

The Effectiveness Of An Additional Stretching Exercise Program In Improving Flexibility Level Among Preschool Boys

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ABSTRACT

This study was conducted to examine the effectiveness of a two minutes' additional stretching exercise program in a 30 minutes games teaching lesson in improving the flexibility level of 6 year old preschool boys ($M = 5.92$, $SD = 0.27$) in a preschool in Malaysia. Fifty (50) preschool boys were selected for the study based on the intact sampling method. From the two classes, one class was randomly selected as an experimental group ($n = 25$), while another class which was used as the control group ($n = 25$). The experimental group underwent intervention in a form of a circuit training program involving a set of additional stretching exercises for two minutes after a five-minute warm up session in a 30-minute games teaching lesson conducted twice a week for 10 weeks. After 10 weeks, ANCOVA analysis was carried out indicated the treatment group was significant with $F(1, 47) = 19.219$, $p < .05$. This indicates that an additional two minutes of additional stretching exercises in the form of circuit training carried out in a 30 minutes gamesteaching lesson conducted twice a week for 10 weeks improved the flexibility level of pre-school boys in a preschool in Malaysia.

Keywords: *additional stretching exercise program (seated L, seated toe touch, hip flexor and standing quadriceps), flexibility, pre-school boys*

INTRODUCTION

Physical fitness is "a set of attributes that people have or achieve that relates to the ability to perform physical activity (Caspersen, Powell, & Christenson, 1985). Physical fitness comprises of five health-related physical fitness components and six skill-related components that enable an individual to perform efficiently and effectively, to enjoy leisure time activities as well as capable of coping with emergencies (Corbin, Lindsey, Mah, Welk, & Corbin, 2002). Flexibility is one of the components of health-related physical fitness. According to Alter (1988), flexibility refers to the ability to move a single joint or series of joints smoothly and easily through an unrestricted, pain free range of motion. It is a vital component of health-related physical fitness which enables an individual or an athlete to perform an action or task efficiently without any risk of physical injury, especially at joints, muscles or ligaments during esentric exercise or training (McHugh et al., 1999). In addition, it enables improvement in posture and muscle symmetry, especially among children (Corbin & Noble, 1980).

Poor aerobic fitness is a significant risk factor for all-cause mortality (Lee, Blair, & Jackson, 1999). Reduced aerobic fitness has been found in studies involving children (Updyke & Willet, 1999) and it has affected the children's physical fitness level for the components of health-related physical fitness. It was also reported that sedentary lifestyle has affected the health, wellness and fitness level of children and adolescents (Dan, Mohd Nasir, & Zalilah, 2011; Derri, Nikos, & Petraki, 2004; Gutin et al., 1990, 1994; Hatano et al., 1997; Lim, 2005; Tomkinson, Olds, & Gublin, 2003; USDHHS, 1996, 2001, 2008, 2010). Studies on the status of flexibility level of secondary school children in Malaysia and abroad also incated

that the average of the score obtained was lower than the mean score. (Aida Al- Awamleh, 2010; Balakrishnan, 2003; Ignico & Mahon, 1995; Kamenka, Bijana, T. V., & Manuela, 2008; Kostic, Miletic, Jovic, & Uzunovic, 2003; Kasmini et al., 1997; Rengasamy, 2003, 2006, 2008; Singh, 2005; Sinnapan, 2006). If necessary measures are not taken in the early stages to enhance the flexibility level, the students would be at high risk in getting posture and muscle injuries (Alter, 1988; Corbin & Noble, 1980; McHugh et al., 1999; USDHHS, 2001).

Effective educational programs and sufficient knowledge on physical fitness should to be given priority at school level to promote and encourage the students' participation in physical activities (Wallhead & Buckworth, 2004). Various intervention programs were conducted at either primary or secondary schools to enhance the component of flexibility as well as the other physical fitness components (Baquet, Berthoin, Gerbeaux, & Praagh, 2001; Bowen, Jenson, & Clark, 2004; Derri et al., 2004; Dragicevick, Hill, Hopkins, & Walker, 1987; Faigenbaum & Pollock, 1999; Hamlin, Ross, & Sang, 2002; Hetrik, Maziakas, Cole, & Le Mura, 2002; Ignico & Mahon, 1995). Besides that, intervention programs in the form of additional stretching exercise program had shown desired improvement for the component of flexibility among preschool children. (Aida Al- Awamleh, 2010; Kamenka et al., 2008; Kostic et al., 2003; P. Sainz De Brada, 2006; Sasa Krstulovic, Mladen Kvesic, & Mirsad Nurkic, 2010; Seyed Sajad Hosseini, Mehriyeh Panahi, Zinab Naghilo, & Leila Darzi Ramandi, 2011).

