

# A Fitness Intervention Program within a Physical Education Class on Selected Health-Related Fitness among 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 selected health-related fitness components among Malaysian secondary school 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 (n = 48), and the other was the control group (n = 38). Pretest data were collected on cardiovascular endurance, flexibility and muscular strength. 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 underwent the treatment of four exercises in 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  $F(1, 83) = 44.69, p < .05$  and for flexibility  $F(1,83) = 46.80, p < .05$ . As for muscular strength, the result was not significant  $F(1,83) = 3.54, p > .05$ . The results indicate that a ten-week physical fitness program within the physical education class was effective in enhancing cardiovascular endurance and flexibility among Malaysian secondary school girls.*

**Key words:** cardiovascular endurance; flexibility; muscle strength; physical inactivity; secondary school girls.

## **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). According to the latest international Health Behaviour in School-aged Children (HBSC) study, less than two-thirds of all young people reported participating in sufficient physical activity necessary to meet the current guidelines (CDC 2008; WHO 2004b). In view of this, many physical education (PE) teachers suggest that being physically inactive and leading a sedentary lifestyle is one of the reasons for a 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 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 the teachers to participate in PA through quality physical education programs conducted in schools to educate and enhance health-related fitness components (USDHHS, 1996, 2001, 2008). Effective school based physical education programs would have the potential to increase PA levels and the knowledge of 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). The findings from National Health Morbidity Survey III (NHMS III, 2006) 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 health-related fitness among school children; however most of the intervention studies were carried 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).

There is a need to study and understand intervention programs within a physical education class as local research has indicated low health-related fitness components among girls (Balakrishnan, 2003; Rengasamy, 2008; Palanippan, 2007). The lack of published research locally and abroad on intervention programs towards girls within the physical education classes in enhancing health-related fitness components prompted the current study. The purpose of this study was to investigate the effect of a physical fitness intervention program within a physical education class towards selected health-related fitness components among Malaysian secondary school girls.

## **Methods**

### ***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 to the experimental and the control group. The experimental group consisted of forty eight ( $n = 48$ ) girls, and the control group consisted of thirty eight ( $n = 38$ ) girls and their mean age was 16.1;  $SD$  0.42. 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 groups 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 regular physical education, the experimental group 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**

A 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 that consisted 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 the 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 of a competitive nature with fun incorporated in it. Finally, it was followed by the cool-down session.

The selected classes for the girls were taught by qualified physical education teachers. To remove the teacher effect, the teachers selected had a minimum of five years of teaching experience in teaching PE and the selected teachers for the present study were PE graduates from a local university. The teachers were briefed on the module prepared by the researcher. The module describes what types 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 girls in the selected schools in the district. By doing so, the control and experimental groups of girls received the same form of warm-up exercises, same type of drills, group activity, same minor games and the same cool-down exercises. The only exception was that, the experimental group 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. In the present study, a treatment of four exercises in circuit form was utilized to improve health-related fitness as suggested by Morgan and Adamson (1972). Once the experimental group had assembled, they would undergo 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 it stressed the cardio respiratory chain (MacArdle, Katch & Katch, 1996). As for the control group, they followed their regular physical education classes conducted in duration of 40

minutes twice a week. After ten weeks, posttest data were collected and analyzed for 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 Castgna, 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 the initiation of the treatment and following the 10-week intervention program. The students were paired and the selected runners were to run while 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 12<sup>th</sup> 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 was then repeated for the next group.

Flexibility was assessed using the Sit and Reach Test using a specially constructed box and this protocol was supported in studies by Faigenbaum et al. (2002), Hatano (1997) and Singh (2005). The reported reliability is .70 or higher as reported by Baumgartner and Jackson (1991). The subjects placed their feet flat against the end of the board. The knees should be fully extended and the feet should be shoulder width apart. The test is performed by the subject extending the arms forward with one hand placed on top of the other hand. The student reached directly forward, palms down, along the measuring scale and held the position of maximum reach for at least one second. The scoring is done by the farthest point reached, and is measured to the nearest centimeter.

The measure of hand strength was carried out by a hand dynamometer as seen in a study by Faigenbaum et al. (2002). The reliability reported is .90 (Baumgartner & Jackson, 1991). The hand dynamometer was adjusted before the test to check the suitability of the grip to ascertain the right grip size by adjusting the grip lever. The subject should stand holding the dynamometer parallel to the side of the dial facing away from the body. To measure the strength, the dynamometer was squeezed as hard as possible without moving the arm. Three trials were recommended and the best trial was taken as measurement to the nearest kg.

## **Results**

ANCOVA was used in the present study as the design employed was a quasi experimental design with an 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 2 indicates that there was a significant main effect in cardiovascular endurance  $F(1,83) = 44.69, p < .05$ ; *Cohen d* = 0.35, and for flexibility  $F(1,83) = 46.80, p < .05$ ; *Cohen d* = 0.36. There was no significant difference for muscular strength  $F(1,83) = 3.54, p > .05$ . Table 1 indicates the adjusted posttest mean scores for the selected health-related fitness components for the experimental and the control groups respectively. The result showed that treatment in the experimental group was effective in enhancing the cardiovascular endurance and flexibility among the experimental subjects.

