ANALYSIS OF PHYSICAL HEALTH TEST RESULTS OF COLLEGE STUDENTS USING FUZZY LOGIC AS AN EVALUATION METHOD

ANÁLISE DOS RESULTADOS NOS TESTES DE SAÚDE FÍSICA DOS ESTUDANTES UNIVERSITÁRIOS UTILIZANDO LÓGICA FUZZY COMO MÉTODO DE AVALIAÇÃO

ANÁLISIS DE LOS RESULTADOS EN LAS PRUEBAS DE SALUD FÍSICA DE LOS ESTUDIANTES UNIVERSITARIOS UTILIZANDO LÓGICA DIFUSA COMO MÉTODO DE EVALUACIÓN

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ABSTRACT

Objective: Based on the evaluation method with fuzzy integrals, this paper analyzes the results of physical health tests of college students. Methods: Principal component analysis was used to extract the psychological factors. The evaluation model was organized into three levels to evaluate the physical health of college students. Results: The physical health status of University Q students is below average. Most of the students' physical examination results are concentrated in the passing areas, and few students have an excellent to good ratio. Conclusion: The fitness assessment model of university students, based on an assessment with fuzzy integrals, has certain generalizability and applicability. The established index system and the comprehensive evaluation model are suitable for thoroughly evaluating each student and comprehensive fitness evaluation of all boys and girls in a class or college. **Level of evidence II; Therapeutic studies - investigation of treatment results**.

Keywords: Fuzzy Logic; Student Health; Physical Examination.

RESUMO

Objetivo: Com base no método de avaliação com integrais fuzzy, este documento analisa os resultados dos testes de saúde física dos estudantes universitários. Métodos: Foi utilizada a análise de componentes principais para extrair os fatores psicológicos. O modelo de avaliação foi organizado em três níveis para avaliar a saúde física dos estudantes universitários. Resultados: O estado de saúde física dos estudantes da Universidade Q está abaixo da média. A maioria dos resultados dos exames físicos dos estudantes está concentrada nas áreas de aprovação, e poucos estudantes têm uma proporção excelente e boa. Conclusão: O modelo de avaliação da aptidão física dos estudantes universitários, baseado em uma avaliação com integrais fuzzy, tem certa generalização e aplicabilidade. O sistema de índice estabelecido e o modelo de avaliação abrangente não só são adequados para avaliação abrangente de cada estudante, mas também para avaliação abrangente da aptidão física de todos os meninos e meninas de uma classe ou faculdade. **Nível de evidência II; Estudos terapêuticos – investigação de resultados de tratamento**.

Descritores: Lógica Fuzzy; Saúde do Estudante; Exame Físico.

RESUMEN

Objetivo: Basándose en el método de evaluación con integrales difusas, este artículo analiza los resultados de las pruebas de salud física de los estudiantes universitarios. Métodos: Se utilizó el análisis de componentes principales para extraer los factores psicológicos. El modelo de evaluación se organizó en tres niveles para evaluar la salud física de los estudiantes universitarios. Resultados: El estado de salud física de los estudiantes de la Universidad Q está por debajo de la media. La mayoría de los resultados de los exámenes físicos de los estudiantes se concentran en las zonas de aprobado, y son pocos los que tienen una proporción excelente y buena. Conclusión: El modelo de evaluación de la aptitud física de los estudiantes universitarios basado en una evaluación con integrales difusas tiene cierta generalizabilidad y aplicabilidad. El sistema de índices establecido y el modelo de evaluación integral no sólo son adecuados para la evaluación integral de cada estudiante, sino también para la evaluación integral de la aptitud de todos los chicos y chicas de una clase o colegio. **Nivel de evidencia II; Estudios terapéuticos – investigación de resultados de tratamiento**.

Descritores: Lógica Difusa; Salud del Estudiante; Examen Físico.