In Malaysia, intervention programs conducted during Physical Education sessions indicated positive effect on the component of flexibility among secondary school students (Arujunan, 2006; Balakrishnan, 2003; Palaniappan, 2007; Rengasamy, 2008, 2012) and in primary schools located in urban areas (Sinnapan, 2006). However, research on the effectiveness of intervention programs in improving the component of flexibility among preschool boys is yet to be reported in Malaysia. This is due to the fact that previous researches were focused on targeted groups of primary and secondary students in urban areas and very little is known about flexibility among preschool children. Therefore, the current researcher intended to investigate the effectiveness of a 2 minutes' additional stretching exercise program (*seated L, seated toe touch, hip flexor* dan *standing quadriceps*) introduced within a 30 minutes games session twice a week over a period of 10 weeks in improving the flexibility level of preschool boys in a preschool in Malaysia.

'General Adaptation Syndrome' (GAS) Theory

This study is based on the theory called *General Adaptation Syndrome* (GAS), invented by Hans Selye, a Hungarian scientist. Selye defined stress as the state manifested by a specific syndrome which consists of all the nonspecifically induced changes within a biological system (Selye, 1956). The *Gas* theory consists of three stages; alarm phase, resistance phase and exhaustion phase.

During the alarm phase, a stressor disturbs homeostasis. The brain subconsciously perceives the stressor and prepares the body either to fight or to run away, a response usually known as the fight or flight response (Martini & Bartholomew, 2000). The hypothalamus, a section of the brain, functions as the control center and determines the overall reaction to stressors. When the hypothalamus perceives that extra energy needed to fight a stressor, it stimulates the adrenal glands to release the hormone epinephrine that causes more blood to be pumped with each beat of the heart, dilates the air sacs in the lungs to increase oxygen intake, increases the breathing rate, stimulates the liver to release more glucose, and dilates the individuals to improve visual sensitivity. The body is then poised to act immediately.

The resistance phase of the general adaptation syndrome begins almost immediately after the alarm phase starts. During the stage of resistance, the body begins to repair the damage caused by the demands of the activity that is in process. The physiological response to a stressor begins the process of adaptation. During this process, the organisms' defense mechanisms fight to gain resistance. This is known as adaptation and is characterized by elevated levels of homeostasis. The changes and adaptation that take place reduce the reaction towards the stressor eventually improves the performance.

In the exhaustion phase of the general adaptation syndrome, the physical and psychological energy used to fight a stressor would have been depleted. This is due to the fact that an individual undergoing the stress would plateau or experience mal adaptation when the stimulus is continuous during the exhaustion phase as the body has run out of reserve energy and immunity. At this stage, the individual would be

exhausted and in a state to collapse as his stress tolerance is decreased by the low sugar level in his blood. So, the individual would have mental and physical exhaustion that would not favour adaptation to take place. The performance will decline tremendously and possibility for traumatic injuries would be high (Martini & Bartholomew, 2000).

The intervention program used in the current study was in the form of two minutes' additional stretching exercise program that included *Seated L*, *Seated Toe Touch*, *Hip Flexor* and *Standing Quadriceps*". It was introduced immediately after the warming up session during a 30 minutes games session that was held twice a week. The program emphasized two vital training principles; intensity and overload principles that focused on the progressive increase of the load and intensity through the application of the GAS theory.

Each of the *Seated L*, *Seated Toe Touch*, *Hip Flexor* and *Standing Quadiceps* exercises were performed for 10 seconds respectively and after each exercise, 5 seconds of rest was provided. As the additional exercises increased the intensity level for the duration of two minutes, it was regarded as the stressor that disturbs homeostasis during the alarm stage. Thus, it would cause necessary changes to the physiology system of the 6 year old pre-school boys selected for the study.