**Table 1.** Mean, Standard Deviation and Adjusted Posttest Mean Scores for the Health-Related Fitness Components of the Groups

Health-Related Components		Experimental (n = 48)			Control (n = 38)		
		Pre	Post	Adjusted Mean	Pre	Post	Adjusted Mean
Cardiovascular	Mean	1344.68	1597.91	1253.94	1253.94	1320.26	1340.86
Endurance(m)	SD	181.24	157.08		114.12	185.43	
Flexibility(cm)	Mean	30.78	33.10	28.44	28.44	27.71	28.72
	SD	6.13	5.47		3.32	3.16	
Muscular	Mean	21.28	21.71	21.18	21.18	20.96	21.00
Strength(kg)	SD	4.63	4.29		5.01	4.53	

**Table 2.** Summary of ANCOVA for the Selected Health-Related Fitness Components

Source	SS	df	MS	F	ES
Cardiovascular Endurance					
Between	1132664.80	1	1132664.80	44.69*	0.35
Error	2103258.90	83	25340.40		
Total	3235923.70	84			
Flexibility					
Between	257.62	1	257.62	46.88*	0.36
Error	456.83	83	5.50		
Total	714.45	84			
Muscular Strength					
Between	9.68	1	9.68	3.54	
Error	226.60	83	2.73		
Total	236.28	84			

\* $p > .05$

## Discussion

The present study was aimed at investigating the effect of a ten-week physical fitness intervention program within a physical education class towards selected health-related components among secondary school girls. The results indicate that there was a statistically significant difference ( $p < .05$ ) towards cardiovascular endurance and in flexibility between the groups when posttest scores were compared (Table 2). As for muscular strength, the result was not significant ( $p > .05$ ).

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. The intervention and the warm-up sessions carried out for about twelve to thirteen minutes twice a week increased the intensity levels. This would have probably increased the training volume among the intervention group which contributed to the significant improvement among them.

Singh (2005) found that the experimental group that followed 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 that followed 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.

As for flexibility, the result indicated a statistically significant difference ( $p < .05$ ) between the experimental and control group of girls (Table 2). Similar studies on implementing intervention programs have reported significant improvements in flexibility (Derri et al., 2004; Faigenbaum & Mediate, 2006; Ignico & Mahon, 1995).

The significant result in the present study can be attributed to the treatment and exercises in the warm-up, treatment, class activity and the cool-down session. In the present study, the warm-up session was included, prior to the treatment and teaching unit. The warm-up session lasted for about eight minutes before the treatment session which lasted for another four minutes. During the warm-up sessions, specific stretching exercises such as burpee and sit-up exercises were also included. The treatment in the present study was carried out twice a week compared to three times as reported in the studies by Ignico and Mahon (1995) and Derri et al. (2004). These specific exercises included in the treatment and the warm-up session targeted the specific muscle groups of the hamstring and abdominal section. This would have increased the training volume and indirectly enhanced flexibility. The present study indicates that the warm-up session, exercises in the treatment and subsequent activities in the regular physical education class and cool-down activities did give sufficient stimulus to stress and stretch these muscle groups. The increased repetitions or training volume to the lower back and hamstring group of muscles may have had an effect on the abdominal muscle groups. Considering the increased training volume

induced in the present study, the significant result in the present study among the girls was expected and is consistent with the findings by Ignico and Mahon (1995), Derri et al. (2004) and by Faigenbaum and Mediate (2006).

The results for muscular strength between the experimental and the control groups for girls were not significant (Table 2). The result is consistent with a similar finding by Faigenbaum et al. (2002). In contrast to the insignificant result in the present study, other intervention studies on muscular strength have shown vast improvements as reported by Flanagan et al. (2002) and Faigenbaum and Mediate (2006). The insignificant result in the present study can be attributed to the insufficient intensity and the non-compliance of the progressive overload principle.

In the present study, the experimental group underwent physical education twice a week, for ten weeks. The intervention program was implemented within the regular physical education class, carried out twice a week. Unlike the subjects in the study by Flanagan et al. (2002) where they had a specific weight training session, in the present study, the exercises in the warm-up and in the treatment session were carried out by the subjects using their own body weights. This probably did not induce the required intensity or the sufficient overload to the specific muscle groups in the upper body to enhance muscular strength as suggested by Flanagan et al. (2002). By doing so, the experimental group of girls did not comply with the training principles of sufficient intensity or the overload needed to improve strength as suggested by the American Academy of Pediatrics (2001), Fleck & Kraemer (1997), National Strength and Conditioning Association [NSCA] 1985; Westcott, (1995). In view of the findings from the present study, similar insignificant result was also reported by Faigenbaum et al. (2002). They reported that after undergoing a weight training program twice a week, the treatment group indicated insignificant result in handgrip strength for upper body. They attributed the insignificant results to the lack of specific exercises introduced in weight training session during the intervention program.

