the predominance of extraversion) and adaptation stress at the first course due to the adaptation in the training process in higher educational institutions.

There was conducted a study on formal dynamic features of personality in order to conduct more in-depth study of the features of temperament, its structure and development. This study reveals the level of psychomotor, intellectual, communicative sphere of s person. There are determined high and normal levels of psychomotor sphere in all studied women of the Tyumen city and the south of the Tyumen region. However, the higher value of this index is prevalent more in urban women than in women of the south of the Tyumen region during all period of training. Test results are shown in Table XI.

**Table XI.** Formal dynamic features of personality (%)

Course	High		Normal		Low	
	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80	The south of the Tyumen region n=80	Tyumen city n=80
<b>Psychomotor Performance Index</b>						
1	37,9	26,7	51,7	70	10,4	3,3
3	22,6	22,7	67,7	68,2	9,7	9,1
5	30	26,3	60	68,4	10	5,3
<b>Mass Adaptation Index</b>						
1	6,9	13,3	93,1	83,4	-	3,3
3	12,9	13,6	83,9	86,4	3,2	-
5	5	10,5	90	89,5	5	-
<b>Intellectual Action Index</b>						
1	10,3	10	62,1	60	27,6	30
3	6,5	9,1	64,5	72,7	29	18,2
5	-	5,3	90	73,7	10	21
<b>Communicational Action Index</b>						
1	34,5	43,3	58,6	50	6,9	6,7
3	51,6	50	38,7	45,4	9,7	4,6
5	35	31,6	60	68,4	5	-
<b>Mass Action Index</b>						
1	13,8	20	82,8	76,7	3,4	3,3
3	9,7	18,2	83,8	77,3	6,5	4,5
5	10	21,1	90	78,9	-	-
<b>Emotional Action Index</b>						
1	27,6	26,7	62,1	66,6	10,3	6,7
3	32,3	40,9	51,6	31,8	16,1	27,3
5	30	5,3	55	73,7	15	21

The normal level of Intellectual Action Index at the 1 course has no significant differences in prevalence among girls of Tyumen city and the south of the Tyumen region, but among students of the 3 course it prevalence is significantly higher in urban women. At the 5 course, the normal level of Intellectual Action Index is prevalent among the girls of the south of the Tyumen region in comparison with the city. It is most common in both groups throughout all the period of training.

In the Communicational Action Index, there is detected the high level in students of the 3 course, both of the Tyumen city and the south of the Tyumen region. Depending on the location of the former place of residence, this index is significantly prevalent among the urban girls of the 1 course. The high level of Communicational Action Index was found in first-year female students of the south of the Tyumen region, compared to the urban students

The normal level of Communicational Action Index was significantly more prevalent in first-year girls of the south of the Tyumen region, compared with students of the city. At 3 and 5 course the normal level of this index is reliably prevalent among the urban students. In general, we can say that the spread of the normal levels of Communicational Action Index increases by the 5 course.



## Discussion

In the study of muscular system, according to the former places of residence, there were determined the significant differences in the absolute and relative hand and back strength index; these measures were significantly higher among rural women in all studied groups. Depending on the year of training, there were found decreasing measures while the period of training in higher educational institutions increases. A major issue of methodological and substantive nature is the question of types, forms of adaptation. In the literature, there is no single interpretation. Thus, according to S. Shtak (2004), by any variety of adaptation models' classification, there can be roughly divided three forms of human adaptation to changing environment: biological, social and psychological.

A. Maklakov (2001) speaks about complex mechanisms of physiological, psychological and social adaptation. He considers them both as levels of adaptation and as separate forms of adaptation. At the same time, he stresses that there are certain physiological and psychological mechanisms that ensure the adaptation process at the three levels. They are interconnected, provide each other with direct influence and determine the integral characteristic of the overall level of body functioning. This integrated feature is a very dynamic entity, which is called the functional state of organism.

The most important measurement determining the body's response to stress, triggering the processes of adaptation and influence their development is the responsiveness of the individual. Responsiveness is a stable individual intensity of the response to stimulus (J. Strelau, 1988), that is, in fact – temperament.

I. Pavlov (1951) provided the important role of temperament for the body to adapt to the environment. According to him, sanguine and phlegmatic are preferred types of temperament. Choleric is worse in adapting to the environment due to the lack of excitation-inhibition balance. Melancholic has the lowest adaptability to life due to a low NS endurance.

However, B. Teplov (2004) was opposed to such valuable features of temperament. He pointed out that the weak type of nervous system is extremely sensitive; the person with this type of temperament occurred before an orientation reaction, which allowed responding to the approach of danger quickly. The heist endurance in relation to vital loads are people with sanguine type of temperament, if we invest in the concept of "endurance" not only the features of the nervous system, but also the endurance of other organs and systems.

One can note that the process of adaptation of foreign students in higher educational institutions is extremely complex and multifaceted, moreover, this process is not only multi-factor, but also with numerous internal connections between these components. Even a wide range of only socio-psychological factors studied and presented in publications and other works is constantly updated with new components (Volet et al, 2012), some of which have caused intra interactions between students.

There is paid careful attention to the psychological, social and cultural aspects of this process that resulted in the appearance of sufficiently developed concepts and models of students' adaptation to training and new environment (Zhou et al, 2008).

Unfortunately, other aspects of adaptation of foreign students to new environment did not use so much attention of researchers. However, all researchers agree that the process of adaptation to new environment and academic loads increase stress burden on foreign students. This effects their mental state and leads to deterioration of physical health, and sometimes even to mental depression (Cemalcilar et al, 2008).

The mutual influence of stress, physical development, physical fitness and physical activity was also widely publicized and detailed in numerous studies. They confirm the positive effects of physical activity on the resistance to stress and ability to overcome it, including psychological distress, it also applies to students (Brown et al, 1988). This pattern is confirmed not only at the psychological and somatic, but also at the biochemical level. It finds a confirm in reducing mental depression, reducing stress-induced immunosuppression and decrease of c-Fos protein in a number of brain regions (Greenwood et al, 2003), in the increase of endogenous antioxidant activity.

The results obtained in our study confirm these observations and demonstrate the close relationship and interaction of a number of diverse external and internal factors on adaptation of foreign students in the training process in higher educational institutions.

## Conclusions

In this study, the features of adaptation of urban and rural people in the training process in higher educational institutions by means of a variety of anthropometric, psychological and psychophysiological methods. Indicators of 480 people were measured. It was established that rural women studying in higher education institutions have higher rates of physical development and greater adaptive capabilities. The dynamics of studied parameters also showed the adaptation processes of stress for all first-year students, regardless of their place of residence. The submissions can serve as a basis for planning health preservation measures in the training process in higher education institutions.

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