A Fitness Intervention Program within a Physical Education Class on Cardiovascular Endurance among Malaysia Secondary School Students

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ABSTRACT

The aim of the study was to investigate the effect of a physical fitness intervention program within a physical education class on cardiovascular endurance of Malaysian secondary school boys and girls. A quasi experimental design was adopted for the study. Two schools in a district were randomly selected. In each school, two classes were randomly assigned intact to the experimental group of boys and girls (n = 45; n = 48) respectively and the other was the control group of boys and girls (n = 42; n = 38) respectively. Data were collected on cardiovascular endurance using Cooper's Twelve Minute Run. The experimental and the control groups underwent regular physical education classes twice a week for ten weeks. Apart from the regular physical education classes, the experimental group of boys and girls underwent the treatment of four exercises in a form of a circuit immediately after the warm-up session. After ten weeks, posttest data were collected. ANCOVA indicated that there was a main effect in cardiovascular endurance $F(1, 84) = 18.17$, $p < .05$; Cohen d = 0.17 between the boys and also a main effect $F(1,83) = 44.69$, $p < .05$; Cohen d = 0.35 between the girls. The results indicate that a ten week physical fitness program implemented within a physical education class was effective in enhancing cardiovascular endurance among the Malaysian secondary school boys and girls.

Keywords: *health-related fitness, cardiovascular endurance, fitness intervention, secondary school students*

INTRODUCTION

Reports abroad indicate that the state of aerobic fitness and other health related fitness among school going children is not very satisfactory (Derri, Aggeloussis, &Petraki, 2004; Gutin et al., 1990, 1994; Hatano et al., 1997; Tomkinson, Olds, & Gublin, 2003; US Department of Health & Human Services, [USDHHS] 1996, 2001). Among children aged between 12-21 only half of them participate in vigorous physical activity (PA), and one-fourth of this population reported that they did not participate in any physical activity (USDHHS, 1996). In view of this, many physical educators suggest that being physically inactive and leading a sedentary lifestyle is one of the reasons for dramatic increase in the prevalence of overweight and obesity, thus attributing to risk factors for cardiovascular diseases (CVD) in adults and even among children (Denke, Sempos, & Grundy, 1993; Gutin et al., 1999; USDHHS, 2001, 2008; Young & Steinhardt, 1995). The American Heart Association (1992) indicated that a sedentary lifestyle is a modifiable risk factor for coronary heart disease (CHD). Conversely, there is evidence that both increased physical activity (PA) and physical fitness especially cardiovascular endurance are associated with improved risk factors for (CVD) (Caspersen, Nixton, & DuRant, 1998; Despres, Bouchard, & Malina, 1990; Sallis et al., 1997; USDHHS, 1996, 2001, 2008). To modify the above situation, all school going children should be encouraged and motivated by teachers to participate in PA through quality physical education programs conducted in schools to educate and enhance cardiovascular endurance (USDHHS, 1996, 2001, 2008). Effective school based physical education programs would have the potential to increase PA levels and the knowledge of fitness on cardiovascular fitness and therefore play an important role in promoting health-related fitness components and contribute to public health (Wallhead & Buckworth, 2004).

In Malaysia, CVD posed the greatest threat beginning in the late 1990s. In 2001 it was reported that 20-30% of total deaths in Malaysia were attributed to CVD (Khor, 2001). Findings from the National Health Morbidity Survey III (MOH, 2008) indicate the prevalence of physical inactivity to be 43.7% among adults and sedentary lifestyles among Malaysian children. A study by Lim (2005) indicated that about 44% of the 75 adolescents studied were sedentary. Further, Dan, Mohd Nasir and Zalilah (2011) reported that one third of the respondents between the ages 13-14 years were in the low physical activity level category. Further, the status of Malaysian school going children undergoing regular physical education in schools indicate low mean scores for health-related fitness components (Balakrishnan, 2003; Kasmini et al., 1997; Rengasamy, 2003, 2006 2008; Singh, 2005; Sinnapan, 2006). It is recommended that proper intervention programs with sufficient intensity levels be implemented at the school level (Council for Physical Education [COPEC] 1998; Dan et al., 2011; USDHHS, 1996, 2001). Intervention programs have indicated enhancement of cardiovascular endurance among school children; however most of the intervention studies were done outside the physical education classes (Derri et al., 2004; Faigenbaum & Mediate, 2006; Faigenbaum, Milliken, Loud, & Burak, 2002; Flanagan, et al., 2002; Ignico & Mahon 1995; Singh, 2005).

