South African Journal for Research in Sport, Physical Education and Recreation, 2011, 33(3): 11-22.
Suid-Afrikaanse Tydskrif vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2011, 33(3): 11-22.
ISBN: 0379-9069

MOTOR PROFICIENCY AND PHYSICAL FITNESS IN ACTIVE AND INACTIVE GIRLS AGED 12 TO 13 YEARS

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ABSTRACT

*In modern day society physical activity levels diminish rapidly among girls and may be a direct consequence of girls experiencing motor difficulties. Therefore the aim of the study was to compare motor proficiency levels and physical fitness levels among active and inactive girls (N=97), aged 12 to 13 years. The BOTMP Short Form was used to assess the girl's motor proficiency levels and the results revealed a highly significant difference (p=0.000007**) between the groups. The Fitness-gram and Activity-gram were used to measure health-related fitness and activity levels respectively. The research indicated that only two of the variables regarding health-related fitness showed a highly significant difference with regard to the healthy fitness zone (HFZ) and needs to improvement zone (NTIZ) between the groups, namely the one-mile-run (p=0.0057**) and the push-up test (p=0.0001**). No significant difference was observed for the curl-up (p=0.7643), trunk-lift (p=0.0922), back-saver sit-and-reach (p=0.2365), shoulder-stretch left arm (p=0.7145) and shoulder-stretch right arm (p=0.2620) and percentage body fat (p=0.2365). The activity logging-chart revealed that the active girls in contrast to the inactive girls met the recommended physical activity requirements of 60 minutes of moderate to vigorous intensity activities every day.*

Key words: Physical activity; Motor proficiency; Physical fitness; Healthy fitness zone; Health-related fitness; Activity-gram; Bruininks-Oseretsky test battery; Fitness-gram.

INTRODUCTION

Motor proficiency focuses on the total development of the child to improve his or her total welfare by means of scientific movement programs for purposes of complying with the requirements of the contemporary age. Aspects of motor proficiency such as running speed and agility, balance, bilateral coordination, strength, visual-motor control and manual dexterity form the basis for recreational activities and physical activities (Bruininks, 1978).

Physical activity is defined as "any form of muscular activity that results in the expenditure of energy proportional to muscular work" (Powers & Howley, 2007:321). Physical activity can be viewed as any activity such as everyday life activities, for example cleaning the house or working in the garden, jogging, playing sport, stretching as well as weight training, and moving the human body by means of the muscles. A variety of these activities should be performed daily in order to comply with the minimum requirements of being active. Habitual physical activities have favourable or unfavourable effects on fitness (Bunc, 2000).

McArdle *et al*. (2001) define physical fitness as an attribute describing how well one performs a physical activity. Physical fitness is prejudiced by nutritional status, genetic makeup and frequent participation in a variety of intense physical activities over time (Gallahue & Ozmun, 2002). It is important to note the interwoveness of physical activities, motor proficiency and physical fitness. The decrease in the physical activity levels may be the result of children experiencing motor difficulties (Wrotniak *et al*., 2006; Chiodera *et al*., 2007). According to Hands (2008:155) "children with motor difficulties are unable to participate successfully in many physical activities enjoyed by their well-coordinated peers". Hands (2008) concur with Powers and Howley (2007) by stating that physical activity is related to physical fitness. Fitness components are being compromised by a lack of activity (Bouffard *et al*., 1996; Hands, 2008; Lennox, *et al*., 2008). Due to inappropriate low performance scores on fitness tests, Rowland and Freedson (1994:670) describe low fitness scores as a "fitness crisis". These statements reveal the importance of participation in physical activities in order to improve motor proficiency, as well as physical fitness.

The tendency is that many children are less physically active than recommended (McArdle *et al*., 2001) and physical activity declines as children get older (Wrotniak *et al*., 2006). According to Chiodera *et al.* (2007), physical activity in schools is declining in many countries and inactivity in childhood has become a recognised risk factor. Children, especially girls, are less active due to modern lifestyles. The increased awareness of the physical activity levels of girls can be found in work done by Goran *et al*. (1998), Engelbrecht *et al*. (2004) and Pate *et al*. (2004) where the researchers came to the conclusion that girls were classified as 'low-active'.