INTRODUCTION

Physical health monitoring, as an important way for our government to understand the current situation of adolescent students' physical health, has limitations only from the test and reported data, and can not reflect the effect of the whole monitoring work comprehensively and multidirectional.[1] Teenagers' physical health is related to the healthy growth of teenagers, the happiness of families, the inheritance and development of nationalities and the prosperity and

growth of the country, which is of great significance to teenagers, families, nations and countries.[2]

College students' physical health test mainly includes body shape, physical function, physical quality, etc. Specific test items include height, weight, vital capacity, standing long jump, grip strength (for boys), sitting forward flexion (for girls) and step test.[3,4] According to the results of College Students' physical fitness test, using the methods of system clustering, one-way ANOVA and discriminant analysis, the models of BMI grading, cluster analysis, ANOVA and comprehensive evaluation grading of physical health were established, and the influence degree and health status of College Students' physical health problems were analyzed by using MATLAB, SPSS and other software.[5,6] The purpose of this paper is to explore the significant influence of weight on college students' physical health and establish a fuzzy comprehensive evaluation model of college students' physical health.

Research objects and methods

Object of study

A total of 258 students from Q University, including 144 boys and 114 girls, aged between 17 and 21, were selected by cluster sampling.

Research technique

Collecting the data of physical examination of Q University students in recent two years, the research group collected the literature materials such as "physical examination of colleges and universities" and "students' physical health" through the school library information center.

According to the basic principles of comprehensive evaluation of physical fitness, the physiological factors are established on the basis of referring to the measurement indexes formulated by the Institute of Physical Fitness Research and foreign physical measurement schemes and referring to the relevant measurement indexes in relevant literature. The symptom checklist 90 (SCI-90) was used for investigation, and then SPSS11.0 software was used for factor analysis of various psychological factors, thus establishing psychological factors.

Use Excel to arrange, input and analyze data. In the evaluation of monitoring effect, there are many factors involved and the quantitative analysis is ambiguous. In order to solve this problem, the fuzzy vector single value in the comprehensive fuzzy scoring method is used for evaluation, and the grade score is given for fuzzy comprehensive scoring.

Model assumption and model establishment

Model hypothesis

In order to ensure the accuracy and rationality of the model solution, we put forward the following assumptions in combination with practical problems:

1. Assume that the influencing factors involved in this paper play a decisive role in physical health;

2. It is assumed that the selected data for model establishment and solution are representative and true and reliable;

3. It is assumed that the physical condition of the students taking the physical fitness test is at a normal level;

4. It is assumed that the deviation of randomly selected data is caused by the students' failure to comply with the physical test specifications;

5. It is assumed that none of the selected test students have any unexpected situation on the same day;

6. Assume that there is no other person to replace the test and there is no cheating behavior;

7. Assume that the invigilator truthfully fills in the test results of the students.

Model building

The general steps of fuzzy comprehensive evaluation are as follows:

1. Combined with specific problems, select appropriate evaluation factors and establish factor sets: $U = \{u_1, u_2, \cdots, u_m\}$;

2. Determine the weight matrix of each factor $A\%$: $A\% = \{a_1, a_2, \cdots, a_m\}$, and $\sum_{k=1}^{m} a_k = 1, a_k \in [0,1]$;

3. Establish an appropriate comment set: $V = \{v_1, v_2, \cdots, v_m\}$;

4. Evaluate each factor to obtain a single factor evaluation matrix:

$$A\%(r_{ij})_{m \times n} = \begin{bmatrix} r_1 & r_2 & \cdots & r_{1n} \\ r_2 & r_2 & \cdots & r_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ r_{m1} & r_{m2} & \cdots & r_m \end{bmatrix}$$

5. Comprehensive evaluation: $B\% = A\% \cdot R\%\{b_1, b_2, \cdots, b_n\}$. In which: $b_j = \sum_{i=1}^{m}(a_i \cdot r_j), j = 1,2,\cdots,n$. And give the evaluation results according to a certain rule.

Research results and analysis

Basic profile

Table 1 gives the mean and standard deviation s of 12 physiological factors, which can be used to calculate the membership function in the following fuzzy evaluation.

