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EFFECTS OF SHORT TERM MULTILATERAL AND SPORT SPECIFIC TRAINING ON PHYSICAL FITNESS PROFILE OF MALAYSIAN SCHOOL CHILDREN

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ABSTRACT

The promotion of regular physical activity in children is essential, since childhood inactivity can influence future negative activity patterns in adulthood. The purpose of this study was to determine the effects of specific and multilateral training on physical fitness profile of Malaysian school children. Thirty healthy children aged 10±0.39 years, were evenly assigned to Control (PE Classes), Experimental I (PE classes plus Tennis Based Training) and Experimental II (PE classes plus Multilateral Training) groups. Experimental groups featured once weekly additional training (one of specific, another of multilateral modality). Physical fitness was assessed thrice: pre-test, mid-test (6^{th} week) and post-test (after 12 weeks of intervention programme). Test battery included one mile walk/run test, 20 meter dash, sit and reach test, vertical jump, hexagon test, sit-ups and push-ups. One-way ANOVA and post-hoc (Tukey HSD) were performed to determine the significance of differences between groups at each time point and to determine the differences between specific means. Experimental group I displayed significant improvement in lower back flexibility after 6 weeks ($p<0.05$); aerobic capacity ($p<0.01$) after 12 weeks, speed ($p<0.01$) and agility ($p<0.01$and $p<0.001$) after 6 and 12 weeks respectively; abdominal and upper body strength after 12 weeks ($p<0.01$ and $p<0.05$ respectively). Experimental group II exhibited significant improvement in lower back flexibility after 6 and 12 weeks ($p<0.01$ and $p< 0.001$); speed ($p<0.05$), agility, power, abdominal and upper body strength (all at $p<0.001$) after 12 weeks of training. No significant improvements were found in control group after 12 weeks in assessed fitness components.

Keywords: Multilateral Training, Sport Specific Training and Fitness Profile.

INTRODUCTION:

Physical activity is a prime contributor to children's healthy development (Malina et al., 2004) and there appear to be long-term benefits from the childhood physical activeness extending into adult life (Jones et al., 1998).

The promotion of regular physical activity in children is absolutely indicated on a preventive medical basis. Inactivity in childhood can influence future negative activity pattern in adulthood (Telama et al., 1996).

Some fundamental movement skills are developed at younger ages. For example balance is best developed at 10 to 11 for boys and at 9 to 12 years for girls (Gambetta, 1998).

Some other activities recommended to emphasize in early training age are the range of movements, balance, strength and the development of basic skills (Pate & Shephard, 1989). Some specific sports skills will be introduced as well.

Recreation and sport activities have an obvious positive link to excellent physical growth in children through the development of gross motor skills (running, jumping and other use of large muscles), strength and endurance (Lyle Sanderson, 1989).

Recreational activities are quite often preferred to other forms of physical activities because they are typically more vigorous than lifestyle physical activity (Corbin & Pangrazi, 1998). Multilateral training is often considered as a solution for overall development of young athletes.

Besides the obvious health related benefits, physical activities help unfolding natural development potential in children. They get used to exploit their motor abilities in variable situations and intensities. This could very helpful in bridging physical activities with sports practices among children. Active involvement of young children into sports can benefit as well. Quite rewarding influence of recreational physical activities could be expected in relation to talent identification.

During the early development stage in particular, children are often subjected to talent identification procedures in order to be selected for training in such “early starting” sports as gymnastics, acrobatics, diving, swimming, tennis, etc. and it is very beneficial for children to get well prepared for related testing and screening procedures by mastering basic movement skills (Krasilshchikov, 2011).

Hence we hypothesized that recreational training could not only serve the health related purposes but also can be beneficial for children to get prepared for the talent identification tests and procedures practiced in various sports they would be exposed to in different age.

OBJECTIVE:

Objective of the study was to investigate the effects of recreational training in two different forms on children's physical fitness level and fitness profile in comparison with the effects of traditional physical education classes.