However, in contrast to the findings in the present study, Flanagan et al. (2002) found that the treatment groups improved significantly when compared to the control groups. In their study, the treatment group participated in their regular physical education classes and followed an intervention program of specific weight training. They concluded that the significant results of the treatment group were due to the sufficient intensity and the overload applied to the specific muscle groups. The weight training program was carried out twice a week, for ten weeks. Faigenbaum and Mediate (2006) found that the intervention group that underwent 15 minutes of activities using a medicine ball within a physical education class indicated significant improvements in muscular strength.

Physical education classes are conducted twice a week in most schools in the country with the duration of 40 minutes per session as directed by the Ministry of Education. This may have fulfilled the minimum duration and the frequency levels required, but lacks the sufficient intensity level to accomplish the total training



volume to enhance health-related fitness components as shown by the control group of subjects. 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 health-related fitness components among the subjects. Furthermore, the present study has shown that girls can safely engage in the treatment exercises as there was no injury as the result of the program.

## Conclusion

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

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# Utjecaj programa interventnog vježbanja u sklopu nastave tjelesnog odgoja na određenu zdravstvenu i tjelesnu spremnost srednjoškolaca

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## Sažetak

Cilj ovoga istraživanja bio je proučiti utjecaj programa interventnog vježbanja u nastavi tjelesnog odgoja na određene komponente zdravstvene-tjelesne spremnosti među srednjoškolcima u Maleziji. U istraživanju smo se koristili kvaziekperimentalnom metodom. Istraživanje je obuhvatilo dvije nasumce odabrane škole u okrugu. U svakoj su školi nasumce odabrana dva cjelokupna razreda od kojih je jedan razred označen kao eksperimentalna skupina ( $n = 48$ ), a drugi kao kontrolna skupina ( $n = 38$ ). Predtestom su dobiveni podaci vezani uz kardiovaskularnu izdržljivost, fleksibilnost i mišićnu snagu. Eksperimentalna i kontrolna skupina bile su deset tjedana podvrgnute redovnoj nastavi tjelesnog odgoja dva puta tjedno. Uz redovnu nastavu tjelesnog odgoja eksperimentalna skupina bila je podvrgnuta tretmanu od četiri vježbe po stanicama u krugu odmah nakon uvodnog dijela sata – zagrijavanja. Nakon deset tjedana dobiveni su rezultati posttesta. ANCOVA je pokazala da su posljedice vidljive u kardiovaskularnoj izdržljivosti  $F(1, 83) = 44,69, p < ,05$  i fleksibilnosti  $F(1,83) = 46,80, p < ,05$ . Što se tiče mišićne snage, rezultat nije bio značajan  $F(1,83) = 3,54, p > ,05$ . Rezultati ukazuju na to da je 10-tjedni program interventnog vježbanja u redovitoj nastavi tjelesnog odgoja pridonio poboljšanju kardiovaskularne izdržljivosti i fleksibilnosti među malezijskim srednjoškolcima.

**Ključne riječi:** fizička izdržljivost; fleksibilnost; kardiovaskularna izdržljivost; mišićna snaga; srednjoškolke.

## Uvod

Strana istraživanja ukazuju na to da je stupanj aerobne uvježbanosti i druge zdravstveno-povezane tjelesne spremnosti među školskom djecom prilično nepovoljan (Derri, Aggeloussis i Petraki, 2004; Gutin i sur., 1990, 1994; Hatano i sur., 1997;

