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Research Article

Effects of Dietary Self-management Intervention and Lose-Weight Plan on College Students

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Abstract: The purpose of this study was to discuss the effect of trinity (i.e., diet management course, regular exercise and change of living habits) intervention on contemporary overweight or obese college students in controlling their weight. By employing questionnaire survey, biochemical detection and trinity intervention method, this study aims to study the selected overweight or obese college students' abilities to control their weight, change in Body Mass Index (BMI) and improvement in physical and mental health through 8-week intervention. According to the study, the following results have been achieved: 1) after the intervention, the subjects showed remarkable decline in weight, especially male students; 2) there was no significant difference in Fasting Blood-Glucose (FBG) and cholesterol for both male and female students, but their triglyceride drops significantly; 3) the subjects had more knowledge in daily diet; for example, they knew well the relationship between food fiber and disease and the secret to control weight, fat reduction and health, etc. 4) the subjects did better in diet change, food selection and dietary behavior, etc. The study shows that lose-weight trinity intervention plan is effective in changing abnormal rate of obese or overweight college students' healthy weight.

Keywords: Dietary self-management, exercise intervention, nutrition

INTRODUCTION

In recent years, with rapid development of China's economy, incidence rate of obesity surges. The study of Ji and Sun (2004) indicates that obesity phenomenon spreads quickly among Chinese students and this disease not only occurs in cities but also in rural areas and the age of the sufferer is lower and lower. According to the 2015 Report on Chinese Nutrition and Chronic Disease issued by National Health and Family Planning Commission of the People's Republic of China, overweight rate of adults in China reached 30.1% and the obesity rate hit 11.9%, an increase of 7.3 and 4.8% compared with that in 2012; overweight and obesity rate of children and teenagers aged between 6 and 17 was respectively 9.6 and 6.4%, up 5.1 and 4.3% compared with that in WHO (2002).

Defined as one of the ten risk factors in the world by the World Health Organization, obesity is also the public health issue of many countries. Improper eating habits, especially increasing intake of fat and sugar and insufficient intake of fiber food, lead to the increase of obesity. Studies of Li *et al*. (1995) showed that regular exercises could improve physical fitness and prevent chronic or degenerative diseases. Most importantly, they could increase anti-pressure ability, prevent melancholia and help the body maintain healthy weight. Prevention of obesity has been one of the world's most significant public health research subjects in the 21st century. Since college students are in their last stage of growth and development, normal growth and development, well-built figure and good living habits will exert significant influence on their physical quality, psychological quality, employment and daily life in this stage. According to the study of Yin *et al*. (2009), 5 national physical fitness investigation data from 1985 to 2005 revealed that Chinese college students took on remarkable growth trend of overweight and obesity in nearly 20 years and they showed significant decline in body functions, 50m race and endurance run, despite their striking improvement in explosive power and flexibility quality. Among the reasons leading to rise of contemporary college students' overweight and obesity rate, sedentary study mode, dietary intake frequency and habit are probably the major issues. However, from the perspective of prevention, specialists of Asian-Pacific Association for the Study of Obesity pointed out that no matter how fat a person was, all risk factors harmful to health would decrease (Thomas *et al*., 2000) as long as BMI value slightly dropped. Consequently, this study mainly conducts intervention from three aspects, namely, diet management course, regular exercise and change of living habits. With interdisciplinary professional assistance like nutrition, rehabilitation and nursing, this study is aimed at strengthening college students' self-management abilities to control their

weight and improving their BMI, in an effort to make college students' BMI stay within healthy level and improve physical and mental health.

MATERIALS AND METHODS

Subjects: The study determined the subjects on the basis of the medial examination reports of students admitted by Chengdu Sport University in September 2013. 1) BMI, calculated on the basis of height and weight, should be greater than 24; 2) students who were abnormal in FBG (reference value: not less than 100 mg/dl), serum cholesterol (reference value: not less than 200 mg/dl) or triglyceride (reference value: not less than 150 mg/dl) or those who showed interest in weight self-management courses could voluntarily sign up for the test.