Analysis of students' evaluation results of aerobics elective classes in Q University

In the analysis of the results of the two indicators at the learning level, there is a bad review on the mastery of knowledge. The reason may be that physical examination pays too much attention to the practical process and ignores the study of theoretical knowledge, so it disagrees with the mastery of relevant knowledge (Figure 1).

Through this physical monitoring, most students in this class have learned some knowledge and mastered the test contents. In the mastery of skills and knowledge, the mastery of skills is better than the mastery of knowledge, because in the process of physical fitness test, students can clearly understand the skills to be mastered in the test items, and then optimize the test results according to their own qualities and skills. Therefore, on the whole, the evaluation results of the learning level are still good.

Table 1. Q university students' physical fitness test numerical statistics.

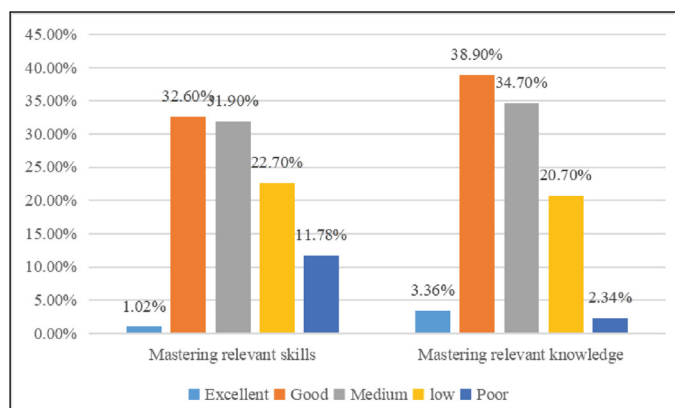| Index	Mean value	Standard deviation	Index	Mean value	Standard deviation
Height	171.21	6.63	Vital capacity	3896.71	688.24
Weight	60.42	10.10	50m	8.02	0.82
Chest measurement	83.60	6.73	Long jump	233.6	20.43
Pulse	82.11	9.36	1000m	248.73	29.33
Systolic pressure	115.73	11.28	Power of gripping	41.38	7.78
Diastolic pressure	72.62	8.96	Seating body flexion	19.63	6.91

Figure 1. Analysis of learning level results.

As shown in Figure 2, in the monitoring results layer, 24% of the students expressed their strong agreement that this monitoring is conducive to improving the physical condition and reaching the excellent level; Similarly, 24% of the students agree with the accuracy and reliability of the test data, and 0.6% of the students think that there may be deviations in the data. Therefore, in the collection of data, it is necessary to train the monitoring personnel before measurement, and timely check the testing instruments in order to improve the accuracy of the data.

Analysis of physical health level

For 114 girls, the proportion of "fail", "pass", "good" and "excellent" in each index is calculated as the membership degree, and then the data are analyzed, and the results are shown in Table 2.

Secondly, for 144 boys, the ratio of "fail", "pass", "good" and "excellent" in each index is calculated as the membership degree, and then the data are analyzed, and the results are shown in Table 3.

Above, the membership degree of male and female students' physical fitness test is obtained and the data are analyzed, from which the comprehensive membership degree of male and female students can be obtained as follows:
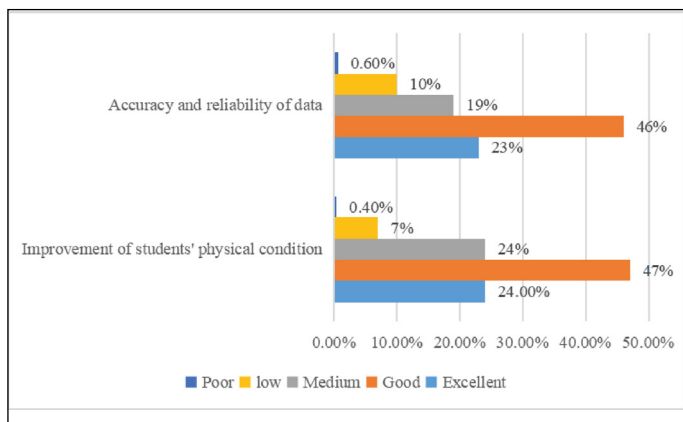

Figure 2. Result layer result analysis.

