College students physical health evaluation index correlation research based on SPSS statistics analysis

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ABSTRACT

With internet and computer abundantly available, most of college students become "indoors man, indoor woman", immerse into network environment and ignore outdoor activities as well as physical exercise. The above phenomenon is the main factors that cause college student's physique drop. College student self good health is education department main control aspect .In order to get clear understanding of college students group physical conditions, college would carry out physical health test to students every year. This paper analyzes physical health test data that from one college feedback to education department, so as to make reasonable evaluation on college students' physique through mathematical statistic software SPSS and corresponding mathematical model and provide theoretical basis for seeking method of improving college students' physique. In research, firstly make research on correlation degree between weight and other test indicators, then utilize SPSS software to carry out normal P-P figure and K-S test on data, get intervals of test result deviation predictions, then apply hypothesis test theory and SPSS software to research physical difference among students from different sources, get that college students physiques are significant different in different sources, finally establish GPM student physical comprehensive evaluation model , and work out the result that college students total physical situations deviation and female students physique is better than male students through data demonstration.

Key words: Physical health standard, SPSS variance analysis, normal distribution, college student physique

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INTRODUCTION

From recently years' college students' physical health data, it can be known that their physique is in the drop tendency. Chinese college physical investigation indicates that national physique monitoring result in 2010 has been reduced around 10% in lung capacity by comparing with that in 1985, college female student 800meters running and male students 1000 meters running have been respectively reduced 10.3% and 10.9% as well as other aspects indicator have remarkable droppings. This paper makes research on college students' physical health test data in one college feedback to education department in order to explore college students' physical conditions through analysis process.

For the research on college students physical health data, many people has made efforts, it provides directional reference for college students' physical improvement through research result. Among them, Ye Chao-Zhong Based on college students' physical health situation testing and evaluation, make research on their sports fitness habits, consciousness and other relative problems, with an aim to explore the root cause of students' physical health drop [1]; Tang Qing-Hu Gathering health management relative theory and method, explore college students' physical health follow-up service management mode so as to change current situation of only testing not interference [2]; Li Yang etc. Analyze recent 3 years 1895 national minority college students' physical health factors from silence university in Gansu province, get relationships among factors, main influence factors and each nationality college

physical situations [3-5].

From empirical analysis, it can be known that lots of factors influence on college students' physical health, what on earth is the main factor influences physical health? And whether measurement data can reflect students' physical true level or not? Does students from different sources physical health influence factors have significant differences or not? How to get students physical health comprehensive evaluation? These questions all need to be analyzed and researched on data. This research firstly establishes weight influence model on physical health, then states different sources students physical health difference examination theoretical basis, finally establishes college students' physical health comprehensive evaluation model so as to provide theoretical basis for directions of college students' physique improvement.

COLLEGE STUDENT PHYSICAL HEALTH TEST ITEMS ANALYSIS AND EVALUATION MODEL ESTABLISHMENT

Since students physical health conditions are brought into school entire work evaluation system, every university would carry out physical health test to students in college every year, then provides test result for education department feedback. At present stage, college students' physical health test items are mainly as following five forms [6].

●Height and weight, that used for evaluating student body symmetry;
●Lung capacity that used for evaluating student maximum ventilation ability;
●Standing long jump, which used for evaluating student long jump ability;

Grip (male) and seated body forward flexion (female), that used for evaluating male student forearm and hands muscle strength and female students achievable movement range of trunk, waist and hip joint in static state. Step test, which used for evaluating heart rate change situations after quantitative loading in 3 minutes.

Physical health model based on weight test data

To analyze weight influences on physical health and judge deviation that occurs to some students' test results, it first should go with data handling, and then utilize SPSS software generating P-P figure and K-S test result so as to define whether measurement data meet normal distribution or not, finally establish grey correlation model that used for analyzing weight test data influences on physical health so as to reflect correlation degree and direction between the two [7].

Random select 45 students test data from one college students physical testing database that feedback to education department, and select one student test value as reference sequence, such sequence represented by x_{0k}, other students test data are regarded as contrast sequence which represented by $x_i(k)$, make standardization handling with each factor, standardization formula is as formula(1) shows.

$$x_i^*(k) = \begin{cases} \dfrac{x_i(k) - \bar{x}_i}{s_i} & s_i \neq 0 \\ 0 & s_i = 0 \end{cases}$$

(1)

Then determine absolute difference, it can get sequence generation number Δ_{0j}, and make use of the generation number Δ_{0j} sequence to calculate correlation index, and take resolution ratio as 0.5, so that can get correlation index corresponding to reference sequence, as formula(2) shows.