MATERIALS AND METHODS:

Thirty subjects were recruited from Sekolah Kebangsaan Kubang Kerian (3) for this study. They were divided into the following groups: Experimental group I (Physical Education classes + Tennis Training), experimental group II (Physical Education classes + Multilateral Training) and control group (Physical Education classes). All the subjects were 10 years old so there was no age difference between groups in this study. Among the limitations of the study was the use of mixed groups in gender.

Control group performed physical activities once a week for a total period of 12 weeks. Experimental groups performed their respective training programmes once a week in addition to regular physical education classes. Experimental groups were involved in the recreational training of two different types. Accordingly, two different intervention programmes were used in the study:

One was developed with predominant use of general conditioning exercises and was designed to meet the requirements of MULTILATERAL fitness training.

Another one was developed with predominant use of specific practices and was designed as SPECIFIC recreational training programme based on tennis practice.

Training Protocol

Multilateral Training Programme

Training sessions in multilateral modality were planned as follows:

Warming up (10 minutes)

Main part of the fitness class (40 min) comprising of:

1. Strength and strength endurance (dumbbell exercises, medicine ball exercises)

- Standing torso twist (10 reps)
- Lay back double arm throw (10 reps)
- Vertical extension (10 reps)

2. Exercises with own body weight
3. Agility and flexibility exercise (ladder and gym ball exercises)

Cooling down-Stretching (10 min)

Basic Tennis Skills Training Programme

Basic Tennis Skills Training Programme sessions were planned as follows:

Warming up (10 minutes)

1. Main part of the tennis basic skills class (40 min)
    - Introduction of skill (every session only one skill will be introduced out of the following)
    - Forehand ground stroke
    - Backhand ground stroke
    - Serve
    - Volley
    - Coaching points for each skill
2. Individual practice
3. Group practice
4. Playing tennis games (Small games with modified rules)

Cooling down-Stretching (10 min)

Standard Physical Education Class Programme

Standard Physical Education Class Programme sessions were planned as follows:

Introductory part (10 minutes)

Warming up

1. Main part of the physical education class (30 minutes)

- Children explore several types of games or sports.
- Group games or small games
- Example of sports included: football, basketball and badminton
- Most of the activities are aerobic type exercises.
- Basic technique and rules of the sport or games were taught.

2. Conclusive part (10 minutes)
   Cooling down session

Testing Protocol

Parameters reflecting anthropometry and major motor qualities of children were measured in this study. Those included:

Anthropometric measurements - Height (cm), Weight (kg), Skinfold measurement (mm)

Agility - Hexagon agility test (Sec)

Flexibility - Sit and Reach test (cm)

Endurance - One mile run/walk test (Sec)

Strength endurance - Modified push ups test (Number completed in 60 Sec), Sit ups test (Number completed in 60 Sec)

Power - Vertical Jump (cm)

Speed - Twenty meter dash (Sec)

Heart Rate (Beats.min^{-1})

DATA AND STATISTICAL ANALYSIS:

Analysis of Variance (ANOVA) with repeated measures was performed to determine the significance of differences between groups at each time point. When the one-way ANOVA revealed a significant difference, post-hoc (Tukey HSD) was used to determine the differences between specific means.

RESULTS AND DISCUSSION:

Twenty seven subjects successfully completed 12 weeks intervention programme and took part in all fitness tests (pre-test, mid-test and post-test). One subject from each group dropped out due to personal reasons or non-compliance to the intervention programme. Thus, the number of subjects used for the statistical analysis in each group was 9 (Table 1).

Table 1 Anthropometrical characteristics of the subjects (n=27) in the study

	Experimental Group I (Tennis)	Experimental Group II (Multilateral)	Control Group (Physical Education)
Gender	Male:3 Female:6	Male:4 Female:5	Male:3 Female:6
Age (years)	10±0.15	10±0.19	10±0.24
Height (cm)			
Pre-test	135.4 ± 5.4	136.2 ± 6.5	131.2 ± 4.5
Mid-test	135.7 ± 5.6	136.4 ± 6.5	131.6 ± 4.6
Post-test	136.3 ± 5.6	136.6 ± 6.6	131.8 ± 4.6
Weight (kg)			
Pre-test	30.0 ± 5.3	29.4 ± 4.1	27.7 ± 3.4
Mid-test	30.4 ± 4.9	29.4 ± 3.8	27.9 ± 3.9
Post-test	30.6 ± 5.5	29.5 ± 3.8	28.7 ± 3.6
BMI (kg/m^2)			
Pre-test	16.4 ± 2.8	15.5 ± 1.5	16.1 ± 1.6
Mid-test	16.5 ± 2.4	15.7 ± 1.4	16.1 ± 1.9
Post-test	16.4 ± 2.7	15.9 ± 1.3	16.5 ± 1.7