A decrease in physical activity results in fewer opportunities to acquire acceptable levels of motor proficiency abilities that would aid them in successful sport participation and cultural activities. A decrease in physical activity levels also contributes to lower fitness levels leading to health problems such as obesity, diabetes and hypertension. The literature clearly indicates that there is a relationship between physical activity, motor proficiency and physical fitness. For this reason it would be worthwhile to determine the extent of this relationship. Thus, the purpose of the study was to compare the motor proficiency levels and physical fitness levels among active and inactive girls (N=97) aged 12 to 13 years.

METHOD

Participants

The participants were a convenience sample drawn from a school in Bloemfontein, Free State province, South Africa. The participants consisted of 50 girls who were identified as active (51.5%) based on their participation in various sports provided by the school, and 50 girls who were inactive (48.5%), participating in cultural activities. As three girls withdrew, a final sample of 97 girls between the ages of 12 and 13 years took part in this study. There were no significant differences (p=0.5183) with regard to age between the active and inactive groups. Note that the n-value varies for some variables in the tables and figures due to girls not completing all the tests as recommended as a result of time constraints, as well as other cultural and sporting activities in which they had to participate during the testing procedure.

Testing procedure

The testing procedures were conducted over an eight-week period. In this period all the girls were tested on a short form of the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP), as well as the Fitness-gram. In addition, girls had to complete an Activity-gram in which their activity levels could be determined. The tests were completed after school hours and administered by students who were familiar with the testing procedures in order to ensure consistency. Each test was demonstrated to the participants and each participant was allowed a practise trial before the actual testing commenced.

Instruments

Bruininks-Oseretsky Test of Motor Proficiency

The short form of BOTMP was used to assess the girl's motor proficiency. According to Bruininks (1978), the short form has been validated against the full scale and consists of 14 items taken from the eight subtests that correlate highly with the subtest score and the total score. The eight subtests assess: gross motor development, including running speed and agility, balance, bilateral coordination and strength; gross and fine motor development, including upper limb coordination; and fine motor development, including response speed, visual-motor control, and upper-limb speed and dexterity (Bruininks, 1978). A total standard score, adjusted for the child's age, was used to interpret test performance. The BOTMP is a standardised, product-orientated assessment commonly used in the assessment of motor abilities in children.

Fitness-gram

The Fitness-gram is a complete battery of health-related items that are scored using criterion-referenced standards (The Cooper Institute, 2005). Standards are age- and gender-related and are established on the basis of how fit children should be to enjoy good health. The tests included cardio-vascular fitness (assessing aerobic capacity by means of the one-mile-run), muscle strength and muscular endurance (push-ups and curl-ups to a specific cadence), flexibility (measuring hamstring flexibility, the back-saver sit-and-reach test was conducted) and body composition (height and weight measures converted to body mass index). In order to establish if the participants fell in the Healthy Fitness Zone, the tests were scored by means of the Fitness-gram software programme (The Cooper Institute, 2005).

Activity-gram

The girls completed an activity logging-chart (The Cooper Institute, 2005) to determine the activity levels of active and inactive groups. Sport participation among the active group varied from swimming, track and field, cross-country, netball, hockey, tennis and squash. The inactive group participated in activities such as singing in a choir, playing musical instruments, horse riding, drama and chess, as well as taking part in debates (public speaking). However, both groups took part in physical education classes presented by the school. The girls participated once a week for 30 minutes in swimming activities during summer (the season in which the research was conducted).

Data analysis

Data was analysed using the Statistical Analysis Software Version 9.1.3. Frequencies and percentages were calculated for categorical data. Medians and percentiles and means and standard deviations were calculated for numerical data. The Chi-square test was used to compare the results of the active and inactive group for categorical data. The Kruskal-Wallis test and t-test was used to compare the results of the active and inactive group for numerical data. A significance level of $p \leq 0.05$ was accepted to test for significant differences and $p \leq 0.01$ to test for highly significant differences between the groups.

RESULTS

Motor proficiency

Children's motor proficiency competence can be classified into three categories: low (<32-42), medium (43-57), and high (58-67>) according to Bruininks (1978:137). Each category can be subdivided into three smaller segments. Low, for example would be very-low (>32), medium-low (32-37) and high-low (38-42); average can be divided into low-average (43-47), medium-average (48-52) and high-average (53-57); and the final category high into low-high (58-62), medium-high (63-67) and very-high (>67).

Motor proficiency levels according to the various segments among the girls in the different proficiency categories in this study are summarised in Table 1.

