

Research on the Detection, Statistics, and Mathematical Modeling Intervention of Physical Form of Tajik and Kyrgyz Middle School Girls

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Abstract: The body shape, function and quality indexes of 618 Tajik students aged 13~17 years from Tashkorgan Tajik Autonomous County, Xinjiang, China were examined by means of medical observation and documentary data. The three indexes of height, weight and chest circumference related to the body shape of tajik girls aged 13 to 17 and the data derived from these three indexes, such as weight/height and chest circumference/height, were analyzed statistically and compared with the relevant data of Kirgiz students. It is suggested that the consciousness education of medical physical exercise should be strengthened to make tajik female middle school students form the habit of lifelong medical physical exercise gradually. At the same time, specific suggestions were put forward to strengthen and improve the medical and physical education work in Tajik schools.

1. Research objectives

Known as "Pamir Eagles", Tajiks are one of the 13 major ethnic minorities in Xinjiang, with a total population of more than 40,000 people, mainly living in Tashkurgan Tajik Autonomous County. It has been settled on the Pamir Plateau at an altitude of 3,000 meters since the 10th century AD. Tajiks can sing and dance. The dance simulates the movements of the eagle spreading its wings and flying around. Through long-term transformation and adaptation to harsh high-altitude natural environments, it has formed its own unique national physical and health characteristics and style. These include physical characteristics of ethnic groups. We selected Tashkorgan region of Xinjiang with the largest concentration of Tajik ethnic group as the monitoring center of physical fitness survey. A total of 600 effective samples of male and female students aged 13 to 17 were selected, and more than 10 indicators related to body shape were investigated and statistically analyzed. This paper focuses on the investigation and analysis of the three indexes of height, weight and chest circumference of Tajik female middle school students and the body shape indexes derived from these three indexes, such as weight/height and chest circumference/height.

2. Research Methodology

By means of medical monitoring method, statistical inference method and literature data method, some body shape indicators of more than 600 Tajik girls aged 13-17 were detected, statistically analyzed and studied, and then the conclusions and suggestions were drawn by means of expert discussion.^[1]

$$u = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{S_{\bar{X}_1 - \bar{X}_2}} (\sim N(0,1)) \quad (1)$$

$$u = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \quad (2)$$

3. Statistics and Analysis

3.1 Characteristic analysis

3.1.1 Age Characteristics

Concerning Tadjik schoolgirls at the age between 13 and 17, three form indexes to Body height, weight, and circumference increase as their age grows, from 13 to 17, their body height increases by 6.69cm, body weight increases by 8.37kg, and circumference increases by 5.54cm. Of increment of the three indexes to body form, height index increases fastest at the age of 14 to 15, by 2.07cm. Weight index also increases fastest at the age of 14 to 15, by 3.45kg. Circumference index increases fastest at the age of 14 to 15, by 3.87cm (see table 1) [2].

Table 1 Increment of Indexes to Body Form of Tadjik Schoolgirls at the Age between 13 and 17

Sex	Age	Height(cm)	Weight(kg)	Circumference (cm)Weight	HeightX1000 Circumference	HeightX100
F	13	145.95	37.72	70.91	258.50	48.6
	14	147.84(1.89)	41.86(4.14)	72.24(1.33)	282.90(24.40)	48.9(0.30)
	15	149.91(2.07)	45.31(3.45)	75.31(3.87)	306.90(24.00)	51.46(2.56)
	16	151.67(1.76)	45.60(0.29)	76.44(1.13)	308.98(2.08)	50.49(0.03)
	17	152.64(0.97)	47.09(1.48)	76.45(0.01)	310.20(1.22)	50.86(-0.37)

Note:(--): is the Average Increment.

3.1.2 Gender Characteristics

Comparing the indexes to Tajik schoolboys and schoolgirls at the age between 13 and 17 (test on difference notability, see table 2), schoolboys are distinctly higher than schoolgirls ($P < 0.01$); On index to body weight at the age range of 13 to 15, although the average value of schoolboys is higher than schoolgirls, but discrepancy is not notable ($P > 0.05$); The weight index to schoolboys at the age between 16 and 17 are distinctly higher than schoolgirls ($P < 0.01$); On circumference index, 13-year-old schoolgirls are distinctly higher than schoolboys ($P < 0.01$). At the age range of 14 to 15, although circumference index of schoolgirls is averagely higher than schoolboys, discrepancy is not that distinct ($P > 0.05$). After 16, schoolboys' circumference index is higher than schoolgirls, and at the age of 17, distinctly higher than schoolgirls.

