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Comparative Study of Anthropometric Characteristics and Cardiorespiratory System Functional Activity in Girls Living in Different Regions of The Aral Sea Area

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Abstract: This article presents a comparative study of anthropometric and cardiorespiratory indicators among adolescent girls living in different ecological zones of the Aral Sea region in the Republic of Karakalpakstan. Within the framework of the study, girls aged 11-15 from the districts of Muynak, Kungrad, and Takhtakupir were selected, and their body structure and functional activity of the cardiovascular and respiratory systems were assessed.

Statistical analysis revealed significant differences in certain anthropometric parameters (body mass, arm and thigh length, shoulder width) depending on the ecological area. The results of this study highlight the extent to which the health of children living in the Aral Sea region is influenced by environmental conditions and may serve as a scientific basis for the development of regional health improvement measures.

Keywords: Aral Sea region, ecological zones, adolescent girls, anthropometric indicators, body composition, cardiorespiratory system, health, ecological stress, regional differences, statistical analysis.

Introduction: Over the past decades, as a result of the sharp decrease in water volume in the Aral Sea, the ecological situation in the lower reaches of the Amu Darya has begun to deteriorate. The continental characteristics of the climate in the region have intensified, air humidity has sharply decreased, and the process of the Aral shores drying up and turning into desert has accelerated. Degradation of natural resources and pollution of the environment with pesticides and industrial waste are being observed.

The rise of salt and dust into the air from the dried part of the Aral Sea is causing the disruption of sanitary-hygienic, medical-biological, and ecological conditions in this area. As a result, a deep transformation process occurred in the Aral Sea natural ecosystems and large-scale ecological changes were observed. This situation led to the formation of a new ecological center that can be called an "extreme environment."

Today, the issue of determining exactly which factors are causing the decline in health indicators of the population in the Republic of Uzbekistan is urgent. Finding a clear and scientifically based answer to this question is complex and requires a multifaceted approach. In particular, the systematic study of adverse factors affecting health and identifying their causes and consequences is one of the most important directions of modern physiological science.

From this point of view, studying the anthropometric indicators and functional activity of the cardiorespiratory system of young people, particularly girls, living in the ecologically distinct Aral Sea region is of great scientific and practical importance.

Research Objectives

The main goal of solving these problems consists of determining the adaptation level of the organism through comparative study of complex anthropometric indicators (height, body weight, body mass index, etc.) of girls aged 16-22 living in different ecological and climatic conditions of the Aral Sea region, as well as the functional activity of their cardiorespiratory system. In achieving this goal, the following tasks were accomplished:

1. **Measuring anthropometric indicators** in respondents selected from young girls living in the Aral Sea territories:

- Height, body weight, BMI (body mass index)
- Width of elbow and ankle joints
- Circumference measurements of waist, hip, calf, wrist, shoulder, chest circumference
- Skinfold thickness - front and back of shoulder, abdomen, back, front of thigh, back of calf

2. **Identifying somatotypic differences** based on the above indicators and assessing the general developmental state of the organism through them.

3. **Determining cardiovascular and respiratory system indicators in girls**:

- Heart rate (HR)
- Blood pressure (BP)
- Respiratory rate (RR)
- Vital capacity (VC)

4. **Comparing each indicator by regions** and assessing the impact of ecological conditions on anthropometric and functional development.

5. **Describing physiological criteria** that can be applied in monitoring youth health and developmental observation based on the obtained data.

Various pathogenic factors present in the external environment negatively affect the human organism, disrupting organismic homeostasis, and this condition can cause the development of diseases. It has been particularly noted that ecological factors play a high role in the formation of widespread diseases such as atherosclerosis and malignant tumors (cancer). At the same time, ecological factors may play an important role in the development of other types of pathological conditions.

Based on this approach, in scientific work conducted by Nurbekov M.K. and co-authors, new scientific information was presented about the impact of ecology on human health, particularly mechanisms for ensuring homeostasis at tissue and cellular levels and controlling the development of widespread diseases. In their research, functional changes occurring in the organism against the background of ecological stresses were deeply analyzed (1).

Physical development is an important indicator reflecting the growth and development processes of the organism. In certain stages of ontogenesis, the mechanism of genotypic characteristics transforming into phenotypic characteristics under the influence of social environmental factors is observed. This process occurs during the growth and development stages of the organism (2).

Physical development is the sum of morphometric indicators expressed through somatometry coefficients, physiometry, and functional activity indicators. Physical development is assessed based on the following main morphometric parameters: body height, body weight, and chest circumference (3, 4). For complete assessment, additional indicators such as leg and body length, shoulder and chest bone width, lung vital capacity, back muscle strength, hand grip strength, and functional work capacity are also taken into account.

Somatoscopy (assessment based on external appearance of the body) includes the study of muscle and bone systems, skin condition, mucous membranes, and biological maturity level (5).

METHODS

The research was conducted among study participants living in the districts of Muynak, Kungrad, and Takhtakupir located in the Northern Aral Sea region. In determining body structure parameters, the generally accepted method proposed by Erkudov V.O., Zaslavsky D.V., Pugovkin A.P. was used.

RESULTS AND DISCUSSION

The research results showed that there are significant differences between morphometric indicators in girls living in different ecological zones of the Northern Aral Sea region of the Republic of Karakalpakstan (Table 1).