TABLE 1: **MOTOR PROFICIENCY SCORES PER GROUP**

Segments		**Inactive (%)**	**Active (%)**
Very-LOW	>32	0	0
Medium-LOW	32-37	0	0
High-LOW	38-42	0	0
Low-AVERAGE	43-47	4.3	0
Medium-AVERAGE	48-52	6.4	0
High-AVERAGE	53-57	21.3	6.0
Low-HIGH	58-62	36.2	14.0
Medium-HIGH	63-67	12.8	28.0
Very-HIGH	>67	19.2	52.0

Table 1 indicates that only 4.3% of the inactive group fell in the low-average segment and 0% of the active group. The inactive group had 6.4% in the medium-average segment and 0% among the active group. The inactive group had 21.3% and the active group 6% in the high-average segment. The final category, namely high, indicated that 36.2% of girls from the inactive group and 14% of girls from the active group were in the low-high segment. The medium-high segment contained 12.8% of the inactive group and 28% of the active group. The final segment refers to the very-high segment and comparing the inactive and active group with one another the various percentages were 19.2% and 52% respectively. In conclusion, although both groups had a majority of girls in the high category, dividing the high category into the smaller segments, the inactive group's highest percentage was in the

low-high segment with 36.2% of the girls. The active group's highest percentage was in the very-high segment including 52% of the girls. There was a highly significant difference (p=0.00007**) regarding the segments of motor proficiency between active and inactive girls.

Physical fitness

Physical fitness was analysed in two ways: (a) if a significant difference occurred in fitness levels (Table 2.1 & 2.2) and; (b) if a significant difference occurred in fitness performance with regard to the healthy fitness zone (HFZ) and needs to improvement zone (NTIZ) (Table 3). Each variable according to the Fitness-gram was used and comparisons made between the active and inactive groups.

TABLE 2.1:**PHYSICAL FITNESS SCORES AND PERCENTILES PER GROUP**

	n		25th Percentile		Median		75th Percentile	
Variables	**IA**	**A**	**IA**	**A**	**IA**	**A**	**IA**	**A**
Height	45	47	144.8	152.4	157.5	157.5	160.0	162.6
Weight	45	47	44.9	43.5	52.6	50.3	59.0	59.4
One-mile-run	45	47	10.2	7.8	14.0	11.0**	15.3	14.0
Push-ups	45	47	2	4	3	7*	5	15
Curl-ups	45	47	7	6	10	14	20	20
Trunk-lift	45	48	22.9	27.9	27.9	30.5*	30.5	30.5
Sit-and-reach L-leg	45	47	0	0.8	10.2	7.6	17.8	20.3
Sit-and-reach R-leg	46	48	0	0.1	10.2	9.8	17.8	20.3
Fat %	45	47	21.5	17.8	24.2	21.2	27.0	25.7

IA = inactive; A = active Significant difference: *= p≤0.05 **= p≤0.01

TABLE 2.2:**PHYSICAL FITNESS SCORES PER GROUP**

	n		Minimum		Maximum		Mean		SD	
Variables	**IA**	**A**	**IA**	**A**	**IA**	**A**	**IA**	**A**	**IA**	**A**
Height	45	47	139.7	121.9	167.6	170.2	154.9	155.4	7.9	9.2
Weight	45	47	33.1	31.8	80.7	88.5	52.8	51.6	11.2	11.1
One-mile-run	45	47	7.5	6.3	17.7	15.6	13.1	11	2.9	3.1
Push-ups	45	47	0	0	27	34	4.2	9.7	5	7.8
Curl-ups	45	47	2	0	75	75	16	17.1	16	15
Trunk-lift	45	48	10.2	0	30	30	26.3	27.9	4.9	5.2
Sit-and-reach L-leg	45	47	0	0	30	30.5	11.4	11.1	11.1	10.5
Sit-and-reach R-leg	46	48	0	0	30	30.5	11.4	11.5	10.6	10.7
Fat %	45	47	12.0	13.5	50.0	30.3*	24.4	21.7	5.7	4.7

IA = Inactive; A = Active SD = Standard deviation Significant difference: *= p≤0.05

No significant difference existed between the mean values in the groups with regard to height (p=0.7874) as well as weight (p=0.5842). According to the median values, the results indicated a significant difference with regard to the one-mile-run (p=0.0011**), push-up test (p=0.0001**) and trunk-lift test (p=0.0344*) where the active group outperformed the inactive group. No significant differences were found between the groups with regard to the curl-ups (p=0.5575), back-saver sit-and-reach left leg (p=0.9590) as well as for the right leg (p=0.9654). For fat percentage, a significant difference (p=0.0156*) was noticeable between the active and inactive groups when comparing the maximum values.