Tomkinson, Olds, i Gublin, 2003; US Department of Health & Human Services, [USDHHS] 1996, 2001). Prema rezultatima posljednje međunarodne studije 'Ponašanje u vezi sa zdravljem djece školske dobi', manje od dvije trećine svih mladih ljudi izjavili su da je njihovo sudjelovanje u fizičkim aktivnostima zadovoljavajuće s obzirom na preporuke navedene u smjernicama (CDC 2008; WHO 2004b). Među djecom u dobi od 12 do 21 godine, samo polovina sudjeluje u nekakvom obliku zahtjevne fizičke aktivnosti (PA), a jedna četvrtina te populacije izjasnila se da ne sudjeluje u nekom od oblika fizičke aktivnosti (USDHHS, 1996). S obzirom na to mnogi su nastavnici tjelesne kulture (PE) poručili da su fizička neaktivnost i prilično sjedeći životni među glavnim razlozima dramatičnog povećanja pretilosti i prekomjerne tjelesne težine koji pridonose stvaranju rizičnih faktora za kardiovaskularne bolesti (CVD) u odraslih, ali i u djece (Denke, Sempos i Grundy, 1993; Gutin i sur., 1999; USDHHS, 2001, 2008; Young i Steinhardt, 1995). Američko društvo za srce (1992) izjavilo je da je sjedeći način života modificirajući rizični faktor za koronarne srčane bolesti (CHD). Suprotno tome, postoje dokazi da su povećana fizička aktivnost (PA) i fizička spremnost povezani s poboljšanjem faktora rizika za CVD (Caspersen, Nixon, i DuRant, 1998; Despres, Bouchard, i Malina, 1990; Sallis i sur., 1997; USDHHS, 1996, 2001, 2008). Kako bi se to promijenilo, sva djeca školskog uzrasta trebala bi biti poticana i motivirana od nastavnika za sudjelovanje u fizičkoj aktivnosti u sklopu kvalitetnog programa tjelesnog odgoja u školama, s ciljem poboljšanja komponenti zdravstvene spremnosti (USDHHS, 1996, 2001, 2008). Učinkoviti školski programi tjelesnog odgoja imaju potencijal za povećanjem razina fizičke spremnosti, znanja o fizičkoj spremnosti i time imaju bitnu ulogu u promidžbi komponenti zdravstvene spremnosti kojima doprinose i zdravlju (Wallhead i Buckworth, 2004).

U Maleziji je CVD postao velika opasnost potkraj 1990-ih. Podaci govore o tome da je u 2001. od ukupnog broja umrlih u Maleziji njih 20-30% umrlo zbog kardiovaskularnih bolesti (Khor, 2001). Rezultati anketa Nacionalnih zdravstvenih bolesti III (NHMS III, 2006) ukazuju na to da je učestalost fizičke neaktivnosti 43,7% među odraslima, a sjedeći životni stil među malezijskom djecom. Iz studije koju je proveo Lim (2005) naznačeno je da je otprilike 44% od ukupno 75 odraslih obilježilo svoj životni stil kao sjedeći. Nadalje, Dan, Mohd Nasir i Zalilah (2011) izvijestili su da je trećina sudionika u dobi od 13 do 14 godina u razini niske fizičke spremnosti. Status malezijske djece školske dobi koja pohađaju nastavu tjelesnog odgoja u školi daje prilično niske srednje vrijednosti za komponente vezane uz zdravstvenu fizičku spremnost (Balakrishnan, 2003; Kasmini i sur., 1997; Rengasamy, 2003, 2006 2008; Singh, 2005; Sinnapan, 2006). Preporučuje se da se valjani interventni programi s određenim stupnjem intenziteta uvedu i na školsku razinu (Council for Physical Education [COPEC] 1998; Dan i sur., 2011; USDHHS, 1996, 2001). Rezultati interventnih programa ukazali su na poboljšanje zdravstvene i fizičke spremnosti među školskom djecom. Međutim, većina studija o interventnim programima izvodila se izvan nastave tjelesnog odgoja (Derri i sur., 2004; Faigenbaum i Mediate, 2006; Faigenbaum, Milliken, Loud i Burak, 2002; Flanagan i sur., 2002; Ignico i Mahon 1995; Singh, 2005).

Postoji potreba za proučavanjem i razumijevanjem interventnih programa u sklopu nastave tjelesnog odgoja s obzirom na to da su istraživanja na lokalnoj razini ukazala na prilično nezadovoljavajuće rezultate kod komponenti koje su vezane uz zdravstvenu i fizičku spremnost djevojaka u školama (Balakrishnan, 2003; Rengasamy, 2008; Palanippan, 2007). Nedostatak publikacija o istraživanjima na nacionalnoj i internacionalnoj razini o interventnim programima namijenjenim djevojkama u sklopu nastave tjelesnog odgoja, kako bi se poboljšale komponente njihove zdravstvene i fizičke spremnosti, bile su povod ovog istraživanja. Svrha ovoga istraživanja bila je istražiti učinak interventnog programa za fizičku spremnost unutar programa tjelesnog odgoja na ciljane zdravstvene i fizičke komponente među malezijskim srednjoškolkama.

## **Metode**

### ***Uzorak***

Dvije škole u okrugu Banting države Selangor nasumce su izabrane za provođenje istraživanja. Ukupan broj četvrtih razreda u svakoj školi je sedam, a u istraživanju su sudjelovala po dva četvrti razreda iz svake škole. Po dva razreda iz svake škole nasumce su svrstana u kontrolnu i eksperimentalnu grupu. Eksperimentalna grupa sastojala se od četrdeset i osam ( $n = 48$ ) djevojaka, a kontrolna skupina od trideset i osam ( $n = 38$ ) djevojaka. Srednja vrijednost njihove dobi bila je 16,1;  $SD$  0,42. Za vrijeme trajanja istraživanja nijedna od učenica iz kontrolne ili eksperimentalne grupe nije odustala. Broj učenica ostao je isti u vrijeme predtesta i u vrijeme posttesta.

