

Assessment of a Physical Education Program on Health-Related Fitness and Selected Biochemical Variables of Obese Male University Students

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Abstract

Background/Objective: Physical educators need to know the effect of a physical education program they have designed for their students. To the author's knowledge, no study has been conducted on the effect of a physical education program on obese university students. The aim of this study was to find the effects of a university-based Physical Education Course (PEC) on selected health-related fitness and biochemical variables of obese male orientation-year students of King Fahd University of Petroleum and Minerals. **Methods/Statistical Analysis:** Thirty five students (18-19 years) registered for the PEC. Each class was 70 minutes, done twice a week for eight weeks. Pre and post measurements were taken for body mass, standing long jump, 30 seconds sit up, sit and reach, 800 m run, fasting blood glucose and blood lipids. Data normality was determined with the Shapiro-Wilk Test. To compare pre and post data, paired t-test was used if normal, and Wilcoxon Signed Rank Test if non-normal. **Findings:** Twenty eight students (mean = 18.93 ± 0.26 years) successfully completed the program. There were significant improvements ($p < 0.05$) in all measured parameters. **Applications/Improvements:** Such findings can encourage obese university students to take their physical education courses seriously. Physical educators can also design programs with the aim of giving their students the benefits of physical exercise.

Keywords: Blood Glucose, Blood Lipids, Health-Related Fitness, Obesity, Physical Education, University Students

1. Introduction

The weight of an individual depends on the balance between the amount of energy taken in and the amount of energy spent¹. Finucane et al.² determined that the body mass index in the world for men and women increased by 0.4 kg m^{-2} and 0.5 kg m^{-2} respectively after every ten years as from 1980 to 2008. They also determined that 205 million men and 297 million women were obese in 2008². Despite the fact that the World Health Organization considers obesity as a global epidemic which needs to be controlled³, there was a 28.7% prevalence of obesity in Saudi Arabia according to Memish et al.⁴.

Obesity can lead to complications such as metabolic syndrome, which can lead to coronary artery disease⁵. Metabolic syndrome consists of disorders such as high insulin levels, excess body weight, abnormal cholesterol levels, high blood pressure, and insulin resistance⁵. Some compli-

cations caused by obesity are type 2 diabetes, hypertension, coronary artery disease, osteoarthritis and asthma⁶.

Many studies have evaluated the effects of aerobic exercise on obese people in an effort to reduce obesity. Schjerve et al.⁷ noted that the cardiovascular health of obese people improved with aerobic exercise. In addition, Lee et al.⁸ noted a decrease in the amount of visceral fat and skeletal muscle lipid in obese people despite no reduction in body mass. According to Mertens and Van Gaal⁹, obese people with and without hypertension can benefit from a moderate weight loss if it can be preserved for a long period, as this can stabilize blood pressure levels without reaching the ideal weight.

Physical educators need to know the effect of a physical education program they have designed for their students. Thus, it is necessary to obtain data on the effect of a physical education program designed for students. This is especially important for students who consider a

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structured physical education course as their only source of physical activity. Such data will also help in modifying physical education curricula. Studies have been conducted to determine the effect of physical education programs on obesity in schoolchildren¹⁰⁻¹². However, to the author's knowledge, there are no investigations which show the effect of a physical education program on obese university students. Therefore, the aim of this study was to evaluate the effects of a physical education program on selected physiological and biochemical variables of obese male orientation students of King Fahd University of Petroleum and Minerals (KFUPM).

2. Methods

2.1 Participants

Thirty five male obese students registered for a university-based Physical Education Course (PEC) that served as the focus of this study. The course was made known to the physical education faculty, and the faculty recruited interested students who wished to participate in the course and encouraged them to register and attend. The students were told about the nature and the aims of the course. At the start of the program, the participants were asked if any of them had a special medical condition. One reported having type 2 diabetes and another, asthma. The diabetic student was asked to always have his blood glucose meter so that he could measure his blood sugar level before, during and after the exercise sessions if required, and to have a juice with him to drink when needed. The asthmatic patient was asked to always have his inhaler with him.

2.2 Ethical Considerations

The course was approved by the Scientific Committee of the Physical Education Department of the University, and the University. The test was done in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki). The participants registered for the PEC by their free will. The students signed a consent form to get their blood samples for testing, and to publish the results of this study. The privacy of their results was guaranteed.

2.3 Study Design

A pilot study was performed before the start of the PEC. In this pilot study, four obese students were selected to determine the exercise intensity, the duration of each

exercise session, and the ability of the participants to perform the exercises at such intensity. The following checks were made to make sure the program was effective and accurate in its measurements: 1. The accuracy of the stadio meter and weight balance; calibration was performed as needed. 2. The opening times of the gym. 3. The condition of the gym (air conditioning, cleanliness, water availability, first aid availability), which were maintained consistently across all PEC exercise sessions.

