



RESEARCH ON INFLUENCE OF PHYSICAL EXERCISE AND NUTRITION INTERVENTION ON PHYSICAL QUALITY OF COLLEGE STUDENTS

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ABSTRACT

The study, setting the freshmen of a college as the objects for body-building and exercise combined with nutrition intervention and observing the difference before and after the intervention, mainly focuses on the difference of influence of body-building and sport combined with nutrition intervention on the body shape, physical function, physical quality and physical prowess of teenagers, so as to provide helpful theoretical and practical basis for nutrition intervention scheme that is used to strengthen the physical quality of teenagers.

1. Introduction

In recent years, according to the tracking investigation of physical exercise conditions for many years made by governments, the investment in public exercise and promotion of national body-building program are good for obtaining the economic and social benefits. Many countries has formulated body-building plan organized by the government in accordance with the national condition, and our country also has carried out the physique test on the whole people separately in 1995 and 2000. All of those activities are aimed to improve the physique of people. Many scholars think that people's physical are mainly affected by nurture, acquired disposition, environmental & social conditions and sports, but the largest factor that affects the physical is the rationality of nutrition ingestion. Reasonable nutrition can help to keep health and prolong lifespan, but the malnutrition will bring bad effect on the body or even lead to some diseases. Yang Zeyi, an expert in Sport & Exercise Nutrition, said that life lies in movement and nutrition, which made people gradually understand that the healthy living

method with scientific exercise and adequate nutrition is essential and helpful for perfecting and improving people's physique. To improve people's physique scientifically and effectively, many experts, scholars and researchers have conduct a large amount of relevant study (Niu, 2013).

According to some existing literatures, college students in different places are obviously different in physical function, which is not only affected by hereditary factor, but also closely related to the local environment and economic condition (Donaldson and Hill, 2003). As is known to all, students from the south have are obviously distinguished from students from the north due to their height, weight and nutrition condition. Students from the south are poorer than students from the north in terms of height and weight, and the students from economically developed area are better than students from developing area (Kathy, 2007). Height, weight, vital capacity and other relevant indexes are the typical reference indexes to judge the physical condition of student and also the important factors for the student physique test. The south of

Yangtze River belongs to subtropical moist climate, it is warm throughout the year and rich in rains, but how are the body shape, physical quality and physical function of teenagers in this region?

In order to promote the physical health level of teenagers in Anhui Province, it is important to get aware of the physical quality, body shape and physical function, exercise features as well as the influencing factors on the physical quality of teenagers in this region and the weak point, and make them have targeted physical exercise and conduct nutrition intervention based on the existing level (Susan, 2007).

Therefore, based on the existing literatures, this paper presents the test and analysis on physical quality, physique state, physical function and other indexes of teenagers in Anhui Province after body-building exercise and nutrition intervention, and further gives the existing problems and the influencing factors. Moreover, the specific influence of intervention on physical quality of teenagers are determined through exercise and nutrition interventions in order to give suggestions to correct lifestyle and exercise way for teenagers as well as excellent exercise and diet habits for students (Wengstrom and Wahren, 2009). The study of influence of physical exercise and nutrition intervention on physical quality of teenagers in the paper can be also used for providing some practical suggestions for improving the physical quality of teenagers in our country and further perfect the health for millions of teenagers in China.

2. Materials and methods

For the whole society, there are lots of complex factors that affect the health of teenagers such as inheritance, material condition, physical exercise, environment, lifestyle, habit and so on. Teenagers' physical quality has become poorer and poorer in the past continuous twenty years because of not only the comprehensive factor, but also the multi-factor dynamic influence. In this paper, the influencing factors on physical quality of teenagers are

divided into macro factor and micro factor according to the different levels of the teaching staff. The micro factor generally refers to what leads to the decrease of teenager's physical quality thanks to the mistakes of education decision makers, including the education PE policy and development strategy in the country or in a region (Kathy, 2007). For example, the relationship between PE and the politics & economy are not well done, the public body-building activity and promotion of public physical status are not set as the basis for administration of the country at the right moment, or the safety education and psychological health education are not developed as early as possible. The macro factor may have an influencing scope of the whole country, causing bad effect to many generations and seriously hindering the healthy development of the society (Wengstrom and Wahren, 2009). Micro factor refers to the mistakes of school educators in teaching process which results in the physical quality decrease of teenagers, for example, the purpose of PE course cannot meet the demand of social development, school leaders think little of PE, the PE teaching contents are out of date, the PE course is not launched on schedule but subject to other courses, PE teachers fails to run new teaching method, and PE evaluation is unreasonable and not objective (Li et al. 2010). The micro factor will bring direct impact on the well-developed in mind and body of the educatees, affecting the benefits of millions of parents or even the stable development of the whole society. Macro factor is an important aspect that affects the health of teenagers, but the micro factor shall not be neglected, as is shown in Figure 1.