In this study, the intervention program was conducted twice a week over a period of 10 weeks. The two minutes' additional stretching exercise program which was introduced immediately after the 5 minutes' warming up session would provide the stress needed to bring the desired changes in the 6 year old pre-school children's body system. This is due to the fact that the pre-school boys would continue with their games with training drills for 10 minutes followed by group activity and mini games respectively for 5 minutes each. These activities would involve a lot of moderate to vigorous activities that will enhance the intensity level as well as giving sufficient stress on the 6 year old pre-school children's physiology level.

After going through the additional stretching exercise program, the 6 year old pre-school children would enter the resistance stage where adaptation would take place. In this 10 week long study, the emphasis was on adapting the alarm and resistance stage of the GAS theory to examine the effectiveness of a two minutes' additional stretching exercise program introduced in a 30 minutes game that was held twice a week in improving the flexibility level of 6 year old preschool boys.

METHODOLOGY

This is a quantitative study opted for quasi-experimental design with the adoption of pretest and posttest (Gay, 1992). 50 preschool boys aged 6 ($M = 5.92$, $SP = 0.27$) from a preschool in Malaysia were deployed for the study. Two preschool classes were randomly selected and randomly assigned intact for the experimental and the control group. The experimental group consisted of 25 ($n=25$) boys, and the control group consisted of another 25 ($n=25$) boys respectively. Both the experimental and control groups underwent regular 30 minutes' games session twice a week for a period of 10 weeks. However, the experimental group underwent the additional 2 minutes' stretching exercise program in the form of circuit training immediately after the warming up session during the 30 minutes games sessions twice a week over the 10 weeks' duration.

Instrumentation

Sit and Reach Test instrument was used to examine the effectiveness of the 2 minutes' additional stretching exercise intervention program introduced during the 30 minutes' games session conducted twice a week for 10 weeks in improving the flexibility level of pre-school boys in a preschool in Malaysia. A specially constructed box was used and this protocol was supported in studies by Faigenbaum and Pollock (1999). The reported validity was at .80 and .90 (Jackson & Baker, 1986) whereas the reliability was .70 or higher as reported by Jackson and Lanford (1989). A pilot study conducted on 25 preschool boys with similar characteristics indicated that the reliability of the instrument used was at .90. Chua (2009) stressed that pilot studies would be essential in providing sufficient training for the researchers to conduct their actual studies effectively later.

Procedures

Consent letters to carry out the study was obtained from Educational Planning and Policy Research Department (EPRD) in Ministry of Education of Malaysia (MOE). The subjects were recruited on voluntary basis and the parents consent was obtained as all the samples of the study were underaged. After being briefed, the samples from both the experimental and control groups began the session with warm up activity for 5 minutes. Then the pre-test was conducted. The subjects placed their feet flat against the end of the board. The knees were fully extended and the feet were shoulder width apart. The test was performed by the samples extending the arms forward with one hand placed on top of the other hand. The samples reached directly forward, palms down, along the measuring scale and held the position of maximum reach for at least two seconds. 3 trials were given for all the samples and the farthest point reached is measured to the nearest centimeter. Yardstick and masking tape were used together with the sit and reach box to collect the data of the preschool boys. Data obtained was recorded in the score form provided.

After the pre-test was carried out, the control group underwent the regular 30 minutes' games session that was divided into several sections beginning with 5 minutes' warm up session involving jogging and stretching activities. It was followed by skill learning section where the actual learning of a skill took place progressively. Then, a mini game section and cooling down section were carried out to complete the 30 minutes lesson twice a week for 10 weeks. On the other hand, the experimental group underwent the 2 minutes' additional stretching exercises in the form of circuit training immediately after the 5 minutes' warming up section. Apart from that, the experimental group underwent all other sections such as skill learning section, mini game section and cooling down section similarly to the control group, twice a week for 10 weeks. After 10 weeks, a post-test, which was similar to the pre-test, was conducted and data of the samples from both the control and experimental groups was collected.

Treatment

A set of additional stretching exercises for 2 minutes in the form of circuit training was introduced for the samples of the experimental group immediately after the warming up session during the 30 minutes games session that was conducted twice a week for 10 weeks. The samples of the experimental group were divided into 4 small groups in order to be located at the 4 stations labelled by the teacher earlier. At each station, the samples had to do a particular stretching exercise before they moved to the other stations one after another to undergo the stretching exercises according to the teacher's instruction.

