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Chinese adolescent physical health standards' empirical research

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ABSTRACT

Adolescent is national development reserve force, is future of nation, his sound growth is always the key point of Chinese Adolescent education. Therefore, Adolescent physical health also attracts considerable great attention. The paper starts from Adolescent health education and his physical health relationships as well as Adolescent physical health standards two aspects, by investigation and analysis, it makes quantitative researches from the perspective of statistics and mathematical statistics. Firstly, take Adolescent physical health status as entry point, by investigating Adolescent physical quality and understanding degree on health education, analyze Adolescent physical health status. Secondly, respectively start from height, weight two external factors and lung capacity one internal factor, establish Adolescent physical health standards discriminant analysis model, define Adolescent height, weight, lung capacity three standards. By comprehensive analysis, finally get conclusions: Chinese Adolescent understanding degree on health education is significant correlated to his physical health; due to most of them don't understand health education, his physique also suffers influences to certain extents. Therefore, define Adolescent height, weight, and lung capacity three events standards, research on his physical health status, and build foundation for Chinese Adolescent sound growth.

KEYWORDS

Adolescent; Physical health; Health education; Correlation analysis; Health standards.

INTRODUCTION

Health always is focus issue of modern people concerns, as flowers of country, Adolescent physical health especially attracts attentions from each circle personnel.

Li Ying through researching on "Adolescent physical health problems gender differences", analyzed different genders' Adolescents, and which kind of differences their physical health existed. The paper by investigating different genders Adolescents gap in height, weight, heart beating frequency, lung capacity and other aspects, carried out comparative analysis, and then researched on Adolescent physiques existing genders differences. The article pointed out that in Adolescent group, schoolboys physiques are far higher than schoolgirls, gender differences were obvious, to eliminate the gender differences, shorten gap between schoolboys and schoolgirls, it should encourage schoolgirls to take more physical exercises. Lu Xiu-Yun by researching on "Shanghai city Adolescent student physical health monitoring management mode explorative research" took Shanghai city as an example, concrete analyzed Adolescent student physical health problems. The article investigated Shanghai city each junior high school, senior high school students' physical health status, and made statistics of school monitoring management modes,

So that provided data basis for researches. The article pointed out that Adolescent physical health monitoring management should follow by Adolescent growth, according to different age groups, different genders students, formulated different standards; it varied with different individuals and regions. Yang Yan-Guo by researching on "Shanghai city Adolescent children physical health promotion to school, family and community linkage pattern research", researched on Adolescent physical health problems from school, family and community three aspects. The article carried out investigation in Shanghai city, took Shanghai city Adolescent children as research objects, analyzed school, family, community the three Adolescent physical health management model. The article put forward: school, family, community should establish different detection mechanism, combine with Adolescent development status, jointly propel to Adolescent sound growth.

The paper on the basis of combining with formers' research results, makes research on Adolescent physical health standards, makes quantitative analysis from statistics and mathematical statistics perspective, by defining Adolescent height, weight, lung capacity standards, and provides orientations for Chinese Adolescents' health education.

ADOLESCENT HEALTH EDUCATIONS AND HIS PHYSICAL HEALTH CORRELATION ANALYSIS

Adolescent physical health status

China "Students physical health standards" requires that when evaluating Adolescent physical health, score⟩90 points are excellent, 75~89 points are favorable, 60~74 points are pass, ⟨59 points are flunk. In order to learn Chinese Adolescent physical health status, sample and investigate them, statistical result is as following TABLE 1.

TABLE 1 : Adolescent physical health status investigation

	Excellent	Favorable	Pass	Flunk
Boy	15.18%	34.23%	45.59%	5.01%
Girl	12.69%	36.63%	44.34%	6.34%
Total	14.14%	35.23%	45.07%	5.56%

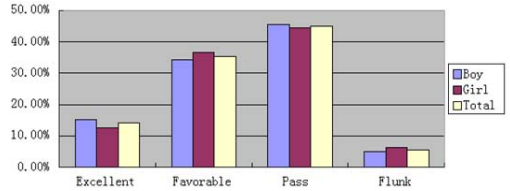

Figure 1 : Adolescent physical health status survey

Above analysis Figure 1 indicates that on a whole, Chinese Adolescent physical health status are mostly favorable and pass, excellent only occupied 14.14%, and also exists 5.56% flunk group. In view of genders, schoolgirls' physique is inferior to schoolboy, no matter number of people that pass 、people that favorable, or number of excellent, schoolboys are more, except for self-physical conditions, which has close relations with schoolboys regular participation in physical exercises.