2.1. Objects

According to the demand of the research, 120 freshmen at age of 17-20 years old of a college were selected as the objectives (Montanari, 2008). All objects were informed the research purpose and experimental method in advance and they were ensured voluntarily to take part in the experiment. The experimental members had

physical exercise and nutrition intervention for 12 weeks.

2.2. Methods

Though the combination of experimental and theoretical study, the data in the paper are true and reliable though the experiments and the

experimental results were analyzed according to the relevant theoretical knowledge to discuss the influence of physical exercise and nutrition intervention on the physical quality of teenager.

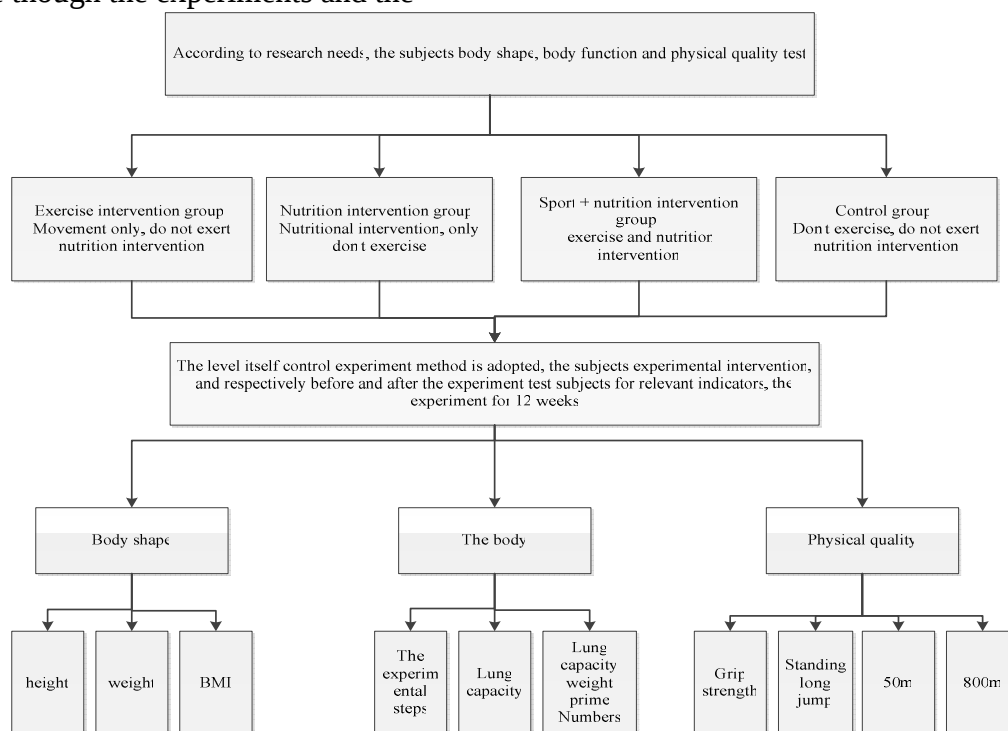


Figure 1: Study design road map

Specific research methods include literature study, experimentation and mathematical statistics (Palacio and Nuin, 2009).

2.3. Contents

According to the *Student Physical Health Standard*, the test items were: height, weight, BMI, vital capacity, step test, vital capacity/weight ratio, grip, standing long jump, 800m, and 50m.

2.4 Specific sport training schedule

Each time of training was launched as planned and the condition was recorded by the tester day to day. After training, the tester communicated with subjects timely to observe the body reaction and ask the feelings, and adjustment was made when necessary to ensure the normal training schedule. The specific training plan is shown in Table 1.