Hence, there is a need to study and understand the combination of exercises introduced in the intervention programs within a physical education class in the local setting, as local research has indicated low cardiovascular endurance among Malaysian school going children (Balakrishnan, 2003; Rengasamy, 2008; Palanippan, 2007). The lack of published research locally and abroad on combination of exercise modes in intervention programs for school students within the physical education classes in enhancing cardiovascular endurance prompted the current study. The purpose of this study was to investigate the effect of a physical fitness intervention program on cardiovascular endurance within a physical education class among Malaysian secondary school children.

Participants

Two schools in the district of Banting in the state of Selangor were randomly selected for the study. There were a total of seven Form Four classes in each of the selected schools. Two classes in each school were randomly selected and randomly assigned intact for the experimental and the control group. The experimental group for boys consisted of forty five (n = 45) and for the control group of boys consisted of forty two (n = 42) respectively and their mean age was 16.1; *SD* 0.42. The experimental group for girls consisted of forty eight (n = 48) and for the control group of girls consisted of thirty eight (n = 38) and their mean age was 16.3; *SD* 0.32 respectively. During the study period, none of the students, neither from the experimental group nor the control group opted out. The number remained the same during the pre and posttest.

Design and Procedure

A quasi-experimental design with a pretest-posttest was adopted for the study (Gay, 1992). The experimental and the control groups followed their regular physical education conducted for 40 minutes twice a week. Both the groups of boys and girls also participated in the compulsory games lesson carried out during the co-curriculum period for one hour and thirty minutes once a week. Apart from the regular physical education, the experimental group of boys and girls followed the physical fitness intervention program of four exercises in the form of a circuit immediately after their warm-up session. Both groups were instructed not to be involved in any other outside activities during the study period, in order to minimize any confounding effects of other activities on the outcome of the present study. A pretest was conducted before initiation of treatment and a posttest was done after ten weeks. The data collected were analyzed for the effectiveness of the treatment.

Physical Education Lesson Cycle

Physical education lesson is divided into sections and each section plays an important role in achieving the daily objective of the lesson (Rink, 1993). In the present study the lesson started off with the general warm-up consisting of ten different types of exercises including light jogging and stretching exercises. The warm up session was followed by the activity section where the actual learning of a skill took place. The teacher introduced the skill for the day and demonstrated what was to be learned for the day. In the present study, Volleyball and Handball skills were introduced to both the experimental and control groups for boys and girl for a ten week period as they followed the Malaysian physical education syllabus. The activity session was followed by the group activity session. Then a modified mini game session followed during which the students played and applied the day's skill in an actual game like situation. Every student was involved in the mini game session that had competitive nature with fun incorporated in it. Finally, it was followed by the cool down session.

The selected classes for the boys and girls were taught by qualified teachers in physical education. To remove the teacher effect, teachers selected had a minimum of five years of teaching experience in teaching physical education and the selected teachers for the present study were physical education graduates from a local university. The teachers were briefed on the module prepared by the researcher. The module describes what type of exercises are to be given during the warm-up session and the type of drills to be followed during the teaching unit for both the experimental and

the control group. The prepared module was to be followed strictly by the teachers to avoid the teacher effect or any other variance. The translated form of the Form Four Malaysian physical education syllabus was taught to both the experimental and the control groups of boys and girls in the selected schools in the district. By doing so, the control and experimental groups of boys and girls received the same form of warm-up exercises, the same type of drills, group activity, same minor games and the same cool down exercises. The only exception was that the experimental groups underwent the treatment for four minutes in a form of a circuit within the physical education class.