After going through the warming up section and the additional 2 minutes' stretching exercises, the samples in the experimental group underwent skill learning section, mini game section and cooling down section to complete the 30 minutes games session. The additional 2 minutes' stretching exercise set was labelled according to the stations as stated below:

1. Seated L (for 10 seconds followed by 5 seconds of rest and continued for 10 seconds and 5 seconds of rest)
2. Seated Toe Touch (for 10 seconds followed by 5 seconds of rest and continued for 10 seconds and 5 seconds of rest)
3. Hip Flexor (for 10 seconds followed by 5 seconds of rest and continued for 10 seconds and 5 seconds of rest)
4. Standing Quadriceps (for 10 seconds followed by 5 seconds of rest and continued for 10 seconds and 5 seconds of rest)

Data Analysis

Data obtained was analyzed using *Statistical Package of Social Science (SPSS)*, version 19.0. According to Mohd Majid Konting (2009), statistical analysis using SPSS produces fast and accurate calculation. After the additional 2 minutes of stretching exercise program (*seated L, seated toe touch, hip flexor and standing quadriceps*) was conducted during the 30 minutes' games session for 10 weeks, analysis

of ANCOVA was used to determine the differences between the control and experimental groups from a preschool in Malaysia.

RESULTS

The descriptive analysis indicated that the samples from a preschool in Malaysia who underwent the 2 minutes’ additional stretching exercises in a 30 minutes’ games session conducted twice a week for 10 weeks were with the mean age of (M = 5.92, SD = 0.27). The maximum age of the samples was 6 whereas the minimum age was 5.

Table 1: Descriptive Analysis of the Raw Data of the Preschool Boys’ Test Score

Variable		Experimental Group		Control Group	
		(n= 25)		(n= 25)	
		Pre-Test	Post-Test	Pre-Test	Post-Test
Flexibility (cm)	Mean	23.4	26.63	22.07	22.98
	SD	2.64	2.89	2.76	3.34
	Range	10	12.5	9	13

Table 1 showed the descriptive analysis of the raw data of the pre-test and post-test score obtained by the preschool boys in the experimental and control group respectively. The analysis indicated that the pre-test mean score for the experimental group was 23.4cm with the standard deviation of 2.64cm. The range for the experimental group’s pre-test score was 10cm. After undergoing the 10 weeks intervention program, the experimental group’s post-test mean score increased to 26.63cm with the standard deviation of 2.89cm. The range for the experimental group’s post-test score was 12.5cm. On the other hand, the pre-test mean score for the control group was 22.07cm with the standard deviation of 2.76cm. The range for the control group’s pre-test score was 9cm. After undergoing the regular 30 minutes’ games session without any intervention programs for 10 weeks, the control group’s post-test mean score increased to 22.98cm with the standard deviation of 3.34cm. The range for the control group’s post-test score was 13cm.

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. The level of confidence was set at .05 for the statistical analysis. To ascertain the effect of the treatment between the experimental and the control group, ANCOVA was computed using the posttest score of both groups 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.

Table 2 Mean, Standard Deviation dan Adjusted Mean

Variable		Experimental Group			Control Group		
		(n= 25)			(n= 25)		
		Pre-Test	Post-Test	Adjusted Mean	Pre-Test	Post-Test	Adjusted Mean
Flexibility (cm)	Mean	23.4	26.63	24.81	22.07	22.98	22.73
	SD	2.64	2.89		2.76	3.34	

Table 2 indicated the adjusted post-test mean scores of the experimental and the control groups respectively for the component of flexibility. The mean was adjusted to 24.81cm for the experimental group whereas for the control group it was adjusted to 22.73cm.

Table 3: Analysis of ANCOVA For the Component of Flexibility

Source	SS	df	MS	F	ES
Flexibility(cm)					
Pre-test	303.923	1	303.923	85.57*	0.645
Group	68.262	1	68.262	19.219*	0.29
Error	166.933	47			
Total	31405.37	50			
Corrected Total	637.496	49			

* $p < .05$

Table 3 showed the analysis of ANCOVA of the experimental and control groups for the component of flexibility among the preschool boys in a selected preschool in Malaysia. The analysis concluded that there was a significant difference between the experimental and control group, $F(1,47) = 19.219$, $p < .05$; *cohen d* = 0.29.