Table 1. Specific training schedule

Weeks	Exercise	Exercise time	Exercise intensity	Exercise place
1	Slow rope skipping, transform the terrain to run, game	60min	120-140 time/min	playground
2	Slow rope skipping, 3000 jogging, game	60min	120-140 time/min	playground
3	Slow rope skipping, 15 min jogging, game	60min	120-140 time/min	playground
4	Basketball dribbling running, The stairs, Slow running, game	60min	120-140 time/min	playground

Table 1. - continue

Weeks	Exercise	Exercise time	Exercise intensity	Exercise place
5	Aerobics, Strength training, game	60min	120-140 time/min	playground
6	Basketball dribbling running, Strength training, game	60min	120-140 time/min	playground/outdoor
7	aerobics, Strength training, game	60min	120-140 time/min	playground/outdoor
8	aerobics, swimming, game	60min	120-140 time/min	playground/outdoor
9	Basketball dribbling running, game	60min	120-140 time/min	playground/outdoor
10	Slow running, game	60min	120-140 time/min	playground/outdoor
11	aerobics, game	60min	120-140 time/min	playground
12	Rope skipping, leapfrog, game	60min	120-140 time/min	playground

The training plan is divided into three stages according to the exercise strength: the first stage (1~3 weeks) is the adaption stage, emphasizing on low intensity of training; the second stage (4~7 weeks) is the improvement stage mainly on medium intensity as well as small amount of high intensity exercise; and the third stage (8~12 weeks) is the consolidation stage mainly for medium and high intensity training (Montanari, 2008). The training time is 5:00-6:00 pm of each day. The subjects wear heart rate monitor during the training process to maintain their heart rates within the applicable scope as far as possible. The researcher recorded the content, attendance, reaction of trainees each time and shall also duty the supervision at the same time. Considering that the trainees are teenager students and in order not to impact their physical and psychological health, attentions shall be paid to the following matters:

(1) Warm up before exercise and do some relaxed movements after exercise to avoid exercise injury;

(2) Communicate with trainees timely and observe the changes during training; conduct proper treatment for the trainees with special condition, and adjust the training plan as per the specified condition (Palacio and Nuin, 2009);

(3) Check the dressing of the trainees to prevent their body injury because of clothing.

2.5. Formulation and implementation of nutrition intervention plan

The nutrition intervention scheme is formulated after surveying the dietary condition and knowing the nutrition level and eating habit of the subjects.

According to Table 2, we can see that the carbohydrate, protein and total energy intake of the subjects everyday are lower than the recommended nutrient intake, with the differences of 3.02g/kg, 0.58g/kg and 0.65g/kg respectively, indicating that the daily diet of the subjects is not very appropriate. The scope of ratio of energy supply of carbohydrate to the total energy supply is within the recommended values while that of fat has exceeded the recommended maximum, indicating that fat intake should be reduced in the diet. The energy supply ratio of protein is higher than 25%, close to the recommended top limit, and there is an unbalanced phenomenon where the actual protein intake is little while the energy supply ratio is high, which will cause reduction of the protein level of an organism for a long time (Chen, 2013).

It can be seen from Table 3 that only the vitamin E intake of the subjects is consistent with the recommended value while other vitamin intake is less than that. These elements are mainly from fruits and vegetables. According to the dietary statistics of the subjects, we can see that most of them eat less coarse food grain, fruits or other foods, which is one of the main reason why they lack of vitamins. Moreover, the mineral

intake is also relatively small, only with the selenium intake close to the recommended amount, indicating that the mineral intake of the subjects is insufficient. There are two subjective reasons causing these phenomena, one being no

knowledge of foods containing these elements and the other no scientific diet consciousness, so theoretical guidance and learning about a rational diet should be strengthened.

Table 2. Subjects were total calorie intake and the three major nutrients TAB

	Carbohydrates	Fat	Protein	The total energy
Intake	3.95	1.59	1.36	29.36
The recommended intake	6.25	1.56	1.25	56.12
The proportion of power	52.13	11.32	26.35	
Recommended power ratio	50-60	13-16	25-32	

Table 3. Before the trial subjects body form basic statistics

Indicators	The control group	Sports group	Nutrition group	Sport + nutrition group	T	P
Height	160	160.7	160.2	160.3	0.000	0.999
Weight	52.21	56.32	55.23	55.20	-0.163	0.939
BMI	23.12	23.21	23.21	23.65	0.788	0.413

3. Results and discussions

3.1 Pre-experiment homogeneity analysis of physical function

Before the experiment, physical function indexes of the control group, motion group, nutrition group and motion & nutrition group had been tested, and the test results indicate that there is no significant difference in physical function indexes of the four groups of students, i.e. students' physical function indexes are almost consistent with each other.

