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Short Communication

Adaptation Potential and Body Mass Index in Assessing the Vital Activity of the Population in Mountain Regions

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Abstract

Background: We aimed to evaluate the functional state of the population of the midlands and highlands of Alai region (Kyrgyzstan) on the basis of body mass index (BMI) and adaptation potential (AP). The characteristic of people with overweight and underweight are presented. A clean dependence of AP on BMI was revealed.

Methods: In Alai region (Kyrgyzstan), 285 citizens of Gulcha village (1.540 m above sea level) and 312 citizens of Sary-Tash village (3.200 m above sea level) were examined in July-August 2023. Blood pressure (BP) was generally measured at rest in the seated position. The BMI and AP were calculated.

Results: In the midlands and highlands BP correspond to the physiological norm. The AP scores in the midlands region for men was 2.32 points, for women - 2.38 points, but in highlands areas these values were slightly higher: for men – 2.52 points, for women – 2.42 points. The total BMI values for men in the midlands and highlands were 23.39 and 23.24 kg/m^2 respectively, for women in the midlands this indicator became higher than normal (26.53 kg/m^2), but in the highlands it corresponded to the norm (24.78 kg/m^2).

Conclusion: It is necessary to determine the value of AP, BMI and type of self-regulation of blood circulation when assessing the functional state of residents living in mountain areas. In the highlands overweight, which is one of the significant risk factors for health disorders, with tension of regulatory mechanisms can become a trigger for the development of cardiovascular diseases.

Keywords: Adaptation potential; Body mass index; Midlands; Highlands; Kyrgyzstan

Introduction

Mountainous territories are the maximum crucial useful resource for the improvement of the republic. Kyrgyzstan, in spite of its small size, consists of areas with very extraordinary dwelling conditions. This variety affects the choppy tactics of human improvement. Among the signs demonstrating the specifics of sustainable improvement, there are, firstly, the reality of the

stress of the influencing conditions; secondly, markers of the country; thirdly, reactions displaying the impact of sure elements at the alternate with inside the sustainability of improvement (1). In our opinion, the specifics of the circumstance are logically discovered each via self-evaluation and goal parameters. One of the signs of the fitness reputation of the populace, that is identified via way of means of the WHO, is the body mass index (BMI) and that is extensively utilized in scientific exercise and in primary science (2). Another indicator is the adaptation potential (AP) of the body, the idea of that is equal to the adaptive competencies of blood circulation (3).

We aimed to objectify checks of the country of the populace of the Alai region (Kyrgyzstan) primarily based totally on BMI and AP.

Methods

In Alai region (Kyrgyzstan) we examined citizens of Gulcha village (1.540 m above sea level) - 125 men (aged 39.9±15.2 years) and 160 women (aged 41. 80±12 years) and Sary-Tash village (3.200 m above sea level) – 148 men (aged 37. 2±13 years) and 164 women (aged 37. 4±12 years) during Jul-Aug 2023.

Systolic (SBP) and diastolic (DBP) blood pressure (mmHg), heart rate (HR, beats/min) were generally measured at rest in the seated position**.** BMI was calculated using the formula: BMI = body weight (kg)/height (m^2), kg/m^2. Participants were classified into four groups: underweight (BMI < 18.5 kg/m^2), normal weight (18.5 kg/m^2 </= BMI < 25 kg/m^2), overweight (25 kg/m^2 </= BMI < 30 kg/m^2), and obesity (BMI >/= 30 kg/m^2) (2). To investigate the functional state of the people, was achieved by calculating AP by R.M. Baevsky, which took into account age (A, yr), height (H, cm), body weight (BW, kg), heart rate (HR, beats/min), and blood pressure (systolic (SBP) and diastolic (DBP), mm Hg). The formula used was as follows: AP = 0.011*HR + 0.014*SBP + 0.008*DBP + 0.014*A + 0.009*BW - 0.009*H - 0.27 (3). The results of the AP values were used to evaluate and classify the functional capabilities of the body: a state of satisfactory adaptation (AP ≤2.59 points), a state of tension of adaptation mechanisms (2.60</=AP</=3.09 points), a state of unsatisfactory adaptation (3.10</=AP</= 3.49 points), a state of failure of adaptation mechanisms (AP≥3.50 points).

The study was conducted in accordance with the principles outlined in the Helsinki Declaration and was approved by the Ethics Committee at the International Higher School of Medicine (Minutes of the Meeting No. 4 dated 09.11.2016).