Table 2. Membership degree of girls' corresponding order to (x_i, y_i).

Indicator set	Result			
	Fail y_1	Get through y_2	Good y_3	Excellent y_3
Height and body mass index x_1	0.12	0.33	0.24	0.29
Vital capacity x_2	0.06	0.32	0.23	0.33
Sit and reach x_3	0.01	0.32	0.18	0.51
Standing long jump x_4	0.05	0.41	0.29	0.36
50m sprint x_5	0.03	0.56	0.16	0.25
800m x_6	0.11	0.28	0.20	0.08

Table 3. Membership degree of boys' corresponding order to (x_i, y_i).

Indicator set	Result			
	Fail y_1	Get through y_2	Good y_3	Excellent y_3
Height and body mass index x_1	0.31	0.41	0.23	0.08
Vital capacity x_2	0.17	0.45	0.12	0.22
Sit and reach x_3	0.12	0.51	0.11	0.17
Standing long jump x_4	0.11	0.66	0.36	0.06
50m sprint x_5	0.08	0.48	0.21	0.33
1000m x_6	0.26	0.57	0.08	0.16

Height standard body mass index:
$$C_1 = (0.22, 0.37, 0.24, 0.19)$$
Vital capacity index:
$$C_2 = (0.12, 0.39, 0.18, 0.26)$$
Index of flexion index of sitting body:
$$C_3 = (0.07, 0.42, 0.15, 0.34)$$
Standing long jump index:
$$C_4 = (0.08, 0.54, 0.33, 0.21)$$
The 50-meter dash index:
$$C_5 = (0.06, 0.52, 0.19, 0.29)$$
800 m/1 000 m index:
$$C_6 = (0.19, 0.43, 0.14, 0.24)$$

Therefore, the fuzzy relation R of $U \rightarrow V$ can be determined, and the membership degree of the fuzzy relation is a matrix of 6×4 order, that is, the fuzzy relation matrix is:

$$R = \begin{bmatrix} 0.22 & 0.37 & 0.24 & 0.19 \\ 0.12 & 0.39 & 0.18 & 0.26 \\ 0.07 & 0.42 & 0.15 & 0.34 \\ 0.08 & 0.54 & 0.33 & 0.21 \\ 0.06 & 0.52 & 0.19 & 0.29 \\ 0.19 & 0.43 & 0.14 & 0.24 \end{bmatrix}$$

According to the calculation of membership degree, we can get:
The comprehensive evaluation of body shape U_1 is: $R_1 = \lambda_1 C_1$;
Comprehensive evaluation of physical function state U_2 is:

$$R_2 = (\lambda_2, \lambda_3) \begin{bmatrix} C_2 \\ C_3 \end{bmatrix}$$

Comprehensive evaluation of physical fitness U_3 is:

$$R_2 = (\lambda_4, \lambda_5, \lambda_6) \begin{bmatrix} C_4 \\ C_5 \\ C_6 \end{bmatrix}$$

According to the formula, the comprehensive evaluation of adolescents' physical health status can be obtained as follows:

$$R_2 = (\lambda_1, \lambda_2, \lambda_3 \lambda_4, \lambda_5, \lambda_6) \begin{bmatrix} C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \\ C_6 \end{bmatrix}$$

$$= (0.12, 0.18, 0.24, 0.37, 0.27, 0.31) R = \begin{bmatrix} 0.22 & 0.37 & 0.24 & 0.19 \\ 0.12 & 0.39 & 0.18 & 0.26 \\ 0.07 & 0.42 & 0.15 & 0.34 \\ 0.08 & 0.54 & 0.33 & 0.21 \\ 0.06 & 0.52 & 0.19 & 0.29 \\ 0.19 & 0.43 & 0.14 & 0.24 \end{bmatrix}$$

$$= (0.11, 0.32, 0.14, 0.22)$$

The score of R_4 is 0.81 < 1, which means that the overall physical health level of students is lower than the standard physical examination level.