Treatment

The present study was conducted over ten weeks; a treatment of four exercises in a form of a circuit was utilized to improve health-related fitness as suggested by Morgan and Adamson (1972). Once the experimental group had assembled, they would undergo the warm-up and stretching exercises for about eight minutes followed by the treatment. The class was then divided into three stations (A, B & C). Once the subjects were ready, the teacher blew the whistle and the subjects in station A, B and C carried out the treatment of Shuttle Run, Burpee and Jumping Jacks respectively according to the stations. During the rest interval, they changed to a new station. Once the three exercises were completed, the whole class carried out the fourth exercise that is the Modified Sit-up in pairs. Each exercise was done for 30 seconds with a rest interval of 30 seconds. The rest interval was reduced to 25 seconds to factor in the overload principle after the fifth week as suggested by Morgan and Anderson (1972). The four exercises were chosen as they used large muscle groups and stressed the cardio respiratory chain (MacArdle, Katch, & Katch, 1996). As for the control groups, they followed their regular physical education classes conducted 40 minutes twice a week. After ten weeks, posttest data were collected and analyzed for between-group differences using analysis of covariance (ANCOVA).

Testing

A common pretest was given using 12-Minute Cooper's Test for cardiovascular endurance with a reliability of 0.95 and the validity coefficients of .65 (Byrd, 1980). The 12-Minute Run/Walk test possesses a high correlation with VO_{2max} of r = .90 (Cooper, 1968). The support for the test is seen in studies by Castagna, Abt, D'Ottavio, and Weston (2005) and Crist (1994). The Test was conducted in a 400 meter track in the school field as recommended by Baumgartner and Jackson (1991). The Cooper's Test was conducted prior to initiation of treatment and following the 10-week intervention program.The students were paired and the selected runners were to run and their partner would serve as the runner's lap scorer. The runners were signaled off with 'Ready and Go'. Lap calls were made out to the runner's times to the scorer as the runners crossed the line. At the 12th minute, a whistle was blown to indicate the end of the run/walk. The lap score was recorded to the nearest 25 meters. The objective was to cover as much distance as possible in twelve minutes. It is then repeated for the next group.

RESULTS AND DISCUSSION

ANCOVA was utilized in the present study as the design employed was a quasi experimental design with intact sampling method. Data were analyzed for normality using the test for skewness and kurtosis. The data indicated that the groups were approximately normally distributed. Further, linearity and regression slopes assumption for ANCOVA were met. For the statistical analysis, the level of confidence was set at .05. To ascertain the effect of the treatment between the experimental and the control group, ANCOVA was computed using the posttest score as the dependent score and the pretest score as the covariate. Effect size was calculated for each comparison using Cohen's delta to evaluate the size of mean differences. The result of ANCOVA in Table 3 indicates that there was a significant main effect for boys in cardiovascular endurance $F(1,84) = 18.17$, $p < .05$; Cohen $d = 0.17$. As for the girls, there was also a significant main effect $F(1,83) = 44.69$, $p < .05$; Cohen $d = 0.35$. Table 1 and 2 indicates the adjusted posttest mean scores for cardiovascular endurance for the experimental and the control groups of boys and girls respectively. The result showed that treatment in the experimental group was effective in enhancing the cardiovascular endurance among the experimental groups of boys and girls.

Table 1 Pretest, Posttest and Adjusted Means for Cardiovascular Endurance Among the Boys in the 40 Minute Session

		Boys						
		Experimental (n = 45)			Control (n = 42)			
Groups		Pre Test	Post Test	Adjusted Mean	Pre Test	Post Test	Adjusted Mean	Partial Eta Squared
Cardiovascular Endurance(m)	Mean	1572.22	1823.33	1836.75	1638.69	1719.64	1705.26	0.17
	SD	129.92	115.10		16.51	247.27		

Table 2 Pretest, Posttest and Adjusted Means for Cardiovascular Endurance Among the Girls in the 40 Minute Session