The data were analyzed using SPSS Statistics 16.0 (Chicago, IL, USA). Continuous variables are reported as mean ± standard deviation (M±SD). Analysis of continuous variables was performed using 2-sample *t*-test and ANOVA was used to compare means among the 3 groups. Pearson's correlation coefficient (r) comparison was used to determine linear associations between numerical variables. Statistical significance was established at a *P*-value 0.01.

Results

Hemodynamic parameters confirmed that in the midlands, as well in the highlands, SBP and DBP correspond to the physiological norm. The determination of AP showed that the score of AP in the midlands region for men was 2.32 points, for women - 2.38 points, but in highlands region these values were slightly higher: for men – 2.52 points, for women – 2.42 points. The common values of BMI for men in the midlands and highlands were 23.39 and 23.24 kg/m^2 respectively, for women in the midlands this indicator became higher - 26.53 kg/m^2, but in the highlands it corresponded to the norm (24.78 kg/m^2) (Table 1). The distribution of BMI among women and men in the Alai region are proven in Fig. 1.

Table 1: Anthropometric and hemodynamic parameters of citizens of the Alai region in the midlands and highlands

Variables	***Midlands***		***Highlands***	
	Male (n=125)	*Female (n=160)*	*Male (n=148)*	*Female (n=164)*
Age (yr)	39.92±15.2	41.80±12.9	37.23±13.6	37.38±12.6
Body weight (kg)	65.0±12.5	66.33±12.1	65.23±11.2*	59.52±12.0*
Height (sm)	167.96±11.5*	158.38±6.8*	167.83±8.4*	155.77±7.5*
Heart rate (beats/min)	76.20±10.6	80.70±12.5	82.38±14.9	80.19±13.2
Systolic blood pressure (mmhg)	109.32±13.7	103.62±13.3	117.35±15.1*	110.27±15.2*
Diastolic blood pressure (mmhg)	73.16±11.9	70.03±9.8	79.90±12.2*	75.78±10.4*
Body mass index (kg/m²)	23.39±6.1*	26.53±5.2*	23.24±4.2	24.78±6.4
Adaptation potential (points)	2.32±0.5	2.38±0.4	2.52±0.5	2.42±0.5

Data are presented as mean ± standard deviation, *-significance of differences at *P*<0.01

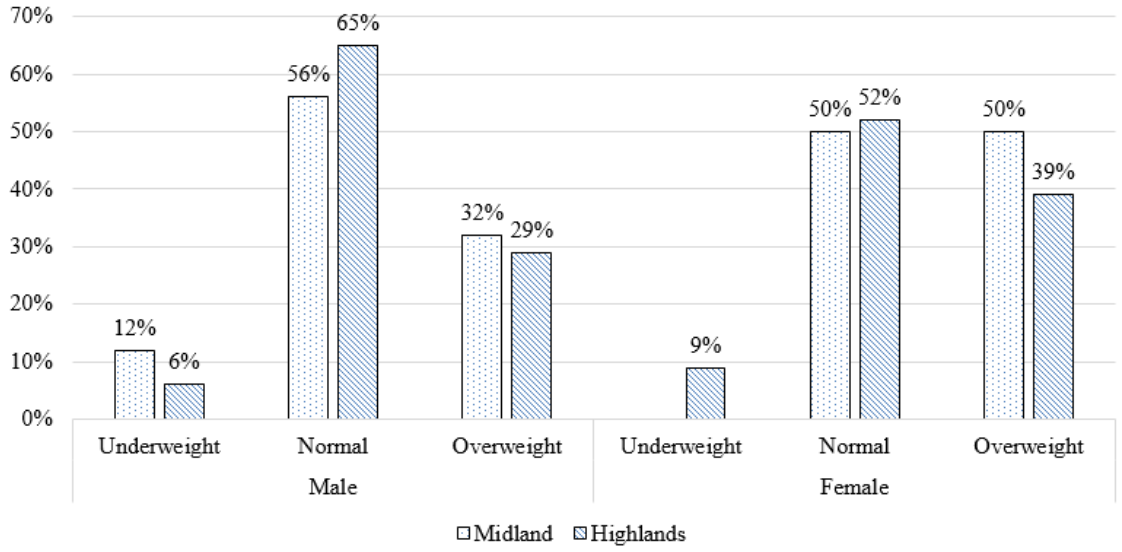

Fig. 1: Distribution by body mass index of citizens of the Alai region in the midlands and highlands

Across all categories of BMI among men in the midlands from Fig. 1, demonstrated that 56% and 32% male had normal and overweight respectively, 12% had underweight. However, in the highlands the percentage of underweight male decreased to 6% and overweight to 29%; the percentage of men with a normal BMI increased to 65%. In female in the midlands, the percentage of persons with normal and overweight were equal (50% each). In the highlands, the percentage of women with overweight decreases to 39% and with normal BMI increases to 52%. At the same time, percentage of underweight women was revealed (9%).