Adolescent physical quality investigation

By investigation and analysis of Adolescent physical health as TABLE 2, it is clear that Chinese Adolescent physique is entirely good, but there are still parts of people unqualified and excellent people amount is fewer. Therefore, it makes further analysis of Adolescent physical quality. Among them, physical quality includes endurance, strength, speed and other indicators.

TABLE 2 : Adolescent physical quality investigation

		Excellent	Favorable	Pass	Flunk
13~15 years old	Boy	11.36%	30.40%	47.93%	4.31%
	Girl	15.35%	27.16%	51.89%	5.60%
16~18 years old	Boy	16.74%	29.18%	49.38%	4.70%
	Girl	13.12%	25.25%	54.27%	7.36%
Total		16.03%	28.47%	50.28%	5.22%

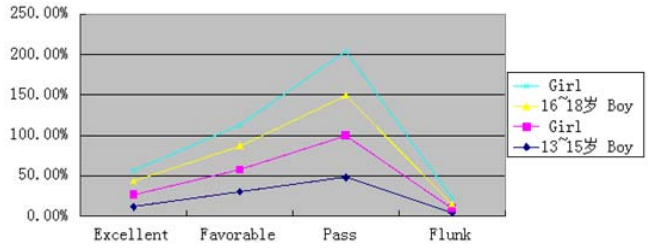

Figure 2 : Different ages, different gender body quality comparison

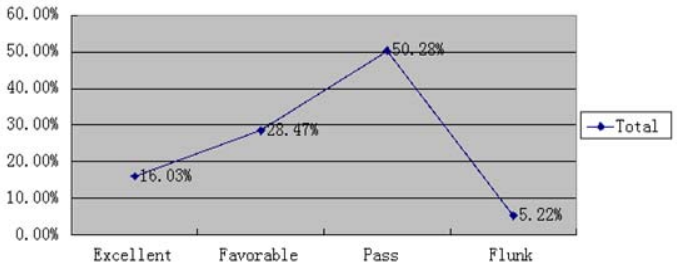

Figure 3 : Adolescent physical quality overall

By above analysis Figure 2and Figure 3, it is clear:on a whole, 94.88% people are above pass level, but relatively physical quality excellent people are fewer that only 16.03%;in view of ages, 16~18 years old adolescent physical quality are entirely better than 13~15 years old, other number of excellent people are more; In view of genders, schoolboys physical quality is better than schoolgirls' physical quality, number of people that physical quality qualified are more.

Adolescent understanding on health education

Health education plays crucial roles in teenager achievements process. Adolescent focuses on health education, then understanding on physical health is also more, and then focus on self-physique promotion, body each technology also can be remarkable upgraded, which has effects on their health growth.

Below TABLE 3 is statistics of Chinese adolescent understanding degree on health education, makes statistical analysis of them, and then get correlation results.

TABLE 3 : Adolescent understanding and investigation on health education

	Particularly understand	Has some knowledge of	Don't know
Percentage	33.0%	50.09%	16.91%

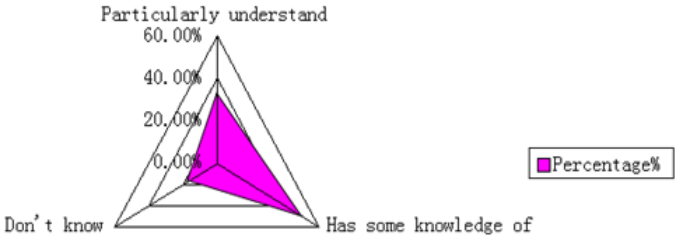

Figure 4 : Adolescents know about health education

Above statistical Figure 4 indicates there are 50.09% adolescents have some knowledge of health education, the ones particularly understand are fewer that only 33.0%, and even partial parts of people don't know health education. It seriously affects Chinese health education development, and meanwhile also restricts adolescent physical health.