% Body Fat			
Pre-test	20.0 ± 5.4	19.0 ± 3.3	18.8 ± 5.8
Mid-test	20.3 ± 4.9	19.3 ± 3.8	19.0 ± 5.8
Post-test	21.0 ± 5.5	19.6 ± 3.6	19.8 ± 5.9

There were no significant difference in mean height, weight and body mass index between three groups of subjects ($p>0.05$).

Motor Qualities

Speed

Timing of experimental group I (PE+T) decreased significantly from 4.43 ± 0.21 sec (pre-test) to 4.14 ± 0.22 sec (post test) and of experimental group II (PE +M) from 4.60 ± 0.24 sec (pre-test) to 4.54 ± 0.19 sec (post test) respectively. However, there was no significant improvement in the control group from the pre-test (4.59 ± 0.15 sec) to the posttest (4.54 ± 0.19 sec). Control group did not display any significant improvement in speed throughout 12 weeks of intervention programme. There was a significant difference between experimental groups and control group during mid-test and posttest (Fig. 1).

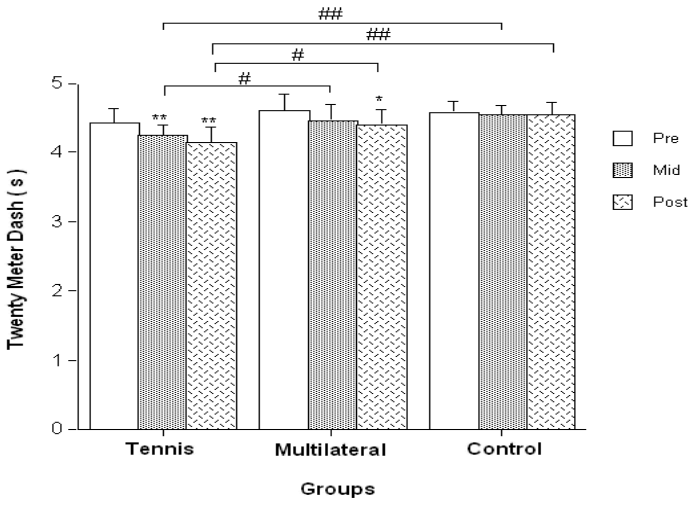

Figure 1 Twenty meter dash speed test (sec) during pre, mid and post tests of experimental group I - tennis (PE+T), experimental group II - multilateral (PE+M) and control group - (PE). Mean (±SD)

*, ** significantly different from pre-test values ($p<0.05$, $p<0.01$ respectively).

#, ## significantly different between groups ($p<0.05$, $p<0.01$ respectively).

Flexibility

Experimental group II (PE +M) exhibited significant improvement ($p<0.001$) from pre-test (0.6 ± 3.1 cm) to mid test (1.6 ± 3.4 cm) and from mid test to post test (2.3 ± 3.2 cm) in the sit and reach flexibility test. There was slight improvement in experimental group I from 4.7 ± 4.1 cm (pre test) to 4.9 ± 4.3 cm (post test). There were no significant changes in sit and reach flexibility test in the control group during the experimental period (Fig. 2).