The Fitness-gram (Cooper Institute, 2005) classifies children into two groups according to performance. The first category refers to children who fall into the HFZ, meaning that the child is healthy for a specific variable according to age. The second category refers to children who fall into the NTIZ. Children who fall into this category need to improve their fitness according to the specific variable. The fitness performance results are indicated in Table 3.

TABLE 3: **FITNESS PERFORMANCE REGARDING HEALTHY FITNESS ZONE (HFZ) AND NEEDS TO IMPROVE ZONE (NTIZ) PER GROUP**

Variables	Inactive group		Active group		Significant difference P-value
	HFZ (%)	NTIZ (%)	HFZ (%)	NTIZ (%)	
One-mile-run	28.0	71.0	57.5	42.6	0.0057**
Push-up	13.3	86.7	55.3	44.7	0.0001**
Curl-up	31.1	68.9	34.0	66.0	0.7643
Trunk-lift	82.2	17.8	93.6	6.4	0.0922
Sit-and-reach L-leg	17.8	82.2	17.0	83.0	0.9238
Sit-and-reach R-leg	15.6	84.4	17.0	83.0	0.8491
Sit-and-reach both legs	13.3	86.7	12.8	87.2	0.2365
Shoulder-stretch L	93.3	6.7	89.4	10.6	0.7145
Shoulder-stretch R	88.9	11.1	95.7	4.3	0.2620
Fat %	95.6	4.4	100	0	0.2365

Significant difference: *= $p \leq 0.05$; **= $p \leq 0.01$

The *one-mile-run* showed a highly significant difference (p=0.0057**) between the mean values of the two groups. The inactive group had 28% of girls in the HFZ and 71.1% in the NTIZ. The active group had 57.5% in the HFZ and 42.6% need to improve their aerobic capacity.

With regard to the *push-up* test, the inactive group only had 13.3% of girls in the HFZ and 86.7% need to improve their arm strength. The active group showed a highly significant difference (p=0.0001**) where 55.3% were in the HFZ and 44.7% need to improve their strength. There was no significant difference (p=0.7643) between the two groups for the *curl-up* test. The inactive group had 31.1% in the HFZ compared to 34% of the girls in the active group. The research showed that 68.9% of girls in the inactive group and 66% in the active group need to improve on their abdominal strength. Based on the *trunk lift* test, there was no

significant difference (p=0.0922) between the two groups. The inactive group had 82.2% in the HFZ with 93.6% of girls in the active group. The findings showed that 17.8% of girls in the inactive group and 6.4% in the active group need to improve their flexibility.

The back-saver *sit-and-reach* test is divided into the left leg, right leg and both legs. In the inactive group 17.8% of the girls fell into the HFZ and 82.2% need to improve hamstring flexibility of the left leg. The active group shows 17% of the girls fell into the HFZ and 83% need to improve. No significant difference was found between the two groups (p=0.9238). Flexibility of the right leg in the inactive group indicated that 15.6% of the girls were in the HFZ and 84.4% need to improve hamstring flexibility of the right leg. The active group indicated that 17% of the girls were in the HFZ and 83% need to improve. No significant difference was found between the two groups (p=0.8491). In addition, a combination of the left and right leg was taken into consideration. The inactive group had 13.3% for both legs and were in the HFZ compared to 12.8% of girls in the active group. The findings indicated that 86.7% of girls in the inactive group and 87.2% in the active group need to improve flexibility in both legs in order to fall in the HFZ. There was no significant difference between the two groups (p=0.2365).

Flexibility of the left arm was measured by means of the *shoulder-stretch*. The inactive group indicated that 6.7% could not perform the shoulder-stretch and 93.3% could stretch the left arm. The active group indicated that 10.6% of the girls could not perform the shoulder-stretch and 89.4% could stretch the left arm. No significant difference was found between the two groups (p=0.7145). Flexibility of the right arm was measured with the same procedure. The inactive group indicated that 11.1% could not perform the shoulder-stretch and 88.9% could stretch the right arm. The active group indicated that 4.3% of the girls could not perform the shoulder-stretch and 95.7% could stretch the right arm. No significant difference between the groups (p=0.2620) was observed. The shoulder-stretch for both the left and right arm was the second test where the majority of girls in this sample fell into the HFZ.