### ***Dizajn i procedura***

Za ovo istraživanje upotrijebljen je kvaziekperimentalni dizajn s predtestom i posttestom (Gay, 1992). Eksperimentalne i kontrolne skupine redovno su polazile satove tjelesnog odgoja dva puta tjedno po 40 minuta. Obje skupine također su sudjelovale u obveznim satovima igre za vrijeme zajedničkog sata u trajanju od sat i trideset minuta jednom tjedno. Uz redovnu nastavu tjelesnog odgoja, eksperimentalna skupina imala je i interventni program fizičke spremnosti koji se sastojao od četiri cirkularne vježbe odmah nakon zagrijavanja. Obje skupine imale su uputu da se ne bave nikakvim dodatnim aktivnostima za vrijeme trajanja eksperimenta kako bi se smanjile mogućnosti bilo kojeg oblika zbunjujućih učinaka na istraživanje. Predtest je napravljen prije početka eksperimenta, a posttest nakon deset tjedana. Prikupljeni podaci analizirani su kako bi se ustanovila učinkovitost postupka.

### ***Ciklus sata tjelesnog odgoja***

Sat tjelesnog odgoja podijeljen je u dijelove od kojih svaki ima važnu ulogu u postizanju dnevnih ciljeva nastavnog sata (Rink, 1993). U ovome radu nastavni sat počinje općim pripremnim vježbama sastavljenim od različitih tipova vježbi koje uključuju lagano trčanje i vježbe istezanja. Nakon uvodnog dijela sata slijedi glavni dio

u kokjem se ovladava novom vještinom. Nastavnik predstavlja i demonstrira vježbu koju je na satu potrebno svladati. U ovome radu obrađivane su, u razdoblju od deset tjedana, s eksperimentalnom i kontrolnom skupinom vještine iz odbojke i rukometa, kao što je predviđeno malezijskim silabom za tjelesni odgoj. Glavni dio sata nastavljen je aktivnostima u skupinama. Nakon toga je slijedio dio s mini igrom tijekom koje su učenici igrali jedan od navedenih sportova, primjenjujući vještine koje su na tom satu usvojili. Svaka učenica sudjelovala je u mini igri s natjecateljskim elementima i dozom zabave. Nakon toga je slijedio završni dio sata s vježbama opuštanja i hlađenja.

Odabrane razrede podučavao je kvalificirani nastavnik tjelesnog odgoja. Da bismo eliminirali utjecaj nastavnika na rezultat, odabrani nastavnik je morao diplomirati na lokalnom sveučilištu i imati najmanje pet godina iskustva u nastavi tjelesnog odgoja. Nastavnici su bili upoznati s modulom koje je pripremio istraživač. Modul opisuje koji tip zagrijavanja će se koristiti tijekom uvodnog dijela sata i koji tip vježbi će se provoditi tijekom nastavne jedinice za obje skupine ispitanika, kontrolnu i eksperimentalnu. Nastavnici su se morali strogo pridržavati pripremljenih modula da bi se izbjegao utjecaj nastavnika ili bilo koje druge varijance. U poučavanju je korišten prevedeni oblik malezijskog silaba tjelesnog odgoja za 16-godišnjake (*eng. Form Four*) s kontrolnom i eksperimentalnom skupinom djevojaka u odabranim školama u okrugu. Na taj su način obje skupine djevojaka dobile jednaku vrstu vježbi zagrijavanja, isti tip glavne vježbe, aktivnosti u skupinama, mini igre i aktivnosti u završnom dijelu sata – hlađenje. Jedina je razlika bila u tome što je eksperimentalna skupina za vrijeme nastave tjelesnog odgoja bila izložena postupku u kružnom oblik, koji je trajao četiri minute.

### **Postupak**

Provedeno istraživanje trajalo je deset tjedana. Postupak od četiri vježbe u kružnom obliku iskorišten je s ciljem poboljšavanja čimbenika koji se donose na zdravstvenu spremu, kao što savjetuju Morgan i Adamson (1972). Nakon što bi se sastavila eksperimentalna skupina, izložilo bi ih se vježbama zagrijavanja i istezanja otprilike osam minuta, nakon čega bi bili podvrgnuti postupku. Skupina je tada podijeljena na tri stanice (A, B i C). Kad bi učenice bile spremne, na znak nastavnika zviždajkom započele bi s vježbama predviđenim za određenu stanicu – izmjenično trčanje (*eng. shuttle run*), “Burpee” i sunožni poskoci. Tijekom odmora skupine bi zamijenile radne postaje. Po završetku rada bila bi izvedena četvrta vježba – modificirana vježba podizanja trupa u paru. Svaka vježba izvođena je 30 sekundi sa stankom od 30 sekundi. Nakon petog tjedna trajanje stanke skraćeno je na 25 sekundi kako bi se uračunao princip preopterećenja kao što predlažu Morgan i Anderson (1972). Navedene četiri vježbe odabrane su jer koriste skupine velikih mišića i opterećuju kardiorespiratorni lanac (MacArdle, Katch i Katch, 1996). Kontrolna skupina slijedila je uobičajenu nastavu tjelesnog odgoja, provedenu 40 minuta, dva puta tjedno. Nakon deset tjedana prikupljeni su podaci posttesta i analizirane su razlike među skupinama upotrebom analize kovarijance (ANCOVA).