$$\xi_{0p}(k) = \frac{\Delta_{\min}^* + 0.5 \cdot \Delta_{\max}^*}{\Delta_{0i} + 0.5 \cdot \Delta_{\max}^*}$$

(2)

Suppose that 5 indicators have the same weight, and then the correlation between contrast factor and reference factor is as formula (3) shows.

$$r_{0i} = \frac{1}{5} \sum_{k=1}^{5} \xi_{0p}(k)$$

(3)

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Students physical health comprehensive score can be got through weight, then make use of P-P figure and K-S test result in SPSS statistics software to carry out normal distribution examination on students' comprehensive correlation degree. If sample point scatters in straight line on normal distribution P-P figure, then examination data is basically in one straight line; if bilateral examination result $p > 0.05$, then it is thought that students comprehensive test correlation degree are conform to normal distribution, finally utilize mathematical theory to determine interval estimation so as to judge test data deviation row in result. If correlation degree meets normal distribution, it can get μ as a confidence interval that its confidence level between 1 and a, its interval is as formula (4) shows.

$$\left(\overline{x} - \frac{s}{\sqrt{n}} t_{\frac{\alpha}{2}}(n-1), \overline{x} + \frac{s}{\sqrt{n}} t_{\frac{\alpha}{2}}(n-1) \right)$$

(4)

Input data can determine the interval, if confidence interval gets smaller from extension data capacity, then it indicates the bigger data capacity is the more precise confidence interval would be, and the better data normal distribution from database that got. If sample data goes beyond confidence interval, data is thought to have deviation.

Different sources students' physical health difference analysis based on hypothesis testing
Make normal distribution test on 8 regions students physical test measurement data, similarly utilize normal P-P figure and single sample K-S test result to analysis each source college students physical health test scores whether belong to normal distribution or not. If it is in normal distribution, in order to state whether different sources students' physical health have significant difference or not, significant test should be made on data, its test steps as following 3 steps.

STEP1 hypothesis H0:
●Different sources students, their physical health have significant difference.
●H1: Different sources students, their physical health don't have significant difference.

STEP2   Apply SPSS software to do K-W test on statistics, gets relative index average value of testing statistics and different sources students' rank average value .

STEP3 Analyze test results.
Test result analysis can get sum of ranks statistics and freedom degree from test statistics relative index average values. Assume that sum of ranks statistics is $K - W$, its value can be calculates as formula (4).

$$K\_W = \frac{\sum_{i=1}^{k} n_i \left(\frac{R_i}{n_i} - \frac{n+1}{2} \right)^2}{\frac{1}{n-1} \sum_{i=1}^{k} \sum_{j=1}^{n_i} \left(R_{ij} - \frac{n+1}{2} \right)^2}$$

(4)

In formula(4),numerator represents interlocks square sum, denominator represents whole group samples rank variance, then input data to determine 8 sources sum of ranks, and bring it into formula(4) can get sum of ranks statistics K_W ,if sum of ranks statistics   and data in K-W test statistics close to and its progressive significance value is above 0.01, then it can get conclusion that different sources students physical health test data has significant difference, on the contrary it doesn't have significant difference.

College students' physical health comprehensive evaluation based on GPM model
The foundation for GPM model setting is reasonable indicator weight defining; this paper adopts entropy method to define indicator weight, if it has n schemes to be evaluated, m evaluation indicators, then original indicator data matrix that formed is $X = \left(x_{ij} \right)_{n \times m}$, p_{ij} represents the probability that x_{ij} occurs to different schemes, information entropy is as formula(5) shows.

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$$H(x) = -\sum_{i=1}^{n} p(x_i) \ln p(x_i)$$

(5)

At first it needs to make positive indicator, the bigger test value is the better indicator would be, and then data handling method is as formula (6) shows.

$$x' = \frac{x_i - \min x_i}{\max x_i - \min x_i}$$

(6)

If the smaller the test value is the better the indicator would be, then data handling method is as formula (7) shows.

$$x' = \frac{\max x_i - x_i}{\max x_i - \min x_i}$$

(7)

Then make indicator being dimensionless, the handling method is as formula(1) shows, and determine the i scheme indicator value weight under the j indicator as formula(8) shows.