The final variable was the *percentage body fat* where there was no significant difference (p=0.2365) between the two groups. The inactive group had 95.6% in HFZ in relation to 100% of girls in the active group. The research showed that 4.4% of girls in the inactive group and 0% in the active group need to improve their body fat percentage. In conclusion, if the total group is taken into consideration, it is clear that both groups had a majority of girls who needed to improve their fitness.

Activity logging-chart

The girls completed an activity logging-chart in order to determine the activity levels of the active and inactive groups. Sport participation among the active group varied from netball, swimming, track and field, cross-country, hockey, tennis and squash. Their participation levels ranged between two to three times a week and Saturdays for competition. The training programs consisted of all the health-related components (cardio-vascular endurance, muscular strength, muscular endurance and flexibility), as well as skill-related components (speed, balance, coordination, agility, reaction time and power) in order to improve overall abilities.

The inactive group participated in activities such as singing in a choir, playing musical instruments, horse riding, drama, chess, taking part in debates (public speaking) and dancing. A majority of these activities did not provide ample opportunities to improve health-related components, whereas horse riding and dancing might influence fitness components such as cardio-vascular endurance, muscular strength, muscular endurance and flexibility. Cultural activities such as playing instruments and drama can have a positive effect on skill-related components, specifically balance and coordination.

The active and inactive girls took part in physical education classes presented by the school. The girls participated once a week for 30 minutes in swimming activities during summer (the season in which the research took place). The physical education classes provided additional opportunities for the active group to enhance their fitness levels. For some of the inactive girls, this was the only form of physical activity they participated in. In conclusion, it is clearly noticeable that the inactive group had fewer opportunities to improve their motor proficiency and health-related fitness components than the active group.

DISCUSSION OF RESULTS

Motor proficiency

It is interesting to note that a majority of both groups fell into the high category regarding motor proficiency competency. However, the smaller segments indicated that the inactive girls had a low-high ability compared to the active girls' very-high ability. The results indicated a significant difference ($p \leq 0.05$) between the groups with regard to the low-high and very-high segments. This supports the results of the research findings of Bouffard *et al*. (1996) and Wrotniak *et al*. (2006) indicating that children in the higher segment of motor proficiency were the most physically active.

Physical fitness

A significant difference between active and inactive girls with regard to the one-mile-run, push-up test, fat percentage and the trunk-lift test was observed in the present study. In contrast, the results revealed no significant difference with regard to the curl-up test and the back-saver sit-and-reach test (left and right leg) between active and inactive girls.

The one-mile-run is a cardio-respiratory endurance test. The results of this study revealed a significant difference ($p \leq 0.05$) between active and inactive girls. This is similar to the findings of Tan (2002) and Dollman and Ridley (2006) who observed inferior cardio-respiratory endurance where inactivity was concerned. Although fat percentage will be discussed separately, the results were needed to make the following comparison with regard to cardio-respiratory endurance. The results indicated a significant difference ($p \leq 0.05$) in fat percentage between active and inactive girls and, according to Chen *et al*. (2006), overweight/obese girls tend to have poorer cardio-vascular endurance.

In order to determine muscular endurance and muscular strength the push-up test and curl-up test were applied. A significant difference ($p \leq 0.05$) between the active and inactive girls existed regarding the push-up test. These results are similar to those of Gallahue and Ozmun

(2002) where a significant increase in muscular endurance and muscular strength only occurred if girls take part in sport training programs. It can be concluded that the sport participation of the active group improved muscular endurance and muscular strength, specifically related to the push-ups.

No significant difference was observed with regard to the curl-up test indicating that the sport training program did not improve muscular endurance and muscular strength as posed by Gallahue and Ozmun (2002), specifically for the curl-up test among active girls who participated in sport. As mentioned earlier, fat percentage will be discussed separately, but the results were needed to make the following comparison with regard to muscular endurance and muscular strength. The results indicated a significant difference in fat percentage between active and inactive girls. According to Chen *et al*. (2006), overweight/obese girls tend to have poorer muscular endurance and muscular strength, which compares well to the push-up test, which contrasts with the curl-up test.

A skinfold calliper was used to determine the fat percentage of active and inactive girls. A significant difference (p 0.05) was observed and compares with research by Dollman and Ridley (2006) who found that inactive girls had higher fat percentages. Higher fat percentage levels are negatively associated with other health-related fitness components such as the one-mile-run (cardio-respiratory endurance) and push-up test (muscular endurance and muscular strength), but not with regard to the curl-up test.