3.1.3 National relationship

Due to the different living style, heredity factors and nutrition conditions of different ethnic group, together with influence of nature environment, discrepancy of body form growth has appeared. We will compare with Tajik the three indexes to body form of Tajik who has similar living and educational condition (see table 3), we can see that indexes to body height, weight, circumference of Tajik students at the age between 13 and 17 is comparatively lower than that of khalkhas. Especially index to body height, there's great distinction between schoolboys. As age grows, although the discrepancy of other indexes becomes smaller, when wholly compared, the discrepancy is still comparatively large. One thing we should point out is that according to past research materials of constitution, when comparing with Han, Uigur, Kazakstan in Xingjiang, Khalkhas' indexes to body form are equally at a low standard. Thus, it can be further explained that Tajik' indexes to body form are very bad. [3]

3.2 Analysis of Derived indexes to Body Form

3.2.1 Comparison of Age Difference (see table 1)

Body weight/height×100 shows the richness and nutritious condition of body growth. Schoolgirls will stay at a comparatively steady level after the age 14. Index to circumference/body height×100 shows a relative index to body enclosing degree, and demonstrates thinness and fatness or relative length-width structure. Derived body form indexes to body weight/height×1000, circumference/body height×1000 of Tajik schoolgirl at the age between 13 and 17 increases as age grows. The peak growing segment is in schoolboys body weight/height×1000 index, it grows rapidly after the age 14. schoolboys circumference/body height×100 index grows most rapidly at the age between 13 and 14. Two indexes of Tajik schoolgirls at the age between 13 and 15 grows most rapidly, and slows down afterwards. From an aging point of view, Tajik schoolgirls look stout at the age between 13 and 15, while from 16 to 17, they naturally grow lanky^[2].

Table 2 Differentiation t Test on Index to Body Form of Tajik Middle School Students at the Age Between 13 and 17

Age	Comparative	value Height(CM)	Weight(KG)	Circumference(CM)	Weight/Height×1000	Circumference/Height× 100
13	margin	3.30	0.68	—3.91	— 0.20	—3.28
	t	3.21	0.61	4.29	0.03	4.37
	p	<0.01	>0.05	<0.01	<0.01	<0.01
14	margin	1.93	0.03	—1.15	—23.36	—1.55
	t	2.97	0.026	1.77	3.71	3.16
	p	<0.01	>0.05	>0.05	<0.01	<0.01
15	margin	7.91	0.33	—1.81	18.80	—3.91
	t	7.28	0.33	1.89	2.87	6.98
	p	<0.01	>0.05	>0.05	<0.01	<0.01
16	margin	9.37	4.36	—1.96	1.10	—3.44
	t	8.68	2.95	1.95	0.16	6.03
	p	<0.01	<0.01	>0.05	>0.05	<0.01
17	margin	10.27	7.41	2.36	24.19	—2.4
	t	10.80	10.90	2.71	4.84	3.58
	p	<0.01	<0.01	<0.01	<0.01	<0.01

Note: The margin is schoolboy \bar{x} -schoolgirl \bar{x}

3.2.2 Comparison of Gender Difference (see table2)

Concerning derived body form indexes to body weight/height×1000, circumference/body height×100 of Tajik students at the age between 13 and 17, different age groups vary, from 13 to 17, except for 16-year-old group whose index to body weight/height×1000 differentiates little, and 17-year-old schoolboy distinctly higher than schoolgirls, in other age groups, two indexes of schoolgirls are distinctly higher than schoolboys. It speaks volume for the fact that before the age of 16, the body richness and fatness of Tajik schoolboys is lower than schoolgirls, schoolboys tend to be lanky while schoolgirls are comparatively stout. When reach the age of 17, body richness of schoolboys just appears to be larger than schoolgirls^[3].

3.2.3 Comparison of ethnic group Difference

Comparing indexes to body weight/height×1000, circumference/body height×100 of 13 to 17-year-old khalkhas students from investigation and research group of Xingjiang students constitutional health with Tajik students who are at the same age range(see table 4), we can see that, concerning index to body weight/height×1000, except for 16-year-old schoolboys, indexes of Tajik students at each age group are higher than Khalkhas students, it shows that Tajik students at the age between 13 and 17 characteristically enjoy larger body richness. Index of schoolgirls at the age between 13 and 15 Tajik is higher than Khalkhas, however, at the age between 16 and 17, become lower than that of Khalkhas students. Index to body richness is larger at the age between 13 and 15

while comparatively smaller at the age between 16 and 17.