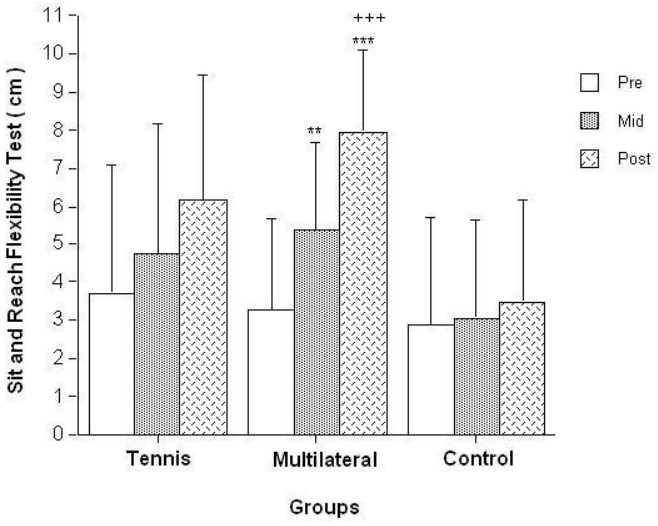

Figure 2 Sit and reach flexibility (cm) during pre, mid and post tests of experimental group I - tennis (PE+T), experimental group II –multilateral (PE+M) and control group - (PE).

, * Significantly different from pre-test values ($p<0.05$, $p<0.001$ respectively)

+++ Significantly different from respective mid-test values ($p<0.001$)

Agility

Experimental group I (PE+T) displayed significant improvement after 6 weeks of sports specific intervention programme from 25.2 ± 3.6 sec. (pre-test) to 19.9 ± 2.4 sec. (mid-test) and further improved timing to 18.3 ± 1.5 sec after 12 weeks. Experimental group II (PE +M) displayed significant decrease in timing after 12 weeks from 27.8 ± 4.9 sec. (pre-test) to 16.7 ± 2.8 sec. (post-test). Control group did not display any improvement in agility. There were significant differences in hexagon agility test during pre, mid and post test between the experimental groups and control group (Fig. 3).

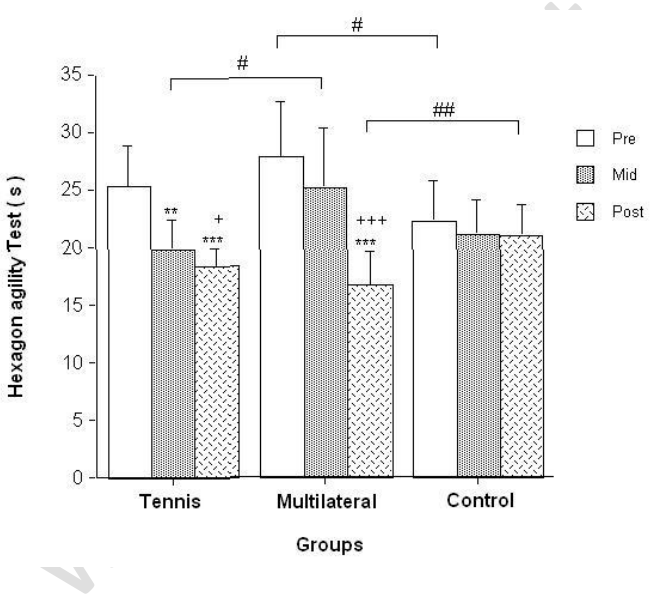

Figure 3 Hexagon agility test (seconds) during pre, mid and post tests of experimental group I - tennis (PE+T), experimental group II - multilateral (PE+M) and control group - (PE).

, * significantly different from respective pre-test values ($p<0.01$ and $p<0.001$ respectively)

$^{+}$, $^{+++}$ Significantly different from respective mid-test values ($p<0.05$ and $p<0.001$ respectively)

$^{\#}$, $^{\#\#}$ Significantly different between groups ($p<0.05$, $p<0.01$ respectively).

Strength and Power

There was a significant improvement from pre test (22.38 ± 3.1 cm) to post test (23.25 ± 3.07 cm) in experimental group I (PE+T) after 12 weeks of intervention programme ($p<0.05$). Although there was an improvement in experimental group II (PE +M) and control group from the pre test (18.34 ± 3.75 cm) to post test (19.78 ± 3.71 cm) and from pre-test (21.23 ± 2.34 cm) to post test (21.10 ± 2.83 cm) respectively, it was not statistically significant. There was a significant difference between experimental group I and group II during pre-test and mid test (Fig. 4).

Other strength parameters did not display significant changes in the course of the study.