Adolescent health education and his physical health correlations

Health education is base of adolescent sound growth, and meanwhile also is the key to affect adolescent growth. Adolescent understanding degree on health and his health consciousness decides adolescent health levels to some extents. Below TABLE 4 is adolescent to health education familiarity extent and his health levels' statistical table, carry out correlation analysis of table data, and then learn the two correlation degree.

TABLE 4 : Adolescent physical quality investigation

	Excellent	Favorable	Pass	Flunk	Particularly understand	Has some knowledge of	Don't know
Total	16.03%	28.47%	50.28%	5.22%	33.0%	50.09%	16.91%

Correlation analysis is utilizing software to handle with data, compares correlation by comparing correlation coefficient sizes. Pearson correlation coefficient is used to show two variables similarity extent mathematical statistical quantity, it can be used to make quantitative calculation on two variables similarities. Its calculation formula is as following :

$$\rho(X,Y)=\frac{\operatorname{cov}(X,Y)}{\sigma_x\sigma_y}=\frac{E\left((X-\mu_x)(Y-\mu_y)\right)}{\sigma_x\sigma_y}$$

Among them, covariance is used as numerator, is product of two variables standard deviation, and it requires two variables standard deviation not to be 0.

And $\mu_x = E(X), \sigma_X{}^2 = E(X-\mu_x)^2 = E(X^2) - E^2(X)$

Therefore, Pearson correlation coefficient can also be written as:

$$\rho(X,Y) = \frac{E(XY) - E(X)E(Y)}{\sqrt{E(X^2) - E^2(X)}\sqrt{E(Y^2) - E^2(Y)}}$$

When two variables Pearson correlation coefficient gets closer to 1or -1, it shows the two correlation is big, or closely related. It gets closer to 1 shows the two are in positive correlation, on the contrary it gets closer to -1 shows the two are in negative correlation.

TABLE 5 : Data correlation

Control variable		Excellent	Favorable	Pass	Flunk
Pearson correlations	Particularly understand	.215	.315	.885	.705
	Has some knowledge of	.167	.254	.790	.295
	Don't know	.158	.219	.545	.654

By above TABLE 5 correlation analysis, it can get conclusions: adolescent physical quality becomes excellent, understanding on health education gets higher, physical quality gets worse, his grasping on health education knowledge will also be fewer, physical education health consciousness will also get lower. Thereupon, it is clear health education has important effects on adolescent sound growth.

DISCRIMINANT ANALYSIS METHOD-BASED ADOLESCENT PHYSICAL HEALTH STANDARDS

Guiding thought

Discriminant analysis is a kind of multiple statistical analysis method; it refers to observe on known evaluation indicators and according to observed data to make classification on evaluation objects. Discriminant analysis general steps are as following Figure 5:

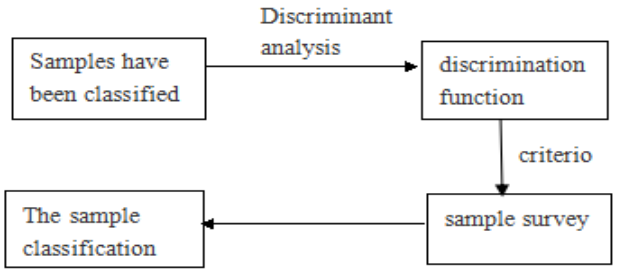

Figure 5 : Discriminant analysis step

Discriminant analysis refers to carry on discriminant analysis of historical data and then continue to establish discriminant function and make classification on observed data. Here utilize Bayes discriminant analysis to make standard research.

TABLE 6 : Adolescent height and weight investigation

		Height (cm)	Weight (kg)
13~15years old	Boy	167.2±5.6	58.2±7.3
	Girl	157.5±5.4	49.9±6.4
16~18years old	Boy	171.8±7.2	61.6±9.6
	Girl	159.6±6.4	51.8±8.3

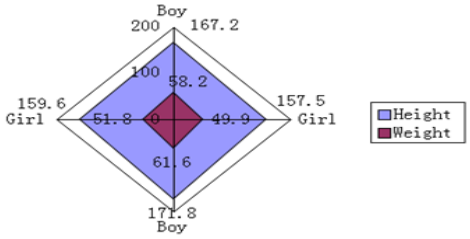

Figure 6 : Adolescent height and weight

Above TABLE 6 and Figure 6 are adolescent height and weight investigation statistics, make discriminant analysis of them, process is as following:

Establish models

Under Bayes discriminant analysis discrimination criterion, established classification function form is:

$$\begin{cases} y_1 = c_{01} + c_{11}x_1 + c_{21}x_2 + c_{31}x_3 + \cdots + c_{p1}x_p \\ y_2 = c_{02} + c_{12}x_1 + c_{22}x_2 + c_{32}x_3 + \cdots + c_{p2}x_p \\ y_3 = c_{03} + c_{13}x_1 + c_{23}x_2 + c_{33}x_3 + \cdots + c_{p3}x_p \\ \cdots \\ y_n = c_{0n} + c_{1n}x_1 + c_{2n}x_2 + c_{3n}x_3 + \cdots + c_{pn}x_p \end{cases}$$

After establishing discriminant functions, input one discriminant corresponding each parameter value into above discriminant parameter, then it can know which class the object belongs to.

According to above data, it carries out processing, and establishes Bayes discriminant analysis classification function equations, so that defines adolescent height and weight standards.

Establish Bayes discriminant analysis classification function

(1)Processing data

Utilize SPSS software to analyze above data, and then it can get following TABLE 7 regarding adolescent height and weight classification function:

TABLE 7 : Coefficient table

Model	Standard coefficient	
	Height	Weight
(Constant)	8.111	7.645
Sports time	1.376	1.212
Food nutrition	1.025	0.989
Body conditions	1.086	0.764
Growth environment	0.191	0.157

a. Dependent variable: comprehensive score

According to above coefficients TABLE 7, it can get classification functions about adolescent height and weight evaluation standards :

$$y_1 = 1.376x_1 + 1.025x_2 + 1.086x_3 + 0.191x_4 + 8.111$$
$$y_2 = 1.212x_1 + 0.989x_2 + 0.764x_3 + 0.157x_4 + 7.645$$

Among them, y is height and weight, x_1 is sports time, x_2 is food nutrition, x_3 is body conditions, x_4 is growth environment.

Improved Bayes discriminant analysis classification function

In order to improve discrimination accuracy, firstly add one item as prior probability, it makes improvements on above Bayes discriminant analysis classification function equations, Bayes discriminant analysis classification function is converted into following form:

$$\begin{cases} y_1 = c_{01} + c_{11}x_1 + c_{21}x_2 + c_{31}x_3 + \cdots + c_{p1}x_p + \ln(q(y_1)) \\ y_2 = c_{02} + c_{12}x_1 + c_{22}x_2 + c_{32}x_3 + \cdots + c_{p2}x_p + \ln(q(y_2)) \\ y_3 = c_{03} + c_{13}x_1 + c_{23}x_2 + c_{33}x_3 + \cdots + c_{p3}x_p + \ln(q(y_3)) \\ \cdots \\ y_n = c_{0n} + c_{1n}x_1 + c_{2n}x_2 + c_{3n}x_3 + \cdots + c_{pn}x_p + \ln(q(y_n)) \end{cases}$$

Now define adolescent height and weight priority probabilities are respectively as $q(y_1) = 0.55$, $q(y_2) = 0.45$

On the basis of considering prior probabilities, it can further respectively get about adolescent height and weight Bayes classification functions as following:

$$y_1 = 1.376x_1 + 1.025x_2 + 1.086x_3 + 0.191x_4 + 8.111 + \ln(0.55)$$

$$y_2 = 1.212x_1 + 0.989x_2 + 0.764x_3 + 0.157x_4 + 7.645 + \ln(0.45)$$

That:

$$y_1 = 1.376x_1 + 1.025x_2 + 1.086x_3 + 0.191x_4 + 7.563$$

$$y_2 = 1.212x_1 + 0.989x_2 + 0.764x_3 + 0.157x_4 + 7.193$$

Above is adolescent height and weight discrimination function.

(2) Define classification criterion

Now define following adolescent physical qualities height and weight evaluation standards TABLE 8 and TABLE 9.