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}}$$

(8)

Finally work out entropy value e_j of the j indicator, get weight ω_j, weight computational is as formula (9) shows.

$$\begin{cases} e_j = \frac{1}{\ln n} \sum_{i=1}^{n} p_{ij} \ln p_{ij} \\ \omega_j = \frac{1 - e_j}{\sum_{i=1}^{n} (1 - e_j)} \end{cases}$$

(9)

Apply formula (9), it can be got corresponding weight of male student and female student five indicators influence on physical health. According to 5 indicators, it can be got students physical health comprehensive evaluation model as formula (10) shows.

$$GPM(t) = 100 \left[\prod_{i=1}^{5} \left(\sum_{j=1}^{n_i} \omega_{ij} f(v_{ij}^t) \right) \right]^{\frac{1}{5}}$$

(10)

In formula(10), $\sum_{j=1}^{n_i} \omega_{ij} = 1$, Input data into formula(10), it can get student physical health comprehensive scores, and master total situation of physical ability quality   according to qualified rate.

EMPIRICAL ANALYSIS
Physique health conditions empirical analysis based on weight test data
Sampling 45 students' physical health test data standardization conditions is as Table 1 shows.

Table 1: Partial sample data standardization result table

Sample No.	Height ratio	Weight ratio	Lung capacity ratio	Step test	Grip and body forward flexion	Long jump ratio
sample1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
sample 2	1.02630	0.93290	0.46788	1.00000	0.79293	0.84685
sample 3	0.99940	1.09165	0.79018	0.70769	0.67677	1.04054
sample 4	1.05320	1.09656	1.26332	0.61539	0.83165	0.97748
sample 5	1.03826	1.00818	0.84850	0.83077	0.68687	1.00451
⋮	⋮	⋮	⋮	⋮	⋮	⋮
sample 37	1.04124	1.44681	1.03903	0.75385	0.79461	0.84685
sample 38	0.99522	0.92799	0.79391	0.69231	0.64983	0.95946
sample 39	0.99402	1.13093	0.77352	0.84615	0.84680	0.89189
sample 40	1.05918	1.09002	0.98114	0.81539	0.84680	0.95946
sample 41	1.03347	1.01964	0.75729	0.75385	0.74579	0.85586
sample 42	1.01196	1.25686	0.68603	0.67692	0.70539	0.84685
sample 43	1.01375	1.03110	0.64679	0.73846	0.98148	1.05405
sample 44	1.03467	1.00491	0.83227	0.73846	0.79630	0.95496
sample 45	1.04423	0.97218	0.78952	0.69231	0.67845	0.92793
Note：sample 1 is reference vector						

From Table 1 data, it can be known that $\Delta^*_{min}=0, \Delta^*_{max}=1.0136$, use SPSS statistics software can get normal P-P figure and K-S single sample test result as Figure 1 shows.
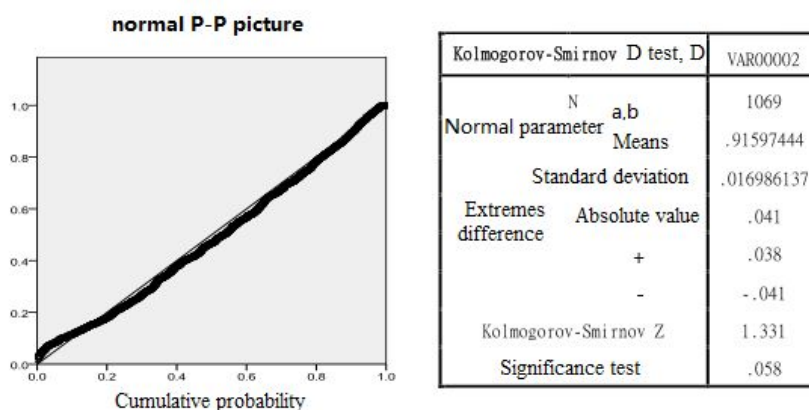

Figure 1: 1069 college students physical health test comprehensive evaluation correlation degree result

From Figure 1, it can be known that students' comprehensive test correlation degree is approximately a straight line, and the straight line basic coincides with diagonal line, bilateral test result is $p=0.058>0.05$, it can judge that students' comprehensive test correlation degree conforms to normal distribution.

Male student and female student each indicator correlation degree to weight is as Table 2 shows.

Table 2: weight and each indicator correlation degree table

Gender	Height	Lung capacity	Step test	Grip weight indicator or seated body forward flexion	Standing long jump
Male students	0.848	0.730	0.693	0.854	0.825
Female students	0.834	0.719	0.686	0.653	0.769

Bring data into formula(4), it can get confidence interval as (0.888949,0.942999),if sample capacity is equal to 100, its confidence interval is (0.912604,0.919344), if sample capacity is equal to 1000, its confidence interval is (0.914885,0.916992);It can be found that confidence interval precise increases following by sample capacity increasing.