Test procedures: Pretest would be conducted on those students meeting the conditions and voluntarily participating in the test on October 15-20 in 2013. After that, 8-week trinity intervention would be conducted on them. And the post test would be completed at the end of December 2013.

Test indexes: Questionnaire test: Questionnaire in this study includes two parts, namely personal information and items based on current popular manuals about national health life.

Blood volume test: The test involves measurement and calculation of height and weight, in addition to FBG, serum cholesterol and triglyceride. The subjects will be timely informed of the groups they belong to and their contact information will be recorded by designated group leaders.

Trinity intervention method:
Diet: To encourage fresh students to lose weight, competitive activities was conducted. Four health lectures were held which were respectively themed on "Weight-loss Diet", "Selection of Diet and Suggestions", "Focus on Red, Yellow, Green and Orange Food when Eating out" and "Healthy Diet". In addition, health handbooks were prepared and special websites (including weight-loss menus, instruction videos on lose-weight exercises, sharing successful experience in losing weight and QA mechanism) were built for the subjects, so as to increase their health self-management abilities.

Self-inspection: To strengthen obese or overweight students' self-management of dietary intake and increase their amount of exercise, weekly self-inspection reports (including diet and exercise record, etc.) linking to the weight-loss website were designed and the students were required to download them in their study. Then the reports would be given to the group leaders for inspection and verification.

Exercise: A designated person would provide fitness methods, including climbing exercise and walking 4,000m every day. Also, students would be encouraged to participate in various sports activities of their schools and relevant information on varieties and methods of weight-loss exercises would be provided for them. And relevant videos and pictures would be linked to the website to improve students' independent ability of partaking in exercises.

Data processing: SPSS 17.0 for windows was used in this study, independent-sample t test, Chi-square test were used between pre- and post-test. All significant level was set at $p = 0.05$.

RESULTS AND DISCUSSION

Basic information of the subjects: In Table 1, there were 104 subjects in this study, including 56 male students and 48 female students. All subjects completed the questionnaire and blood test. From the perspective of age, the result showed no difference in gender($p<0.05$) while male students were higher than female students in BMI (26.11±1.58. vs. 24.44±2.59, $p<0.05$).

Analysis on improvement results of weight and blood biochemical values: Table 2 showed as follows:

- After intervention of trinity for 8 weeks, the subjects showed dramatic decline in weight on the whole, down from 70.91±11.26Kg to

Table 1: Age and BMI of subjects

	Total (N = 104)	Male (n = 56)	Female (n = 48)	T value	p value
Age	19.48±2.36	19.48±2.36	19.48±2.36	-0.415	0.369
BMI	25.35±2.48	26.11±1.58	24.44±2.59	-2.66	0.001

Table 2: BMI and serum biochemical indicators

	Overall		Male		Female	
	Pre	Post	Pre	Post	Pre	Post
Body weight	70.91±11.26	67.16±12.12*	80.25±9.580	75.11±10.66*	61.23±11.57	60.58±12.47
BMI	26.35±3.150	24.31±4.15*	26.71±3.160	24.51±2.89*	25.66±2.320	24.11±3.06*
FBG	93.89±7.630	92.87±6.250	94.66±6.040	92.33±5.880	92.12±6.050	91.81±7.140
Cholesterol	189.15±31.24	187.69±26.58	196.12±26.14	191.47±28.06	188.25±33.14	181.06±26.87
Triglycerides	112.58±45.69	105.61±38.24**	133.58±54.18	125.36±45.87**	91.47±36.47	85.78±41.15**