Analysis of anthropometric and hemodynamic parameters discovered the dependence of AP at BMI, as indicated by a reliable correlation coefficient (r=0.586; *P*<0.01) between these indicators (Fig. 2).

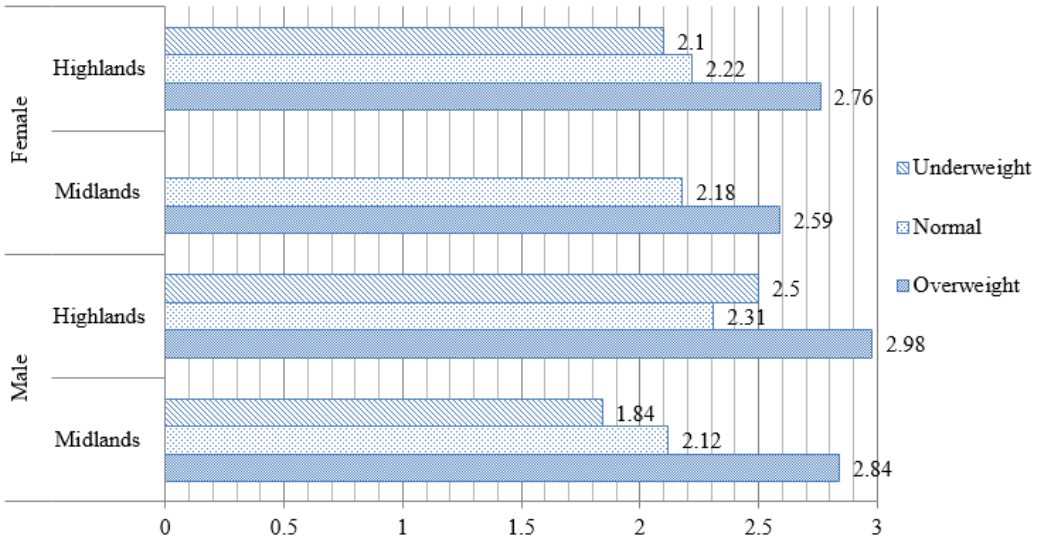

Fig. 2: Values of adaptation potential in individuals with different body mass index

The Fig. 2 shows that in the midlands and highlands for men and women with normal BMI AP values less than 2.59 points, but in persons with overweight this indicator for male in the midlands became 2.84 points, in the highlands - 2.98 points; in female - 2.59 and 2.76 points respectively.

Discussion

Measurement and evaluation of hemodynamic parameters demonstrated that in the midlands and highlands, values SBP and DBP were normal. As the facts the citizens aged 30-39 years are much more likely to have a normal BMI and much less underweight. With growing age (40-49 years) in both categories (male and female) in the midlands and highlands the percentage of overweight people increased – this is a well-known fact associated with a decrease in physical activity and tone of the sympathetic nervous system in older age groups, as well as a slowdown in metabolic processes (4-6). In men and women in the highlands with underweight, a certain pattern is manifested on the part of HR, which exceeded both the normative data (95 and 90 beats /min respectively) and the indicators of the midlands. Such an increase in HR reflects the overall effect of heart rate regulation, indicates sympathetic activation and mobilization of the cardiovascular system to ensure activity in uncomfortable conditions of the highlands (7).

To a greater extent, such changes on the part of the cardiovascular system are characteristic of people with a cardiac type of self-regulation of blood circulation, in whom blood pressure is maintained by increasing heart rate, systolic volume and increased contractile capacity of the myocardium (8,9). From a scientific point of view, the fact of the discovery of a vascular type of self-regulation of blood circulation in overweight people in the highlands is also interesting. The change in the self-regulation of blood circulation towards the predominance of the vascular component during long-term adaptation in difficult conditions of the highlands indicates its economization.

Conclusion

It is necessary to determine the value of AP, BMI and type of self-regulation of blood circulation when assessing the functional state of residents living in mountain areas. In the highlands overweight, which is one of the significant risk factors for health disorders, with tension of regulatory

mechanisms can become a trigger for the development of cardiovascular diseases.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interest.

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