3.2 Results of post-experiment body shape change of the subjects and analysis

It can be seen from Table 4 that there is no significant difference in the height of the control group, nutrition group, motion group and motion & nutrition group before and after the experiment. In weight, there is no significant difference for the control group before and after the experiment while a significant difference ($P < 0.01$) for the motion group, group & nutrition group before and after the experiment; a significant difference also exists for the nutrition group before and after the experiment. In the aspect of BMI, there is no significant difference

for the control group before and after the experiment while a significant difference for the motion group ($P < 0.01$) as well as the nutrition group and group & nutrition group ($P < 0.05$) before and after the experiment.

It can be seen from Table 5 that there is no significant difference in the height of the control group, nutrition group, motion group and motion & nutrition group before and after the experiment. It shows that the intervention plan of 12 weeks of aerobic exercise with the heart rate of 120-170 times/min companied with the recipe and nutrition education oriented nutrition intervention plan has little impact on college students' height (Zhang et al. 2012). It is mainly because that the height of 70% of teenagers is influenced by congenital factors while less influenced by acquired factors such as environments, nutrition, and exercise.

It can be seen from Table 5 that the weight of the motion group and the motion & nutrition group has decreased obviously with an significant difference (PCO.OI) compared with the control group and the weight of the nutrition group has increased obviously with an significant difference ($P < 0.05$) after the experiment compared with the motion group.

The experiment shows that scientific diets and physical exercise are good for weight loss while only diet control or physical exercise does not have a good effect. By analyzing the reason, I think this is mainly because that the subjects have maintained a certain amount of exercise and a rational diet during the experiment. Relevant data show that the weight of a human body decreases obviously in the initial stage of physical activities resulting from that the moisture and fat of the body have been consumed during exercise and then decreases slowly. From an energy supply standpoint, according to the intervention plan in the study, the subjects' heart rates are kept at 120-150 times/min and even an amount of exercise with the heart rate of 160 times/min is reached which is equal to a long run at the speed 4km/h. This intense exercise is within the scope of aerobic energy supply, so the energy consumed is almost supplied by steatolysis. Therefore, the subjects'

weight has decreased at different levels. This point can also provide a scientific theory basis for obesity people to lose weight. In addition, it was also discovered during the experiment that some students in the motion group had a bigger demand for foods after having consumed a lot of energy in exercise due to no nutrition intervention plan and their weight fails to reduce obviously and even increases due to no control of their diet and excessive intake of calories higher than the consumption of calories. Therefore, teenagers should also pay attention to diet control during physical exercise to avoid weight increase due to overeating.

It can be seen from Table 5 that, compared with the control group, the BMI of the motion group and the motion & nutrition group ($P < 0.01$) as well as the nutrition group ($P < 0.05$) increases significantly after the experiment. BMI is closely related to the weight and height, so is change in BMI. The three indexes almost increase.

Table 4. After the experiment subjects body form basic statistics

Indicators	The control group	Sports group	Nutrition group	Sport + nutrition group	T	P
Lung capacity	2958.32	2921.65	2914.25	2945.45	0.004	0.998
Vital capacity index weight	33.23	33.54	32.12	32.65	0.030	0.888
Bench test	45.12	44.12	44.56	44.75	0.625	0.524

Table 5. Before the trial subjects body form basic statistics

Indicators	The control group	Sports group	Nutrition group	Sport + nutrition group	T	P
Height	160	160.7	160.2	160.3	0.000	0.999
Weight	56.23	48.12	52.68	50.20	5.03	0.011
BMI	23.56	26.36	26.48	26.65	5.50	0.013

3.3. Results of post-experiment physical function change of the subjects and analysis

The vital capacity/weight ratio is the ratio of vital capacity of a human body to the weight, i.e. a relative value of vital capacity per 1kg reflecting the degree of correlation between the vital capacity and weight, which is used to carry out objective quantitative comparative analysis of individuals and groups at different ages and of different genders (Qi and Tian, 2011). The ratio

can also provide a reference for material selection for oxygen metabolism sport athletes and students' physical general evaluation. The calculation formula: vital capacity/weight, unit: milliliter (ml) for vital capacity and kilogram (kg.) for weight. The step test index is an important index reflecting individual cardiovascular status. The greater the ratio is, the higher the skill level is, on the contrary then is lower (Zhang et al. 2013).