TABLE 8 : Adolescent weight standard

		Malnutrition	Lower weight	Normal weight	Overweight	Obesity
13~15years old	Boy	3.61%	43.17%	41.17%	3.88%	7.4%
	Girl	7.88%	41.38%	46.06%	2.59%	2.09%
16~18years old	Boy	3.14%	46.72%	37.02%	5.33%	7.79%
	Girl	7.36%	45.53%	41.55%	4.17%	1.39%
Total		5.19%	43.90%	41.80%	3.93%	5.19%

TABLE 9 : Adolescent height standards

		Too short height	Normal height	Too tall height
13~15years old	Boy	2.54%	39.78%	40.05%
	Girl	6.38%	41.25%	45.76%
16~18years old	Boy	3.01%	45.77%	36.42%
	Girl	7.42%	44.56%	41.04%
Total		5.47%	43.72%	41.96%

According to above standards, input one adolescent each evaluation indicator scores into above classification function, it gets corresponding y value, and compare to above adolescent height and weight evaluation standards that belong to above range, then it can judge whether the adolescent height and weight conform to standard or not.

Adolescent lung capacity standard research

Height and weight are external expressions whether adolescent body is healthy or not, and lung capacity similarly is also internal important factor of his physical quality. Therefore, on the basis of above analysis, it further analyzes adolescent lung capacity. Define its discriminant standards.

Below TABLE 10 is statistical investigation of Chinese different age groups' adolescent lung capacity, utilize discriminant analysis guiding thought, analyze them, process is following:

TABLE 10 : Adolescent lung capacity investigation

		Lung capacity (ml)
13~15years old	Boy	3542 ± 536.1
	Girl	2590 ± 371.4
16~18years old	Boy	3984 ± 514.3
	Girl	2784 ± 427.9

(1)Processing data

Utilize SPSS software to analyze above data, and then it can get following TABLE 11 regarding adolescent lung capacity classification function:

TABLE 11 : Coefficient table

Model	Standard coefficient	Standard error
	Lung capacity	.000
(Constant)	7.926	.000
Sports time	1.235	.000

Food nutrition	1.098	.000
Body conditions	1.447	.000
Growth environment	0.989	.000

According to above coefficients TABLE 11, it can get classification functions about adolescent lung capacity evaluation standards :

$$y = 1.235x_1 + 1.098x_2 + 1.447x_3 + 0.989x_4 + 7.926$$

Among them, y is lung capacity, x_1 is sports time, x_2 is food nutrition, x_3 is body conditions, x_4 is growth environment.

Now define adolescent lung capacity priority probability is $q(y) = 0.65$,

On the basis of considering prior probabilities, it can further get adolescent lung capacity Bayes classification functions as following:

$$y = 1.235x_1 + 1.098x_2 + 1.447x_3 + 0.989x_4 + 7.926 + \ln(0.65)$$

That:

$$y = 1.235x_1 + 1.098x_2 + 1.447x_3 + 0.989x_4 + 7.276$$

Above is adolescent lung capacity discrimination function.

(2) Define classification criterion

Now define following TABLE 12 adolescent physical qualities lung capacity evaluation standards:

TABLE 12 : Adolescent lung capacity criterion

		Excellent	Favorable	Pass	Flunk
13~15years old	Boy	11.37%	29.34%	51.98%	7.31%
	Girl	13.27%	30.21%	47.14%	9.38%
16~18years old	Boy	9.82%	27.39%	53.11%	9.68%
	Girl	11.53%	29.03%	49.10%	10.34%
Total		11.53%	29.07%	50.54%	8.86%

According to above standards, input one adolescent each evaluation indicator scores into above classification function, it gets corresponding y value, and compare to above adolescent lung capacity evaluation standards that belong to above range, then it can judge whether the adolescent lung capacity conform to standard or not.

CONCLUSION

Firstly, the paper carries on correlation analysis of adolescent health education and his physical health relationship. Start from adolescent physical health, investigate adolescent physical quality and health education, from the perspective of statistics, and carry on numerical analysis. And then get

conclusions: Chinese adolescent due to understanding extent on health education is not high, his physical health also suffers indirect influences, most physical health indicators are just good and qualified, while little arrives at excellent. It also reflects Chinese adolescent health education work confronted issues to certain extents.

Secondly, the paper researches on adolescent physical health standards, respectively starts form height and weight two external factors and lung capacity one internal factor, by discrimination analysis method, establish correlation analysis model, from the perspective of mathematical statistics, make quantitative researches on adolescent height, weight and lung capacity three items standards. By defining adolescent height, weight and lung capacity three items standards, analyze adolescent physical health levels, and then point out directions for adolescent sound growth.

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