Different sources students' physical health difference empirical analysis based on hypothesis test
Make normal distribution test of 10 students from one of sources can get normal P-P figure and K-S test result as Figure 2 shows.
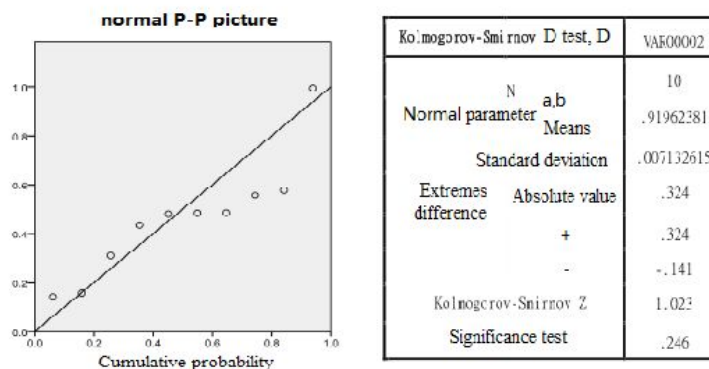
Figure 2: one source students' physical health test data normal distribution test result

Similarly apply SPSS statistics software can get other 7 sources students' physical health test data normal distribution test results, test results are all conform to normal distribution.

8 sources total 80 sample data, apply SPSS software can get K-W test statistics and rank result as Table 3 shows.

Table 3: K-W test result table

test statistics	
statistics	correlation index average value
sum of ranks statistics	3.037
Freedom degree	7
Progressive significance	.882
Rank	

Sources	sample capacity	rank average value
Source 1	10	41.00
Source 2	10	40.20
Source 3	10	43.60
Source 4	10	49.00
Source 5	10	41.10
Source 6	10	35.20
Source 7	10	33.20
Source 8	10	40.70
Total	80	/

Finally get K_W equal to 2.737 that close to 3.037, its progressive significance is 0.882>0.01, therefore it can get those different sources students' physical health data have significant difference.

Student physical health conditions comprehensive evaluation empirical analysis based on GMP model
In order to avoid too small value and standardize data goodness, adopt standard method as formula (11) shows, from which x' arrives at 1 as highest while 0 as lowest.

$$0.4 \cdot x' \cdot 0.92 + 0.6 \tag{11}$$

Use entropy method can get male students and female students each indicator weight value as Table 4 shows.

Table 4: Table of male students and female students each indicator weight defined by entropy method

Indicator	Lung capacity body mass index	Step test	Standing long jump	Grip body mass index	Seated body forward inflexion
Male students	0.20	0.30	0.15	0.30	0.05
Female students	0.15	0.30	0.15	0.30	0.10

Use 30 sample data shows in Table 5, bring them into GMP model shows in formula(10) can get students fail rate as 50.3%,pass rate as 32.4%, while good and excellent student numbers proportion is less than 20%, it can judge student physical health conditions is totally in worse level.

Table 5: 30 samples original data

Sample No.	Height	Weight	Lung capacity	Step test	Grip and body forward inflexion	Long jump
Sample 1	167.30	61.10	4561	65	59.4	2.22
Sample 2	171.70	57.00	2134	65	47.1	1.88
Sample 3	167.20	66.70	3604	46	40.2	2.31
⋮	⋮	⋮	⋮	⋮	⋮	⋮
Sample 28	162.80	48.60	3011	50	20.1	1.67
Sample 29	162.30	54.90	3245	49	16.8	1.64
Sample 30	164.00	54.80	2522	47	19.3	1.65

To further state male student and female student physical health total condition take newly students total 1069 samples to carry out comprehensive evaluation, their results are as Figure 3 shows.
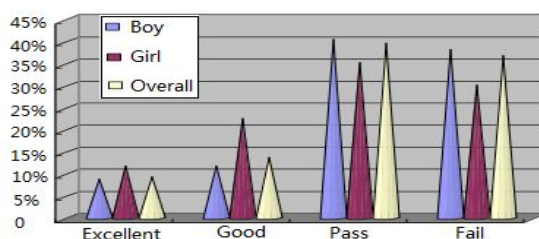

Figure 3: Male student, female student and total physical health evaluation result classified ratio cone figure

CONCLUSION

This paper carried out research on college students physical health feedback data to education department, focused analysis on weight and physical health other indicators correlation degree conditions and test value deviation judgments, studied different sources student physical health data differences, established GMP student physical health comprehensive evaluation model, and verified modern college students physique drop facts through data. Research results showed that the proportion of good and better physique among fresh college students is quite small, while failed and qualified students covered large proportion, female student physique was better than male student in the category of excellent and good, while lower than male student in failed and qualified category, which proofed that on a whole female physique was better than male, while whole student physical conditions reflected worse result. This research provided theoretical basis for physical health test data analysis so as to make contribution for improving college students' physique.

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