It can be seen from Table 6 that there is no significant difference for the control group and nutrition group in the aspect of vital capacity index before and after the experiment while a significant difference for the motion group and the motion & nutrition group ($P<0.01$). There is no significant difference for the control group and nutrition group in the aspect of vital capacity/weight ratio before and after the experiment while a significant difference for the motion group and the motion & nutrition group ($P<0.01$). There is no significant difference for the control group and nutrition group in the step test index before and after the experiment while a significant difference for the motion group and the motion & nutrition group ($P<0.05$).

It can be seen from Table 7 that compared with the control group, the vital capacity of the motion group has increased obviously with a significant difference ($P<0.05$) and that of the motion & nutrition group after the experiment also has increased obviously with a significant difference ($P<0.01$); compared with the motion group, the vital capacity of the motion & nutrition group has increased obviously with a significant difference ($P<0.05$), and compared with the nutrition group, the vital capacity of the

motion & nutrition group has increased obviously ($P<0.01$). The vital capacity of the subjects after nutrition intervention has slightly increased and the motion group and motion & nutrition group have a greater increase range, indicating that physical exercise can increase teenagers' vital capacity. The vital capacity is closely related to exercise intensity. With the increase of exercise intensity, the vital capacity will increase. Under the exercise intervention plan, the subjects have been in exercise with moderate intensity for a long time and the muscle body can generate a lot of CO_2 while generating energy. To remove CO_2 out of the body, the respiratory system in muscle body is required to increase the workload. With the increase of depth of respiration, the respiratory muscle is exercised and its strength is increased. With the increase of exercise time, the respiratory rate will decrease and slow and deep respiratory status will appear where the respiratory muscle can get a full rest when lung is assured to have oxygen, which effectively increases the respiratory capacity and further increases the vital capacity and also promotes the subjects free of asthma during exercise.

Table 6. Each body function index change before and after the experiment table

		The control group	T	P	Sports group	T	P	Nutrition group	T	P	Sport + nutrition group	T	P
Lung capacity	Before	2947.21	0.029	0.989	2865.32	2.855	0.007	2915.65	0.588	0.625	2945.32	5.231	0.000
	after	2950.23			3121.23			2994.23			3430.21		
Vital capacity index weight	Before	33.21	0.237	0.852	33.52	2.798	0.008	32.15	0.914	0.362	32.14	3.126	0.003
	after	33.12			40.26			35.21			41.25		
Bench test	Before	45.21	0.234	0.845	44.56	2.212	0.038	44.15	0.727	0.419	45.36	2.512	0.018
	after	46.36			49.12			46.32			50.02		

Table 7. Before the trial subjects body form basic statistics

Indicators	The control group	Sports group	Nutrition group	Sport + nutrition group	T	P
Lung capacity	2945.23	3125.36	2991.23	3436.21	6.123	0.007
Vital capacity index weight	33.25	42.12	35.42	41.36	5.321	0.009
Bench test	46.32	49.23	46.81	50.12	4.412	0.032

4. Conclusions

In the paper, through exercise intervention and nutrition intervention test on 120 freshmen and post-experiment data analysis, it is obtained that different plans have influences with different degrees on college students' body shapes, physical functions and physical quality which is detailed as follows:

(1) In the aspect of physical functions, the subjects' vital capacities increase slightly.

Physical exercise increases the capacity of respiratory system, besides, some foods in the nutrition intervention plan such as apples and tomatoes also have obvious promotion functions on vital capacity. However, only nutrition intervention has no effect. Step tests indicate that the cardiovascular function has improved after the subjects experience intervention.

(2) In the aspect of physical quality, what is different from other literatures is that the subjects' upper body strength has improved after exercise intervention, which mainly results from that the items promoting the upper body strength in the exercise intervention plan for the subjects with weak upper body strength. The lower body strength of the subjects in different groups has increased, indicating that intervention plans can promote the lower body strength of teenagers. Standing long jump results of the subjects in different groups before and after the experiment are different from each other significantly, indicating that exercise intervention and nutrition intervention can obviously promote the speed quality of the subjects.

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