DISCUSSION

The findings had indicated that the intervention program in the form of 2 minutes' additional stretching exercise program (*Seated L, Seated Toe Touch, Hip Flexor and Standing Quadriceps*) introduced immediately after the warming section during a 30 minutes' games teaching lesson conducted twice a week was able to improve the flexibility level among the preschool boys from a selected preschool in Malaysia. This finding is consistent with studies abroad and locally that indicated that intervention programs in the form of additional exercises would enhance the flexibility level of preschool children (Aida Al-Awamleh, 2010; Kamenka et al., 2008; Rengasamy, 2012; Sasa Krstulovic et al., 2010; Seyed Sajad Hosseini et al., 2011; Sinnapan, 2006).

As a whole, this current study indicates that 2 minutes of additional stretching exercises in the form of circuit training in a 30 minutes games conducted twice a week for 10 weeks improved the flexibility level of pre-school boys in a preschool in Malaysia. The significant result in the present study can be attributed to the treatment and exercises in 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. During the warm-up sessions, specific stretching exercises such as seated L and seated toe touch were also included. The treatment in the study was carried out two minutes twice a week compared to four minutes twice as reported in studies by Siannapan (2006). 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 treatment, games activities 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 had an effect on the abdominal muscle groups. Considering the increased training volume to enhance health-related fitness components as shown by the control group of subjects.

A similar study by Aida Al-Awamleh (2010) had introduced a gymnastic training program for the experimental group whereas the control group underwent free play. The result indicated that the improvement of flexibility level among the preschool children from the experimental group that underwent the gymnastic training was significant compared to the preschool children in the control group. There could be a possibility that the gymnastic intervention program used by Aida Al-Awamleh (2010) was in line with the ACSM's guidelines (ACSM, 1998) of training principles to improve the component of flexibility. This is due to the fact that her findings had similarity with the current study in which the current study had also

applied four exercises in a form of a circuit for two minutes complying the training principles recommended by ACSM (1998). ACSM had indicated that the static stretch needs to be maintained for 10 to 30 seconds with a repetition of 3 to 4 times per session and it should be performed at least twice a week in order to enhance the flexibility level. Thus, it can be concluded that the preschool children at the age of 6 are suitable to be exposed to the intervention programs in Malaysia.

CONCLUSION

This study has proved that the intervention program in the form of 2 minutes' additional stretching exercise program (*Seated L, Seated Toe Touch, Hip Flexor and Standing Quadriceps*) introduced immediately after the warming section during a 30 minutes' games session conducted twice a week for 10 weeks was able to improve the flexibility level among the preschool boys from a selected preschool in Malaysia. As an effective program in enhancing flexibility level of young children, it would be an ideal option to be introduced and recommended to teachers at preschools as equipments are not needed and time could be saved. The implementation of this program could play a major role in enhancing preschool children's flexibility level as well as enabling them to move smoothly and happily in life.

REFERENCES

- Aida Al-Awamleh. (2010). The effectiveness of using Educational Gymnastics skills on motor capabilities and social behaviour among kindergarten children. Tesis Kedoktoran, Universiti Konstanz, Jerman.
- Alter, M. J. (1988). Science of stretching. Champaign, IL: Human Kinetics.
- American College of Sports Medicine. (1998). ACSM fitness book (2nd ed.). Champaign, IL: Human Kinetics.
- Arjunan, R. (2006). Effectiveness of circuit training towards cardiovascular endurance among Form One students. Unpublished master's thesis, University of Malaya, Kuala Lumpur, Malaysia.
- Balakrishnan, M. (2003). Keberkesanan pendidikan jasmani 80 minit sekali seminggu dalam meningkatkan tahap kecergasan fizikal berlandaskan kesihatan pelajar perempuan tingkatan empat. Tesis Sarjana Fakulti Pendidikan, Universiti Malaya: Kuala Lumpur.
- Baquet, G., Berthoin, S., Gerbeaux, M., & Praagh, V. E. (2001). High- intensity aerobics training during a 10 week one- hour physical education cycle: Effects on physical fitness of adolescents aged 11 to 16. *International Journal of Sports Medicine*, 22, 295-300.
- Bowen, J. M., Jenson, W. R., & Clark, E. (2004). School-based intervention for students with behavior problem. New York, NY: Kluwer Academic/ Plenum.
- Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Rep* 1985;100:126-31.
- Chua Yan Piaw. (2009). Kaedah dan Statistik Penyelidikan Buku 1: Kaedah penyelidikan. Kuala Lumpur: McGraw-Hill.