Table 3: Analysis on acquisition of nutrition knowledge

Items	Pre (Correct %)	Post (Correct %)	Test X^2; p
Which kind of food is the main supplier of sugar or starch?	89.4%(93/104)	97.1%(101/104)	4.90; p = 0.027*
2. Which kind of food contains rich iron?	86.6%(90/104)	94.2%(98/104)	3.54; p = 0.060
3. Which of the following food is the best snack, in terms of nutrition balance?	85.6%(89/104)	96.2%(100/104)	7.00; p = 0.008*
4. For healthy diet, the concept of low oil, salt, sugar and high fiber should be established.	81.7%(85/104)	94.2%(98/104)	7.68; p = 0.006*
5. Which of the following food is the main source of calorie? 6	78.8%(82/104)	85.6%(89/104)	1.61; p = 0.204
6. Which kind of food is not the main source of dietary fiber?	74.0%(77/104)	86.5%(90/104)	5.13; p = 0.023*
7. Which of the following is not the main function of vegetables and fruits?	78.8%(82/104)	87.5%(91/104)	2.78; p = 0.095
8. Intake of food containing rich fiber can decrease blood glucose and blood fat and thus reduce chronic disease.	97.1% (101/104)	99.0%(103/104)	1.02; p = 0.313
9. Vitamins in vegetables and fruits can help the body maintain optimal state.	91.3%(95/104)	92.3%(96/104)	0.064; p = 0.800
10. Reasonable weight reduction speed is 1.5-2 kg one week.	35.6%(37/104)	92.3%(96/104)	72.58; p = 0.00**
11. Maintenance of ideal weight can prevent cardiovascular diseases.	70.2%(73/104)	91.3%(95/104)	14.98; p = 0.00**
12. Which of the following nutrients cannot provide calorie?	57.7%(60/104)	85.6%(89/104)	19.89; p = 0.00**
13. With the same weight, sugar (like rice and noodles) can provide more calorie than fat.	65.4%(68/104)	91.3%(95/104)	20.67; p = 0.00**

67.16±12.12Kg ($p<0.05$). Male students mainly showed change in weight and their weight decreased from 80.25±9.58K (before intervention) to 75.11±10.66Kg ($p<0.05$). And Male students' decline in weight was of no statistical significance.

- Both male and female students showed remarkable decrease in BMI on the whole, down from 26.35±3.15Kg/m^2 (before intervention) to 24.31±4.15 Kg/m^2. Herein, male students declined from 26.71±3.16Kg/m^2 (before intervention) to 24.51±2.89 Kg/m^2 (after intervention), whereas female students decreased from 25.66±2.32 Kg/m^2 to 24.11±3.06 Kg/m^2.
- Both male and female students showed no obvious difference in FBG and cholesterol before and after intervention. FBGs of male and female students were respectively 93.89±7.63mg/dl and 92.87±6.25mg/dl and cholesterols were 189.15±31.24mg/dl and 187.69±26.58mg/dl.
- Both male and female students showed striking difference in triglyceride before and after the intervention ($p<0.01$) and their triglyceride declined from 112.58±45.69 mg/dl to 105.61±38.24 mg/dl ($p<0.01$) on the whole. Herein, male students dropped from 133.58±54.18 mg/dl to 125.36±45.87mg/dl ($p<0.01$) whereas female students decreased from 91.47±36.47 mg/dl to 85.78±41.15 mg/dl ($p<0.01$).

Comparison before and after nutrition knowledge test: In Table 3:

- Questions 1-5 are relevant contents on daily eating guide. This study mainly launched investigations on such issues as "main food source of calorie", "cognition of mineral substance, iron" and "balanced nutrition concept" in basic knowledge. According to the answers of Question 1 and 5, there was no difference before and after the test (the corresponding chi-square value were 3.54 and 1.61, $p = 0.060$ and $0.204>0.05$). However, correct ratio of the other 3 questions after the test were remarkable higher than that before the test, where in the correct ratio of Question 1 "Which kind of food is the main supplier of sugar or starch" after and before the test was respectively 97.1% and 89.4% ($X^2 = 4.90$, $p = 0.027<0.05$), that of Question 3 "Which of the following food is the best snack, in terms of nutrition balance" after and before the test was respectively 96.2 and 85.6% ($X^2 = 7.00$, $p = 0.008<0.05$) and that of Question 4 "For healthy diet, the concept of low oil, salt, sugar and high fiber should be established" after and before the test was respectively 94.2 and 81.7% ($X^2 = 7.68$, $p = 0.006<0.05$).
- Questions 6-9 are contents about increasing food fiber and preventing diseases. Among these four questions, only the correct ratio of Question 6 "Which kind of food is not the main source of dietary fiber" after the test was notably higher than that before the test (86.5% vs. 74.0%; $X^2 = 5.13$, $p = 0.023<0.05$). And there was no obvious difference in correct ratio of the other three questions before and after the test, namely, "Which of the following is not the main function of vegetables and fruits", "Intake of food containing rich fiber can decrease blood glucose and blood fat and thus reduce chronic disease" and "Vitamins in vegetables and fruits can help the body maintain optimal state".
- Question 10 and 11 are the secret to control weight. According to the two questions involved in the study, the effect after the test was better than that before the test, wherein the correct ratio of Question 10 "Reasonable weight reduction speed is 1.5-2 kg one week" before and after test was respectively 35.6 and 92.3% ($X^2 = 72.58$, $p = 0.000<0.05$) and that of Question 11 "Maintenance of ideal weight can prevent cardiovascular diseases" before and after the test was respectively 70.2 and 91.3% ($X^2 = 14.98$, $p = 0.000<0.05$).

Table 4: Results of improved healthy diet

	Overall		Male		Female	
	Pre	Post	Pre	Post	Pre	Post
Food content	23.45±5.26	27.28±4.58*	23.57±6.32	27.15±5.21*	23.18±3.29	27.36±5.11*
Eating patterns	29.78±7.26	30.47±8.12	30.23±6.39	29.66±6.25	29.41±6.36	30.25±6.47
Cooking mode	26.77±6.59	26.97±8.09	27.11±5.87	27.18±6.21	26.37±6.66	26.78±7.15
Eating out	20.11±5.47	24.89±6.08*	19.34±5.44	24.19±7.26*	20.69±5.17	25.48±6.07*
Eating behavior	15.31±5.03	18.18±5.39*	15.26±5.63	18.47±4.99*	15.40±4.19	17.87±5.43*

- Question 12 and 13 are contents about fat decrease and healthy eating. Likewise, there are two questions about this study. The correct ratio of these two questions after the test was also strikingly higher than that before the test, wherein that of Question 12 "Which of the following nutrients cannot provide calorie" before and after the test was respectively 57.7 and 85.6%, (X^2 = 19.89, p = 0.000<0.05) and that of Question 13 "With the same weight, sugar (like rice and noodles) can provide more calorie than fat" before and after the test was, respectively 65.4 and 91.3% (X^2 = 20.67, p = 0.000<0.05).

Analysis on improvement effects of diet and health questions: As indicated in Table 4:

- From the perspective of diet, scores of the subjects after the test were remarkable higher than that before the test (27.28±4.58 vs. 23.45±5.26, p<0.05). There was no significant difference between male and female students in scores, but they both have higher scores than before after the test. Herein, scores of male students after and before the test were respectively 27.15±5.21 (p<0.05) and 23.57±6.32 (p<0.05), whereas the scores of female students were respectively 27.36±5.11 and 23.18±3.29 (p<0.05).
- From the perspective of eating ways, there was no significant difference in the subjects' scores before and after the test (26.77±6.59 vs. 26.97±8.09, p>0.05). Herein, scores of male students before and after the test were respectively 30.23±6.39 and 29.66±6.25, whereas the scores of female students were respectively 29.41±6.36 and 30.25±6.47 (p>0.05).
- From the perspective of cooking method, there was no significant difference in the subjects' scores before and after the test (26.77±6.59 vs.26.97±8.09, p>0.05). Herein, scores of male students before and after the test were respectively, 27.11±5.87 and 27.18±6.21 (p>0.05), whereas the scores of female students were respectively, 26.37±6.66 and 26.78±7.15 (p>0.05).
- From the perspective of food selection when eating out, scores of the subjects after the test were remarkable higher than that before the test (24.89±6.08 vs. 20.11±5.47, p<0.05). Herein, scores of male students after and before the test were respectively, 24.19±7.26 and 19.34±5.44 (p<0.05), whereas the scores of female students were respectively 25.48±6.07 and 20.69±5.17 (p<0.05).
- From the perspective of dietary behaviours, scores of the subjects after the test were remarkable higher than that before the test (18.18±5.39 vs.15.31±5.03, p<0.05). Herein, scores of male students after and before the test were respectively 18.47±4.99 and 15.26±5.63 (p<0.05), whereas the scores of female students were respectively 17.87±5.43 and 15.40±4.19 (p<0.05).