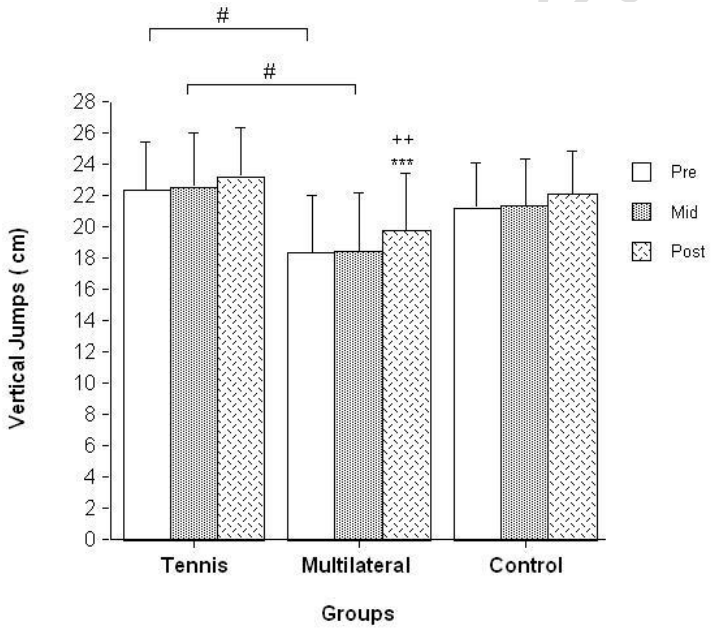

Figure 4 Vertical jumps (cm) during pre, mid and post tests of experimental group I - tennis (PE+T), experimental group II - multilateral (PE+M) and control group - (PE).

*** Significantly different from respective pre-test values ($p<0.001$)

$^{++}$ Significantly different from respective mid-test values ($p<0.001$)

$^{\#}$Significantly different between groups ($p<0.05$).

Observed improvements in speed and agility could be partially explained by use of the shuttle runs and agility (ladder exercise) training during both general and specific intervention programme in the experimental groups. It has been showed that running speed in children was improved in both sexes rather sharply from 5 to 8 years of age, sex differences were small during most of childhood although becoming slightly more apparent closer to adolescence (Malina et al., 2004).

The significantly improved sit & reach and hamstring flexibility in experimental groups was not surprising. Both boys and girls progressively become more flexible from childhood to adolescence (Wilkinson et al., 1996).

Results of the present study are in accord with another study which revealed that after 12 to 14 weeks of strength training with incorporated stretching exercises improved hamstring flexibility. It appears that strength training also can improve hamstring flexibility, since stretching exercises were incorporated into the training programme (Lillegard et al., 1997; Weltman et al., 1986).

Similar results were obtained in the treatment group whichperformed significantly better in the sit-and-reach test after 10-week physical fitness programme (Ignico & Mahon, 1995). The main reason for flexibility improvement in such short span of time was that activities designed were included on a daily basis as part of the warm-up a cool down procedures.

As on speed and power, previous study showed that the children who participated twice a week in the strength training had significantly greater gains in 1RM chest press strength as compared to the control groups. 1RM chest strength was increased by 11.5%, whereas gains made by control group was 4.4% (Faigenbaum et al., 2002).

It was suggested that children physical fitness can be improved during the childhood years and favor training frequency of twice per week for children participated in an introductory strength training program, for the every segment of each session lasted approximately 30-40 minutes, and the session ended with 10 minutes of game, stretches and cool down activities (Faigenbaum et al., 2002).

Main practical conclusion of the study was that specific and general recreational training of once a week in addition to physical education classes brought about the same improvement to physical fitness of the children. Irrespectively of whether they applied specific or multilateral fitness programme, there were no significant differences in physical fitness profile between the experimental groups. Results of the study obviously indicated that children who were involved in the intervention programme improved significantly in speed and agility in comparison to control group.

As for the fitness profile is concerned intervention programme brought improvement in speed, agility, strength and flexibility in the experimental groups.

Physical education classes held in the primary school should increase the physical activity intensity and include the programmes which consist of elements of fun and play in order to be useful in children's motor development.

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