Corbin, C. B., & Noble, L. (1980). Flexibility: A major component of physical fitness. *The Journal of Physical Education and Recreation*, 51, 23-24, 57-60.

Corbin, C. B., Lindsey, R., Welk, G. J., & Corbin, W. R. (2002). *Concepts of Fitness and wellness. A comprehensive life style approaches* (4th ed.) New York, NY: McGraw-Hill.

Dan, S. P., Mohd Nasir, M. T., & Zalilah, M. S. (2011). Determination of factors associated with physical activity levels among adolescents attending school in Kuantan. *Malaysian Journal of Nutrition*, 17(2), 175-187.

Derri, V., Nikos, A., & Petraki, C., (2004). Health related fitness and nutritional practices: Can they be enhanced in upper elementary school students? *The Physical Educator*, 61(1), 3-44.

Dragicevick, A. R., Hill, P. M., Hopkins, W. G., & Walker, N. P. (1987). The effects of year of physical education on physical fitness in two Auckland schools. *New Zealand Journal of Health, Physical Education and Recreation*, 20(1), 7 - 11.

Faigenbaum, M. S., & Pollock, M. (1999). Prescription of resistance training for health and disease. *Medicine and Science in Sports and Exercise*, 31(1), 38-45.

Gay, L. R. (1992). *Education research: Competencies for analysis and application*. Macmillan.

Gutin, B., Basch, C., Shea, S., Contento, I., DeLozier, M., Rips, J. et al. (1990). Blood pressure, fitness and fatness in 5 and 6 year old children. *JAMA*, 264, 1123-1127.

Gutin, B., Islam, S., Manos, S., Cucuzzo, N., Smith, C., & Stachura, M. E. (1994). Relation of body fat and maximal aerobic capacity to risk factors for atherosclerosis and diabetes in black and white 7 - 11 year old children. *Journal of Pediatrics*, 125, 847-852

Hamlin, M., Ross, J., & Sang, W. H. (2002). The effect of 16 weeks of regular physical activity on fitness levels in primary school children. *Journal of Education New Zealand*, 35, 45-55.

Hatano, Y., Hua, Z. D., Jiang, I. D, Fu, F., Zhi, C. J., & Wei, S. D. (1997). Comparative study of physical fitness of the youth in Asia. *Journal of Physical Education & Recreation*, 3(2), 4-11

Hetrik, A., Maziekas, M., Cole, P., & Le Mura, L. (2002). High versus low, frequency resistance training in children. *Medicine Science Sports and Exercise*, 34(5).

Ignico, A. A. & Mahon, A. D. (1995). The effects of a physical fitness program on low fit children. *Research Quarterly for Exercise and Sports*, 66(1), 85-90.

Jackson, A., & Lanford, N. J. (1989). A criterion related validity of the Sit and Reach Test: Replication and extension of previous findings. *Research Quarterly for Exercise and Sports*, 60(4), 384-387.

Jackson, A. W., & Baker, A. A. (1986). The relationship of the sit and reach test to criterion measures of hamstring and back flexibility in young females. *Research Quarterly for Exercise and Sports*, 57,183 - 186.

Kamenka, Z., Bijana, T. V., & Manuela, S. (2008). Changes In some Of The Motor Abilities Of Preschool Children. *Physical Education And Sport*, 6, 41-50.

Kasmini, K., Idris, M. N., Fatimah, A., Hanafiah, S., Iran, H., & Asmah Bee, M. (1997). Prevalence of overweight and obese school children aged between 7-16 years amongst the 3 major ethnic groups in Kuala Lumpur, Malaysia. *Asia Pacific Journal of Clinical Nutrition*, 6(3), 172-174.

Kostic, R., Miletic, D., Jovic, D., & Uzunovic, S. (2003). The influence of dance structures on the motor abilities of preschool children. *Facta Universitatis, Series Physical Education and Sport*, 1(9), 83-90.

Lee, C. D., Blair, S. N., Jackson, A. S. (1999) Cardiorespiratory fitness, body composition, and all-cause and cardiovascular disease mortality in men. *Am J Clin Nutr* 1999;69:373-80.