## Testiranje

Kao predtest je korišten zajednički 12-Minute Cooper's Test koji se koristi za kardiovaskularnu izdržljivost s pouzdanošću od 0,95 i koeficijentom vrijednosti od ,65 (Byrd, 1980). Test trči/hodaj 12-minutni posjeduje visoku korelaciju s  $VO_{2max}$  od  $r = 0,90$  (Cooper, 1968). Podloga za test pronađena je u istraživanjima koje su proveli Castgna, Abt, D'Ottavio i Weston (2005), i Crist (1994). Test je proveden na 400-metarskoj stazi u sklopu školskog igrališta, kao što su preporučili Baumgartner i Jackson (1991). Cooperov test je proveden prije uvođenja *postupka*, te po završetku 10-tjednog interventnog programa. Učenici su raspoređeni u parove. Odabrani trkači su trebali trčati, a njihov partner je bio brojač otrčanih krugova. Trkačima je signalizirano s „Priprema i Kreni”. Prilikom prijelaza linije koja označava jedan krug, brojač krugova bi ubilježio trkačevo vrijeme. U dvanaestoj minuti znak zviždaljkom bi označio završetak trčanja/hodanja. Krug bi se zabilježio na najbližih 25 metara. Cilj je bio pretrčati najveću moguću udaljenost u zadanome vremenu – 12 minuta. Zatim je postupak ponovljen za sljedeću skupinu.

Fleksibilnost je provjeravana korištenjem testa Predručjenje u sjedu (*eng.* Sit and Reach Test). U tu je svrhu konstruirana posebna kutija. Takav postupak svoju utemeljenost ima u istraživanjima koja su proveli Faigenbaum i sur., (2002), Hatano (1997) i Singh (2005). Iskazana je pouzdanost od 0,70 ili više, kao što su izvijestili Baumgartner i Jackson (1991). Ispitanik postavi puna stopala na kraj daske. Koljena trebaju biti potpuno ispružena, a stopala poravnata s ramenima. Test se provodi tako da ispitanik ispruži ruke u predručjenje s dlanom jedne ruke na nadlanci druge ruke. Ispitanik zatim pregibom, dlanovima okrenutim prema dolje, po mjernoj ljestvici, pokuša doseći što dalje i zadržati taj položaj najmanje jednu sekundu. Kao rezultat se bilježi najudaljenija dohvaćena točka, izmjerena na najbliži centimetar.

Snaga ruke mjerena je ručnim dinamometrom, kao što je prikazano u radu koji su objavili Faigenbaum i sur., (2002). Ustanovljena je pouzdanost od ,90 (Baumgartner i Jackson, 1991). Hvatište ručnog dinamometra je prije testiranja bilo prilagođeno namještanjem poluge hvatišta. Ispitanik je trebao stajati držeći dinamometar paralelno sa stranom brojčanika okrenutom od tijela. Da bi se izmjerila snaga, ispitanik bi stisnuo dinamometar svom snagom, bez pomicanja ruke. Nakon tri pokušaja zabilježio bi se najbolji rezultat zaokružen na najbliži kilogram.

## Rezultati

U radu je korišten ANCOVA test s obzirom na to da je primijenjen kvazi-eksperimentalni dizajn s nepromjenjivom metodom uzorkovanja. Napravljena je analiza podataka na normalizaciju uporabom testa za koeficijent asimetrije i spljoštenosti (*eng.* Skewness, kurtosis). Podaci su ukazivali na prilično ravnomjernu distribuciju skupina. Nadalje, zadovoljena je pretpostavka nagiba linearnosti i regresije za ANCOVA test. Za statističku analizu, razina pouzdanosti postavljena je na ,05. Da bi se doznao učinak postupka između eksperimentalne i kontrolne skupine, izračunat

je ANCOVA test uporabom rezultata posttesta kao zavisnog rezultata i predtesta kao kovarijante. Učinkovitost je izračunata za svaku usporedbu uporabom Cohenove delte da bi se vrednovala veličina razlika srednjih vrijednosti.

ANCOVA rezultati u Tablici 2 ukazuju na postojanje značajnog glavnog učinka u kardiovaskularnoj izdržljivosti  $F(1,83) = 44,69, p < ,05$ ; Cohen  $d = 0,35$ , i fleksibilnosti  $F(1,83) = 46,80, p < ,05$ ; Cohen  $d = 0,36$ . Ne postoji značajna razlika za mišićnu snagu  $F(1,83) = 3,54, p > ,05$ . Tablica 1 pokazuje prilagođene srednje vrijednosti rezultata posttesta za odabranu komponentu fizičke spremnosti eksperimentalne i kontrolne skupine koja se odnosi na zdravlje. Rezultati su pokazali da je tretman u eksperimentalnoj skupini među ispitanicima učinkovito poboljšao kardiovaskularnu izdržljivost i fleksibilnost.