		Girls						
		Experimental (n = 48)			**Control (n = 38)**			
Groups		Pre Test	Post Test	Adjusted Mean	Pre Test	Post Test	Adjusted Mean	Partial Eta Squared
Cardiovascular Endurance(m)	Mean	1344.68	1597.91	1581.70	1253.94	1320.26	1340.86	0.35
	SD	181.24	157.08		16.51	247.27		

Table 3 Summary of ANCOVA for Cardiovascular Endurance Between the Groups for Boys and Girls

Source	SS	*df*	MS	*F*	ES
Cardiovascular Endurance					
Boys					
Between	371093.19	1	371093.19	18.17*	0.17
Error	1715375.16	84	20421.13		
Total	3235923.71	85			
Girls					
Between	1132664.80	1	1132664.80	44.69*	0.35
Error	2103258.90	83	25340.40		
Total	3235923.70	84			

*$p < .05$

The present study was aimed at investigating the effect of a ten week physical fitness intervention program within a physical education class towards cardiovascular endurance among secondary school boys and girls. The results indicate a statistically significant difference ($p < .05$) in cardiovascular endurance between the experimental and the control groups when posttest scores were compared (Table 3).

Significant differences in cardiovascular endurance in the present study are in agreement with similar studies reported by Singh (2005), Ignico and Mahon (1995), Derri et al. (2004), and Sallis et al. (1997). In the present study, four exercises were carried out during the intervention period which lasted for about four minutes. In the present study, the warm-up session was included, prior to the treatment and the teaching unit of Volleyball and Handball skills for ten weeks. The warm-up session in the present study lasted for about eight minutes before the treatment session which lasted for another four minutes. A total of twelve to thirteen minutes were allocated for warm-up and intervention. During the warm-up sessions, specific stretching and jogging exercises were included. The intervention included burpee, sit-up, 20 meter shuttle run and jumping jacks were carried out for a total of twelve to thirteen minutes twice a week increased the intensity levels. This would have probably increased the training volume among the intervention group for boys and the girls which contributed to the significant improvement among them.

Derri et al. (2004) reported the intervention group followed a two day of physical education class of 45 minutes a session, combined with an hour of the intervention program carried out three times a week, for eight weeks. Their results showed improved posttest scores in cardiovascular endurance among the intervention group. The study by Derri et al. included an hour of the intervention program compared to the present study where the warm-up, intervention and volleyball and handball units were carried out for 40 minutes twice a week. The interaction among the warm-up, intervention and games skills unit would have increased the training volume among the students. A similar study by Singh (2005) found that the experimental group following a two day physical education with a physical fitness intervention program indicated a significant improvement. Similarly, Sallis et al. (1997) indicated that the intervention group on a 15-minute intervention program implemented within the physical education class, similar to the present

study, reported a significant improvement. The results reported by these studies are consistent with the present finding that carried an intervention program for two days a week within a physical education class.

Physical education is conducted twice a week in most schools in the country with a duration of 40 minutes a session as directed by the Ministry of Education. This may have fulfilled the minimum duration and the frequency levels required, but lack the sufficient intensity level to accomplish the total training volume to enhance cardiovascular endurance as shown by the control group of boys and girls. Nevertheless, the significant findings of this study suggested that an intervention program within regular physical education classes was effective in enhancing cardiovascular endurance and flexibility. It is strongly suggested that physical educators and curriculum planners introduce intervention programs within regular physical education as it is seen necessary for increasing the intensity level which is sufficient to improve selected cardiovascular endurance among the Malaysian school students. Further, the present study has shown that boys and girls can safely engage in the treatment exercises as there was no injury as a result of the program.

CONCLUSION

The aim of the study was to investigate the effectiveness of an intervention program within a physical education class towards the enhancement of cardiovascular endurance among Malaysian secondary school boys and girls. It indicated that an intervention program within a physical education class had a positive effect towards cardiovascular endurance among the experimental group of boys and girls. Consequently, such intervention programs can be incorporated in the physical education curriculum to enhance cardiovascular endurance in secondary school boys and girls. In conclusion, a physical fitness intervention program within a physical education class carried out twice a week was effective in enhancing cardiovascular endurance among the Malaysian secondary school boys and girls.

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