Table 1

Physical Development in Girls Living in Different Areas of the Aral Sea Region (μ; (L.L.; U.L. 95% confidence interval)

Indicators	Zone №1	Zone №2	Zone №3	P-value (Kruskal-Wallis test)	P-value (pairwise comparisons)		

					Zone №1 - Zone №2	Zone №1 - Zone №3	Zone №2 - Zone №3
Body mass, kg	55.31 (53.32; 57.30)	55.24 (54.29; 56.19)	53.19 (51.60; 54.78)	0.04038	1	0.7256	0.03241
Height, cm	161.59 (160.51; 162.67)	162.08 (161.22; 162.93)	160.72 (159.67; 161.76)	0.05959	1	0.8515	0.05437
Trunk length, cm	51.42 (50.37; 52.48)	53.62 (48.98; 58.25)	50.57 (49.01; 52.13)	0.177	1	0.2033	0.4631
Arm length, cm	67.81 (66.05; 69.56)	66.80 (65.66; 67.93)	64.63 (62.82; 66.44)	0.01534	0.6735	0.01601	0.09581
Shoulder length, cm	30.23 (29.63; 30.83)	29.89 (29.34; 30.44)	29.45 (28.37; 30.52)	0.08222	1	0.09614	0.2343
Forearm length, cm	23.32 (22.81; 23.82)	23.41 (23.09; 23.72)	22.77 (22.18; 23.36)	0.1913	1	0.4026	0.2787
Hand length, cm	19.70 (15.62; 23.79)	18.09 (16.07; 20.11)	16.20 (14.92; 17.49)	0.002578	0.3363	0.002821	0.0371
Leg length, cm	85.13 (83.07; 87.20)	86.72 (85.52; 87.91)	84.55 (82.03; 87.08)	0.09749	0.2591	1	0.2371
Thigh length, cm	50.29 (48.71; 51.86)	49.70 (48.95; 50.45)	47.04 (45.52; 48.56)	0.01418	1	0.06605	0.01681
Calf length, cm	34.90 (33.93; 35.88)	36.09 (35.39; 36.79)	36.66 (35.16; 38.16)	0.0855	0.2496	0.08886	1

Indicators	Zone №1	Zone №2	Zone №3	P-value (Kruskal-Wallis test)	P-value (pairwise comparisons)		
Foot length, cm	21.58 (20.88; 22.28)	21.45 (20.74; 22.17)	21.15 (20.15; 22.14)	0.493	1	0.6736	1
Chest sagittal diameter, cm	25.50 (23.99; 27.02)	24.76 (24.47; 25.06)	24.76 (23.74; 25.79)	0.1907	1	0.3761	0.2968
Chest transverse diameter, cm	17.11 (16.41; 17.81)	17.69 (16.92; 18.46)	17.71 (16.80; 18.62)	0.987	1	1	1
Shoulder acromial diameter, cm	31.28 (30.28; 32.28)	31.80 (31.08; 32.51)	32.27 (31.05; 33.49)	0.02451	0.3014	0.02473	0.2953
Chest circumference, cm	84.17 (82.64; 85.69)	84.86 (83.95; 85.76)	85.59 (84.02; 87.16)	0.5678	1	0.9158	1
Distantia cristarum, cm	25.86 (25.18; 26.54)	26.16 (25.69; 26.64)	26.76 (26.15; 27.37)	0.04587	1	0.06072	0.1263
True conjugate, cm	18.64 (18.06; 19.22)	18.60 (18.26; 18.95)	18.92 (18.19; 19.65)	0.8288	1	1	1
Distantia trochanterica, cm	31.53 (30.85; 32.21)	31.60 (31.22; 31.97)	31.05 (30.58; 31.53)	0.3116	1	0.9105	0.3938
Pelvic circumference, cm	90.91 (88.82; 93.00)	91.64 (90.34; 92.95)	90.84 (88.90; 92.77)	0.793	1	1	1

STATISTICAL ANALYSIS RESULTS

According to experimental results, a statistically significant difference was observed between zones 1 and 3 in terms of body mass (P = 0.03241), indicating that girls living in zone 3 have relatively lower body weight. The differences between other zones were not at a significant level.

Arm length showed a notable difference between zones 1 and 3 (P = 0.01601), indicating that zone 3 girls lag behind in anthropometric development. A similar

tendency was observed in hand length, with a clear difference between zones 1 and 3 (P = 0.002821).

The difference between zones 1 and 3 in thigh length was statistically significant (P = 0.01681). Such differences may have emerged under the influence of ecological conditions and social factors.

Additionally, significant differences were noted in shoulder acromial diameter (P = 0.02473) and distantia cristarum (P = 0.04587) indicators. It can be noted that these features have considerable differences in morphological development.

Other indicators, including height, true conjugate, and pelvic circumference diameter, showed no statistically significant differences between zones (P > 0.05), indicating that some morphometric features are more stable relative to ecological variability.

CONCLUSION

The conducted scientific research showed that there are certain differences between anthropometric and morphofunctional indicators of girls living in different ecological areas of the Aral Sea region of the Republic of Karakalpakstan.

It was determined that there are statistically significant differences in body weight, arm length, hand length, thigh length, shoulder width, and some measurements of pelvic bones among adolescent girls living in Muynak, Kungrad, and Takhtakupir districts. These differences may be related to ecological factors, environmental quality, nutrition level, and socio-economic conditions.

Additionally, some functional indicators related to the cardiorespiratory system were observed to differ slightly according to ecological zones. These results can serve as an important practical basis for developing regional rehabilitation and health improvement programs in forming a healthy generation adapted to the ecological environment of the Aral Sea region in the future.

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