Table 3 Margin of Three Body Form Indexes of Khalkhas and Tajik at the Age between 13 and 17

Age	Height(cm)		Weight(kg)		Circumference(cm)	
	M	F	M	F	M	F
13	9.10	5.3	5.78	5.71	7.19	4.67
14	11.08	6.0	4.00	7.24	3.87	5.70
15	8.38	4.92	6.41	4.42	4.40	2.90
16	6.96	4.94	2.09	5.00	6.69	2.95
17	5.68	3.97	0.09	5.00	5.08	3.69

Note: the margin is $\bar{x}_{\text{Khalkhas}} - \bar{x}_{\text{Tajik}}$ (dates of Khalkhas are dates under this question for discussion)

Table 4 Comparison of Two Derived Indexes to Body form of Tajik and Khalkhas Schoolgirl

age	weight / height×1000			circumference / height×1000		
	Khal \bar{x}	Tzh \bar{x}	margin	Khal \bar{x}	Tzh \bar{x}	margin
13	256.68	258.5	—18.2	48.50	48.60	—0.10
14	266.52	282.9	—16.38	48.67	48.90	—0.23
15	286.57	306.9	—20.33	49.10	51.46	—2.36
16	310.49	308.98	1.51	50.52	50.49	0.03
17	323.39	310.20	13.19	50.43	50.86	—0.43

Note: Margin is $\bar{x}_{\text{Khalkhas}} - \bar{x}_{\text{Tajik}}$

Index to circumference/body height of Tajik schoolboys in each age group at the age between 13 and 17 is lower than that of Khalkhas students of the same age, there're two underlying reasons, first one is that Tajik students are shorter than Khalkhas students, although their body richness is comparatively large, relative index to enclosure degree is affected by body height, thus their body form appears to be smaller. Second one is that the circumference of Tajik schoolboys is small. Although their body height is comparatively short, as for circumference degree, their body height comparative value becomes even smaller. A national characteristic is then determined that their body form is small. Concerning index to circumference/body height of schoolgirls, the margin between Tajik and Khalkhas students at the same age is very small, at the age range of 13 to 15, comparing by average value, Tajik student is slightly larger, manifested by large body richness and moderate fatness. However at the age range of 16 to 17, Tajik tend to become lanky and small, the overall national characteristic takes on a lanky but fierce state.

4. Research conclusion

Three body form indexes of Tajik schoolgirls increase as age grows. Increment of body height, weight reaches its peak at the age between 14 and 15. Concerning index to circumference of schoolboys, there're two climaxes at the age between 13 and 14, 16 and 17, while for girls, it is still between 14 and 15. Comparing three indexes of both sexes, schoolboy at each age group is distinctly higher than schoolgirls; the same is true to weight. Index to circumference, schoolgirl is higher than schoolboy at the age between 13 and 15, while the reverse is true at the age between 16 and 17. Of three body form indexes, Tajik students, in each age group, is lower than Khalkhas students.

Due to the fact that the derived indicators of weight/height x 1000 and chest circumference/height x 100 for Tajik high school girls increase with age, the increase is significant from the age of 13 to 15, but slows down afterwards.

Comparing two derived indexes of both sexes, except 16-year-old group, there's no distinct difference of index to body weight/circumference, in 17-year-old group, index to schoolgirl is distinctly higher than schoolboy, and in other age groups, schoolgirl is distinctly higher than schoolboy concerning two indexes. Comparing with Khalkhas students of the same age, of index to

body weight/height, Tajik schoolboy is higher than Khalkhas schoolboy except 16-year-old group, while Tajik schoolgirl is higher than Khalkhas schoolgirl at the age between 13 and 15. However, at the age between 16 and 17, Tajik schoolboys are all lower than Khalkhas students, while Tajik schoolgirls are higher.

Through analysis and comparison for three body form indexes and two derived body form indexes of Tajik schoolgirls at the age between 13 and 17, we can see that although the body form of Tajik students short and thin, their body richness is still very large. Thus it is so-called lanky but vigorous national body form characteristic.

5. Sports medicine intervention methods and measures

As a result of genetic factors and atrocious living environment, along with local nutritious condition, poor physical and healthy education facilities, Tajik students demonstrates a national characteristic of lanky and small body form when comparing with other ethnic groups. Through analytical research and expertise consultant, proposition for improvement of Tajik school's physical education is summarized as below.

Educational departments of all levels should pay much attention of the nutritious structure, living environment and sanitation of Tajik students.

What is given top priority to health is the guideline that should be entirely carried out, at the same time, physical education of Tajik schools should be given great attention, and an one-hour-physical-exercise time per day should be guaranteed.

Through physical education, the consciousness of physical education as long as the habit of life-long physical education should be reinforced.

During physical and healthy education, a complete constitutional and athletic training, especially strength training, of Tajik schoolgirls should be enhanced.

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