Two orientation classes were given to the participants before the formal PEC began. The participants were taught how to measure their heart rate at rest and during the PEC exercise sessions by measuring their pulse. Karvonen's equation¹³ was used to determine target heart rate, and is given by:

$$THR = ((HR_{max} - HR_{rest}) \times \text{Exercise intensity}) + HR_{rest} \quad (1)$$

where THR = target heart rate, HR_{max} = maximum heart rate and HR_{rest} = resting heart rate.

Pre and post PEC measurements were taken for: 1. Body mass in kg using a stadiometer with weight scale to determine the body composition¹⁴, 2. Standing long jump in cm using a measuring tape to determine the explosive strength¹⁵, 3. 60 seconds sit up to determine muscular endurance¹⁶, 4. Sit and reach in cm using a sit-and-reach box with a zero point at 21 cm to determine flexibility¹⁴, and 5. 800 m run to determine cardiorespiratory fitness¹⁷. Only pre PEC measurements were obtained for age and height. These tests are the standard used in the Physical Education Department of KFUPM. The cardiorespiratory fitness test was performed in the evening; outside temperatures did not exceed 35°C, and there was low relative humidity.

2.4 Exercise Program

The PEC was a physical education course offered by the university named "Weight Control". It was offered during the second semester of the 2013/2014 academic year from March 1 to April 21, 2014. The duration of each class (exercise) session was 70 minutes, twice a week for eight weeks, and was conducted at the university's gym. All the students who registered for the course participated at the same time. Their attendance was monitored by making a roll call.

Two instructors supervised the program. A supervised 10 minute warm up and 10 minute cool down were conducted in conjunction with each PEC exercise session. The warm up exercises consisted of walking, slow jogging,

and total body stretch exercise, while total body stretching was used to cool down. The PEC exercises given to the students were fast walking, jogging, sit ups, push-ups, and stretching exercises which lasted for 50 minutes with 30-60 seconds rest intervals. The exercise intensity was increased gradually for the participants during the eight-week PEC as follows: 40 to 50% intensity from the first to the third week, 50 to 60 % intensity from the fourth to the sixth week, and 60 to 70% intensity in the seventh and eighth weeks. Each of the exercises were explained and demonstrated to the students before they performed them.

2.5 Blood Sampling

The lab technician of the University's clinic conducted the blood tests. The blood biochemical variables measured before and after the program were fasting blood glucose, Total Cholesterol (TC), Low Density Lipoprotein (LDL-c), High Density Lipoprotein (HDL-c) and triglycerides. The measurements were done at the KFUPM Clinic. Blood samples were taken from the students after a 10 to 12 hour fast, with water allowed during the fast.

2.6 Data Analysis

Descriptive statistics, normality tests and comparisons were done with SPSS 16. Shapiro-Wilk Test was used to

determine the normality of the data. Paired t-test was used to compare normal pre and post PEC data, while Wilcoxon Signed Rank Test was used for pre and post PEC comparison in case any of the pre or post variables were non-normal.

The research hypothesis was that there would be a statistically significant improvement in the health-related fitness and biochemical variables of the obese participants from pre to post following the successful completion of the PEC program.

3. Results

Twenty eight participants (18-19 years, mean age = 18.93 $\pm$ 0.26 years) successfully completed all the pre and post PEC tests with a 100% attendance rate in all sessions. The parameters which did not pass the normality tests were pre and post PEC data for BMI, and post data for 800 m run.

The changes in body composition and health-related fitness are in Table 1. There were improvements ($p < 0.05$) in the health-related fitness parameters after the program. The changes in blood glucose and blood lipids are in Table 2. There were improvements ($p < 0.05$) in the blood glucose and blood lipids parameters after the program.

Table 1. Changes in body composition and health-related fitness (n = 28)

Parameter	Mean $\pm$ SD Pre	Mean $\pm$ SD Post	% Improvement	p value
Body Mass (kg)	113.5 $\pm$ 18.7	110.1 $\pm$ 18.7	3.0	<0.001*
BMI (kg m ⁻²)	38.10 $\pm$ 5.57	36.94 $\pm$ 5.62	3.0	<0.001*
Standing Long Jump (cm)	129.6 $\pm$ 20.4	140.7 $\pm$ 23.8	8.5	0.002*
60 s Sit Ups (repetitions)	19 $\pm$ 4	30 $\pm$ 7	58.8	<0.001*
Sit and Reach (cm)	24.5 $\pm$ 8	27.2 $\pm$ 8	10.9	0.001*
800 m Run (min)	7.34 $\pm$ 1.60	5.55 $\pm$ 1.04	24.3	<0.001*