Suggestion

Improve school sports facilities, increase openness, build a school physical health education culture, create a good environmental atmosphere, strengthen the publicity of sports characteristics in campus culture, and integrate sports into campus culture. It is suggested that the weak links should be strengthened and the work quality of the superior links should be maintained in the future physical monitoring work. Take targeted methods and measures to enhance the efficiency of organizational work, so as to improve the effect of physical fitness monitoring. Colleges and universities should pay attention to malnutrition and overweight in all height and weight segments, as well as the body shape index of obese college students. It is suggested that diversification should be adopted in physical education teaching methods, and targeted measures should be formulated to improve their morphological structure, so as to promote the normal development of college students' physical form.

The establishment of various sports associations or clubs in colleges and universities can strengthen the links of various links in physical education. To strengthen the publicity of community youth sports activities, build community sports culture atmosphere, strengthen the organization and guidance of community youth sports activities, and improve the scientific and safety of community youth sports activities. Fuzzy comprehensive evaluation of college students' physical fitness is also helpful for reasonable grouping and targeted training in physical education class, which has a good reference value for teaching, and is meaningful and popularized for scientific evaluation of students' physical fitness. It is suggested to try out the student sports association system or club system in Q University, so as to stimulate students' interest in strengthening physical exercise, integrate physical education with competition and entertainment, and achieve the purpose of strengthening students' physique and improving their health level.

Strengthening the hardware construction of sports facilities in colleges and universities and creating a good exercise environment are essential inputs for strengthening students' physique. It is suggested that colleges and universities should increase investment in sports venues and equipment, so that students can engage in physical exercise in an environment with complete facilities and good activity atmosphere, so as to promote students to develop the habit of exercising consciously, cultivate students' lifelong sports ideas and develop the habit of exercising consciously.

We should set up a new teaching goal system of physical health education course, build a teaching model with physical health education characteristics, comprehensively apply traditional teaching models, actively introduce new physical education teaching models, comprehensively sort out the teaching process of physical health education course, carry out "sunshine long-distance running" activities in response to national requirements, formulate "sunshine long-distance running" programs, and promote the formation of students' exercise habits in a large area with characteristic activities. Improve the "Implementation Plan of Physical Health Test", make more investigations and interviews, and work out effective measures to ensure the smooth development of physical test. Therefore, it is suggested to set up a college students' physique monitoring center, which is responsible for testing the physical health of all college students, and provides scientific and objective basis for the education authorities to effectively monitor the physical health of college students.

Through the quantitative analysis and evaluation of all levels, the students' physique monitoring achieved the highest score in the evaluation of organizational benefits, while the behavior change was the lowest. Grasp the change of the new physical test standard, strive to increase the number of students with "excellent" and "good" ratio, and gradually reduce the proportion of failing. The influence of psychology on physical health is far greater than that of physical health on psychology. Therefore, it is necessary to guide college students to take part in physical exercise purposefully, and to improve their mental health by bearing the outcome of the competition, which is of guiding significance to promote the overall improvement of college students' health.

CONCLUSION

In this paper, from BMI, one standard deviation, fuzzy mathematics and other angles, using a variety of statistical methods, and also passing various test scales, it is concluded that there is no significant difference between the significant impact of body weight on college students' physical health and the physical health of students from different places of origin. The current situation of female students' physical health is mainly concentrated in the passing areas, and the common characteristics are: There are very few students who can reach the excellent standard, and there are not many students with good proportion. From the perspective of fuzzy comprehensive evaluation, the physical test results of Q University students are quite different from the standard physical test level, and the physical health status of young students is worrying. As we all know, the most direct, effective and economical way to improve the physical health level of young people is to actively and scientifically participate in physical exercise.

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