Tablica 1. i 2.

## Rasprava

Opisani rad je kao cilj imao istražiti učinke desetotjednog interventnog fitness-programa u sklopu nastave tjelesnog odgoja s obzirom na odabrane komponente zdravstveno-tjelesne spremnosti među djevojkama srednjoškolskog uzrasta. Rezultati ukazuju na postojanje statistički značajne razlike ( $p < ,05$ ) s obzirom na kardiovaskularnu izdržljivost i fleksibilnost među skupinama kad se usporede rezultati posttesta (Tablica 2). Što se tiče mišićne snage, ne postoji statistički značajna razlika ( $p > ,05$ ).

Značajne razlike u kardiovaskularnoj izdržljivosti su u skladu sa sličnim istraživanjima koje su proveli Singh (2005), Ignico i Mahon (1995), Derri i sur., (2004) i Sallis i sur., (1997). U našem istraživanju izvedene su četiri vježbe tijekom interventnog razdoblja koje je trajalo otprilike četiri minute. Intervencije i zagrijavanja koji su trajali između dvanaest i trinaest minuta, dva puta tjedno, povećali su razinu intenziteta. To je vjerojatno povećalo i obujam vježbanja u interventnoj skupini, što je u konačnici pridonijelo značajnom poboljšanju njihove spreme.

Singh (2005) je ustanovio da je eksperimentalna skupina koja je radila po dvodnevnom programu tjelesnog odgoja s interventnim programom fizičke spreme pokazala značajan napredak. Slično tome, Sallis i sur. (1997) ustanovili su da je skupina koja je radila po petnaest-minutnom interventnom programu ugrađenom u nastavu tjelesnog odgoja postigla značajna poboljšanja. Objavljeni rezultati su u skladu s našim rezultatima.

Što se fleksibilnosti tiče, rezultati ukazuju na statistički značajnu razliku ( $p < ,05$ ) između eksperimentalne i kontrolne skupine djevojaka (Tablica 2). U sličnim studijama o korištenju interventnog programa također je ustanovljen značajan napredak u fleksibilnosti ispitanika (Derri i sur., 2004; Faigenbaum i Mediate, 2006; Ignico i Mahon, 1995).

Značajni rezultati u našem istraživanju mogu se pripisati provedenom tretmanu i vježbama provedenim tijekom zagrijavanja, tretmana, nastavnih aktivnosti i vježbama

opuštanja u završnom dijelu sata. U našem je istraživanju provedbi tretmana i nastavne jedinice prethodilo zagrijavanje. Zagrijavanje je trajalo otprilike osam minuta. Slijedio je tretman od četiri minute. Tijekom zagrijavanja provedene su specifične vježbe istezanja – „burpee“. Bile su uključene i vježbe podizanja trupa. Tretman je proveden dva puta tjedno, za razliku od tri puta tjedno u radu koji su proveli Ignico i Mahon (1995) i Derri i sur., (2004). Specifične vježbe provedene tijekom zagrijavanja i provedbe tretmana ciljale su točno određene mišićne skupine tetiva i abdominalnog dijela. To bi povećalo obujam treninga i neizravno poboljšalo fleksibilnost. Istraživanje je pokazalo da su zagrijavanje, vježbanje prema tretmanu, aktivnosti koje su slijedile nakon toga, u redovnoj nastavi tjelesnog odgoja, te aktivnosti hlađenja i opuštanja u završnom dijelu sata, predstavljale dovoljan poticaj za aktiviranje i rastezanje tih mišićnih skupina. Veći broj ponavljanja ili povećanje obujma treninga usmjerenih prema donjem dijelu leđa i odgovarajućoj skupini mišića i tetiva također je mogao imati utjecaja na abdominalnu skupinu mišića. Uzimajući u obzir povećani obujam treninga, proveden tijekom našeg istraživanja, opravdano su očekivani značajni rezultati kod djevojaka, a što je u skladu s rezultatima koje su dobili Ignico i Mahon (1995), Derri i sur., (2004), Faigenbaum i Mediate (2006).

Razlike u rezultatima mišićne snage između eksperimentalne i kontrolne skupine djevojaka nisu bile značajne (Tablica 2). To je u skladu sa sličnim rezultatima koje su dobili Faigenbaum i sur. (2002). Nasuprot beznačajnim rezultatima našeg istraživanja, druga istraživanja intervencija na mišićne skupine pokazala su golema poboljšanja, kao što su objavili Flanagan i sur., (2002) Faigenbaum i Mediate (2006). Nepostojanje značajnih razlika u našem istraživanju može se pripisati nedovoljnom intenzitetu provedenih vježbi i nepoštivanju principa progresivnog preopterećenja.