*p < 0.05

Table 2. Changes in blood glucose and blood lipids (n = 28)

Parameter	Mean $\pm$ SD Pre	Mean $\pm$ SD Post	% Improvement	p value
FBG (mg/dL)	139 $\pm$ 13	122 $\pm$ 13	12.1	<0.001*
TC (mg/dL)	183 $\pm$ 22	158 $\pm$ 18	13.9	<0.001*
LDL-c (mg/dL)	113 $\pm$ 23	93 $\pm$ 20	18.1	<0.001*
HDL-c (mg/dL)	63 $\pm$ 17	47 $\pm$ 12	26.4	<0.001*
Triglycerides (mg/dL)	140 $\pm$ 61	102 $\pm$ 43	27.5	<0.001*

FBG = Fasting blood glucose; TC = Total cholesterol; LDL-c = Low density lipoprotein; HDL-c = High density lipoprotein

*p < 0.05

4. Discussion

This study investigated the effect of a PEC on the health-related fitness and selected biochemical variables of obese male orientation-year students. There were significant improvements in health-related fitness variables and biochemical variables at the end of the PEC. This validates the research hypothesis of this study.

The statistically significant changes in body mass and BMI agree with previous studies which focused on the effect of an 8 to 14 weeks exercise program on obese adult volunteers¹⁸⁻²². According to Slentz et al.²³, the intensity of exercise sessions plays a role in the reduction of body mass of obese people. An increase in exercise intensity leads to a more noticeable change in body composition, and also leads to an increase in the amount of energy spent, which can be more than energy intake²³. In this study, the most likely reason for body mass and BMI reduction was the combination of the duration per session, and the intensity of the exercises which was increased from 40-50% to 50-60% to 60-70% during the program duration.

Motivation is also considered a factor in achieving weight loss^{8,19,24}. In this case, it can be said that the students were motivated to control their weight as they volunteered to participate in this course, and had a 100 % compliance rate in all the sessions.

The improvements in standing long jump, 30 seconds sit up, sit and reach, and 800 m run indicated the following health-related fitness parameters have improved respectively: Explosive strength²⁵, abdominal muscle endurance²⁵, flexibility²⁶, and cardiorespiratory fitness²⁷. The following improvements have been reported in other obese adult volunteers: sit ups²⁸, sit and reach²⁸ and cardiorespiratory fitness²⁹. Despite these improvements, only post trunk flexibility was in the fit range. The program duration was possibly not enough to enable the participants to achieve a fit level in all health-related fitness parameters.

The significant improvements of some of the blood parameters of this study agree with some previous studies²⁰⁻²². This study also has disagreements with a study from Ho et al.¹⁸ on the significant reduction in all the measured blood parameters. The data of this study show that the participants reduced their risk of getting a heart disease, as unhealthy values of blood lipids signify a high risk of having a heart disease³⁰.

The average fasting blood glucose and HDL-c levels of the participants before the start of the program were

unhealthy, while the other blood lipid components were in the healthy range. At the end of the PEC, the fasting blood glucose remained at an unhealthy level, while the HDL-c was at a healthy level. Fasting blood glucose did not reduce to the healthy range possibly because the program duration was not long enough. The reduction in fasting blood glucose levels implies the non-diabetic participants reduced their risk of contracting diabetes³¹.

4.1 Limitations

A limitation of this study was the lack of information on the participants who did extra exercises during the week apart from the one given in the course. Another limitation is that the participants of this study were male. This is to be considered before making any general conclusions concerning the effect of a structured PEC on health and fitness and blood biochemistry parameters, as there is data to show that aerobic exercise affects males and females differently³². Also, controls were not taken because it was a graded course as required by the university.

4.2 Implications and Recommendations

The findings show that a structured PEC at the university level can play a role in improving university students' health, thus, contribute to decreasing the obesity prevalence in Saudi Arabia, and other countries which face the obesity crisis. It is recommended that the design of physical education curricula should consider playing an active role in improving the health-related fitness of students.

5. Conclusion

This study investigated the impact of a university-based physical education program on obese male participants. There was an improvement in health-related fitness and selected biochemical variables of the participants. These findings suggest that such data will be beneficial for both participants and physical educators. These findings can serve as encouragement for obese people at the university level to take their physical education courses seriously, especially if participating in these courses is their best opportunity to engage in physical activity. These data can also help physical educators design programs which can help their students get the benefits of physical exercise, especially if they are obese.

6. Conflict of Interest

There are no conflicts of interest to declare.

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