ANALYSIS AND DISCUSSION

By employing trinity intervention method including diet management course, regular exercise and change of living habits, this study conducted 8-week intervention on overweight and obese college students and achieved favorable effects. Through the investigation on nutrition knowledge of the subjects, we knew that they showed remarkably positive effects in nutrition knowledge and dietary behaviors after the intervention despite their difference in such factors as exercise habits, parents' education background and household income. A great many students acquire nutrition knowledge from the website built in the study and 85% of the students often read the information on the Internet in detail, especially the knowledge on "Daily Eating Guide" and "Health Education Pamphlets", etc.

By introducing self-management courses into individual weight-loss case, trinity intervention is effective in changing diet and selecting food when eating out. Although students' scores in eating ways and cooking methods were higher than before, there is no statistical significance. The four lectures, themed on "Weight-loss Diet", "Selection of Diet and Suggestions", "Focus on Red, Yellow, Green and Orange Food when Eating out" and "Heathy Diet", were helpful to broaden horizons of overweight or obese students and made them register remarkable progress in diet structure and selection of food when eating out. In the future, more diversified themes and practical eating experience courses should be designed to improve healthy dietary behaviors of weight losers.

According to the study, the number of students with BMI value higher than 26 declined from 37 to 22. The studies of Foster *et al*. (2005) and Lin *et al*. (2010) revealed that weight loss of 5-10% would reduce

chronic diseases resulting from obesity. The results showed that trinity self-management intervention plan was effective in controlling weight and BMI. It is common knowledge that the three keys to controlling weight are diet control, regular exercise and good living habits. Consequently, it is of extremely importance to strengthen individual self-management abilities for overweight or obese students continuing weight-loss plan. In the study, we built special healthy weight management website to cultivate overweight or obese college students' independent abilities to control weight. Aside from that, students were divided into groups to compete with each other at set intervals to evaluate the weigh-loss effects. According to the result, better effects had been achieved, which further proved some scholars' research viewpoints (Luo *et al*., 2006). There were eating records and movement monitoring forms in the study and the subjects could also search relevant information on the Internet and download self-monitoring forms on diet and exercise record to continue filling in and monitoring weight change. Therefore, applicable information related to weight loss is planned to link with the website to facilitate the subjects' query in the future. By virtue of the subject's self-monitoring in weight, diet and exercises, self-management of the subjects' weight control would be strengthened.

CONCLUSION

- After 8-week trinity intervention, the subjects' weight reduced obviously, with average weight loss of 3.75 Kg. Male students' weight dropped more obvious than female students but they both showed remarkable decline in BMI vale. After intervention, there was no striking difference in FBG and cholesterol, while both male and female students had remarkable drop in triglyceride.
- After 8-week trinity intervention, students had more knowledge in daily eating guide, wherein they had notable improvement in correct ratio of such questions as "main food source of calorie", "cognition of mineral substance, iron" and "balanced nutrition concept". Also, they showed stronger cognitive abilities in knowledge about increase of food fiber and prevention of diseases. In particular, their performance in answering questions about the "secret to control weight" and "fat decrease and healthy eating" doubled.
- After 8-week trinity intervention, the subjects achieved remarkable performance in diet change, food selection when eating out and dietary behaviours, etc. In addition, they also made greater progress in eating ways and cooking methods.

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