Lim, S. F. (2005). Penambilan nutrien, aktiviti fizikal dan status kesihatan tulang di kalangan pelajar sekolah menengah. Tesis sarjana muda, Universiti Putra Malaysia, Serdang.

Martini, F. H., & Bartholomew, E. F. (2000). *Essentials of anatomy and physiology* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.

McHugh, M. P., Connolly, A. J. D., Eston, R. G., Kremenec, I. J., Nicholas, S. J., & Gleim, G. W. (1999). The role of passive muscle stiffness in symptoms of exercise-induced muscle damage. *Am. J. Sports Med.*, 27, pp. 594-599.

Mohd Majid Konting. (2009). Kaedah penyelidikan pendidikan. Kuala Lumpur: Dewan Bahasa dan Pustaka.

P. Sainz De Baranda, P. I Rodriguez, F. M Santonia, P. A Lopez, P. Andujar, V. Ferrer & A. Pastor. (2006). Effects of hamstring stretching exercises on The Toe Touch Test in elementary school children. Teviot Scientific Publications.

Palaniappan, V. (2007). Keberkesanan latihan litar terhadap kecergasan berlandaskan kesihatan di kalangan pelajar perempuan tingkatan empat. Tesis Sarjana Fakulti Pendidikan, Universiti Malaya, K. L.

Rengasamy, S. (2003). The impact of four exercises in a form of a circuit towards some health related measures among college students. Paper Presented at The 4th. International Congress of Health Physical Education Recreation Sport and Dance (ICHPER.SD - ASIA CONGRESS), Bangkok, Thailand, 20-23, March.

Rengasamy, S. (2006). The effect of regular physical education towards cardiovascular endurance. *Journal of Educational Research*, 26, 61-70.

Rengasamy, S. (2008). The effect of a physical fitness intervention program on health-related fitness components among Form Four Malaysian students. Unpublished Doctorial Thesis, University of Malaya, Kuala Lumpur, Malaysia.

Rengasamy, S. (2012). A physical intervention program within a physical education class on selected health-related fitness among secondary school students. *Procedia- Social and Behavioral Sciences* 55, 1104-1112.

Sasa Krstulovic, Mladen Kvesic, & Mirsad Nurkic. (2010). Judo Training Is More Effective Fitness Development Than Recreational Sports In 7 Years Old Girls. *Physical Education And Sport*, 8, 71-79.

Selye, H. (1956). *The stress of life*. New York, NY: McGraw-Hill.

Seyed Sajad Hosseini, Mehriyeh Panahi, Zinab Naghilo, & Leila Darzi Ramandi. (2011). The effect of exercise training on perceptual motor skills and physical fitness factors in preschool children. *Middle- East Journal Of Scientific Research*, 9(6), 764-768.

Singh, M. (2005). The effect of an intervention program on the health related physical fitness of lower secondary school boys. Unpublished doctoral thesis, University Science Malaysia, Kelantan.

Sinnapan, R. (2006). Effectiveness of an intervention program on physical fitness among primary school children. Unpublished master's thesis, University of Malaya, Kuala Lumpur.

Tomkinson, G. R., Olds, T. S., & Gublin, J. (2003). Secular trends in physical performance of Australian children: Evidence from the talent search program. *Journal of Sports Medicine and Physical Fitness*, 43, 90-98.

U.S. Department of Health and Human Services (USDHHS). (1996). *Physical Activity and health: A report of the Surgeon General*. Atlanta, GA: Author.

U.S. Department of Health and Human Services (USDHHS) (2001). *The surgeon general's call to action to prevent and decrease overweight and obesity*. Rockville, MD: Public Health Service, Office of the Surgeon General.

U.S. Department of Health and Human Services [USDHHS] (2008). *Physical activity guidelines for Americans*. Retrieved from <http://www.health.gov/paguidelines>

U.S. Department of Health and Human Services [USDHHS] (2010). *Physical activity guidelines for Americans*. Retrieved from <http://www.health.gov/paguidelines>

Updyke, W., & Willett, M. S. (1999). *Physical fitness trends in American youth 1980-1989*. Bloomington, IN: Chrysler-AAU physical fitness program.

Wallhead, T. L., & Buckworth, J. (2004). The role of physical education in the promotion of youth physical activity. *Quest*, 56, 285-301.