The trunk-lift test and back-saver sit-and-reach test was conducted to determine the girls' flexibility. A significant difference ($p \leq 0.05$) occurred between active and inactive girls, specifically with regard to the trunk-lift test. This is comparable to the findings of Garcia (2002) who stated that flexibility decreases with sedentary lifestyles. Conversely, no significant difference regarding the back-saver sit-and-reach test was observed. According to Baquet *et al*. (2006) hamstring flexibility decreases every year among girls.

In conclusion a majority of girls in both groups need to improve their fitness levels, indicating insufficient fitness levels on various aspects as mentioned in the above paragraphs with regard to fitness.

Activity logging chart

The recommended physical activity requirements refer to 60 minutes of moderate to vigorous intensity activities every day (The Cooper Institute, 2005; Spinks *et al*., 2007). The activity logging-chart for both groups revealed that the active girls met the recommended physical activity requirements (accumulated by means of sport participation, physical education classes and recess time) in comparison with the inactive girls who did not meet the requirements.

Various studies such as Bouffard *et al*. (1996), Engelbrecht *et al*. (2004) and Wrotniak *et al*. (2006) found that low activity levels and sedentary lifestyles among girls are rapidly increasing. For this reason, inactivity is becoming an international epidemic. This study clearly indicates that effort should be made to improve activity levels as far as possible to aid inactive girls to become active and to stay active throughout life.

RECOMMENDATIONS

In an attempt to improve activity levels, motor proficiency and fitness levels among girls, the followings strategies may be applied:

Physical education programs in the school environment should be revised. According to Naughton *et al*. (2006) and Chiodera *et al*. (2007), physical education has declined in schools. Nevertheless, the school involved in the present study provided physical education classes. Pate *et al*. (2004) concluded their study with the observation that boys participated in significantly more moderate-to-vigorous physical activity and vigorous physical activity than did girls. Although the girls who participated in the present study had access to physical education classes, it is clear that the classes were not appropriate for the inactive girls with regard to the time (duration) spent on physical education, as well as the intensity and frequency of the classes. The present study revealed that inactive girls did not meet the recommended minimum daily physical activity requirements as posed by Spinks *et al*. (2007).

The results indicated sufficient motor proficiency competency for both groups, although the smaller segments indicated that the inactive girls had a low-high ability compared to the active girls' very-high ability. Skill-related components such as balance, coordination, agility, reaction time, speed and power can be improved by means of motor development programs. Establishing these programs in the school environment will provide opportunities to improve fundamental skills (motor proficiency), to facilitate physical activity and sport participation as posed by Haubenstricker and Seefeldt (1986). A lack of motor proficiency can be improved by means of intervention programs conducted by a Kinderkineticist or physical therapist. The success of intervention programs is evident in work done by Chiodera *et al*. (2007) and Van Niekerk *et al*. (2007).

The present study clearly indicated insufficient fitness performance on various aspects and supports the findings of the study of Rowland and Freedson (1994:670), which describes children's low fitness scores as a "fitness crisis". According to Hands (2008), the fitness components are being compromised by a lack of reduced activity. Conversely, the present study revealed that the active girls also exhibited poor fitness levels. To facilitate the improvement of fitness levels and health, inactivity should be minimised by means of a decrease in time spent with technology such as television and computers. It would be advisable to promote sport and physical participation at primary school levels.

The results clearly point out that the active girl's exhibited better motor proficiency levels and outperformed the inactive girls in fitness components such as the one-mile-run and the push-up test. Hence, this study indicated a relationship between physical activity, motor proficiency and physical fitness.

The study demonstrated several limitations, which could be overcome in future research. The limitations include the following:

- The study's population sample consisted of 97 girls who were all recruited from the same institution and province, therefore the results cannot be generalised to the larger population of 12 and 13 year old girls in the country, as certain discrepancies may occur.
- The representation of different ethnic groups in this sample was not recorded. This may be a variable that should be contended with in further research especially in South Africa where cultural practices may play a defining role.
- Although the study had only a small sample, the end result remains important. Research on the motor development of children is well acknowledged but research on skill-related fitness (motor proficiency) is still limited. Conversely an abundance of research on health-related fitness is available.

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(Subject Editor: Prof. S. Wilders)