U našem je istraživanju eksperimentalna skupina bila podvrgnuta nastavi tjelesnog odgoja dva puta tjedno deset tjedana. Interventni program bio je primijenjen u sklopu redovite nastave tjelesnog odgoja – dva puta tjedno. Za razliku od studije koju su proveli Flanagan i sur. (2002), gdje su ispitanici tijekom treninga radili s utezima, u našem istraživanju su ispitanici tijekom zagrijavanja i provedbe tretmana koristili isključivo težinu vlastitog tijela. To vjerojatno nije bilo dovoljno da bi potaklo potreban intenzitet ili dovoljno preopterećenje određenih mišićnih skupina gornjeg dijela trupa s ciljem poboljšavanja mišićne snage, kao što su postigli Flanagan i sur. (2002). Takvim postupkom eksperimentalna skupina djevojaka nije radila u skladu s trenažnim principima zadovoljavajućeg intenziteta ili postizanja preopterećenja potrebnog da bi se poboljšala snaga, kao što savjetuju Američka udruga pedijatarata (2001), Fleck i Kraemer (1997), Nacionalna udruga za snagu i kondicioniranje [NSCA] 1985; Westcott, 1995). Slično nepostojanje značajnih razlika objavili su i Faigenbaum i sur. (2002). Izvijestili su da nakon provedenog treninga u teretani, dva puta tjedno, skupina ispitanika nije pokazala značajan napredak u *handgrip* snazi gornjeg dijela trupa. To su pripisali nedostatku specifičnih vježbi tijekom vježbanja u teretani za vrijeme trajanja interventnog programa.

Unatoč svemu, nasuprot nalazima našeg istraživanja, Flanagan i sur. (2002) uočili su da skupine nad kojima je proveden postupak postižu značajna poboljšanja kad ih se uspoređi s kontrolnim skupinama. U njihovu istraživanju skupina nad kojom je proveden postupak sudjelovala je u redovnoj nastavi tjelesnog odgoja i pratila interventni program posebnog rada s utezima. Zaključili su da značajnost razlika u rezultatima proizlazi iz dovoljnog intenziteta i primijenjenog preopterećenja na određene mišićne skupine. Program s utezima proveden je dva puta tjedno u trajanju od deset tjedana. Faigenbaum i Mediate (2006) ustanovili su da je skupina u kojoj je intervenirano, a koja je bila podvrgnuta 15-minutnim aktivnostima korištenjem „medicinke” tijekom nastave tjelesnog odgoja pokazala značajan napredak u mišićnoj snazi.

Nastava tjelesnog odgoja provodi se dva puta tjedno u većini škola u zemlji, a nastavni sat traje 40 minuta, u skladu s odredbama Ministarstva obrazovanja. To možda može zadovoljiti zahtijevani minimum trajanja i razinu učestalosti, no izostavlja zadovoljavajuću razinu intenziteta da bi se postigla ukupna razina trenažnog obujma s ciljem poboljšavanja komponenti fizičke spremne s obzirom na njihov zdravstveni utjecaj, kao što se vidi kod ispitanika kontrolne skupine. Unatoč tome, značajnost postignutih rezultata našeg istraživanja upućuje na to da je interventni program, u sklopu redovne nastave tjelesnog odgoja, učinkovit u poboljšavanju kardiovaskularne izdržljivosti i fleksibilnosti. Iznimno je bitno da nastavnici tjelesnog odgoja i kreatori kurikula uvedu interventni program u redovnu nastavu tjelesnog odgoja s obzirom na očitu potrebu za povećanjem razine intenziteta dovoljnu za poboljšanje odabranih komponenti fizičke spremne s obzirom na zdravstveni utjecaj na subjekte procesa. Nadalje, naše je istraživanje pokazalo da djevojke mogu bez straha za sigurnost biti podvrgnute postupku vježbanja jer tijekom programa nije došlo ni do jedne ozlijede.

## **Zaključak**

Cilj ovog istraživanja bio je istražiti učinkovitost interventnog programa na poboljšanje određenih komponenti fizičke spremnosti s obzirom na njihov zdravstveni utjecaj na malezijske srednjoškolke. Pokazalo se da interventni program u sklopu redovite nastave tjelesnog odgoja ima pozitivan učinak na kardiovaskularnu izdržljivost i fleksibilnost. Kao posljedica toga takav interventni program može biti uvršten u kurikulum tjelesnog odgoja s ciljem veće koristi na komponente fizičke spremnosti i veći utjecaj na zdravlje. Interventni program tjelovježbe u sklopu redovne nastave tjelesnog odgoja koji se provodi dva puta tjedno učinkovito je poboljšao kardiovaskularnu izdržljivost i fleksibilnost kod djevojaka.