

A Comparative Study of Motor Development Patterns of Trained and Untrained Indian Girls

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Abstract

The primary purpose of the study was to compare the motor development patterns of trained and untrained girls of 10-16 years of age. The present investigation was carried out on 752 trained girls and 957 untrained girls from different games and sports (trained) and from different part of India (untrained) falling in the age range of 10-16 years. Six components of motor development namely Explosive Leg Strength, Abdominal Strength, Trunk Flexibility, Speed, Agility and Endurance were assessed using standard techniques. The results in general indicate a trend of improvement in all the motor performance components of trained and untrained girls belonging to 10-16 years of age. Further, the results also indicate that trained girls are superior to untrained girls on selected motor performance at every age level. The trend of improvement is rapid upto 13 or 14 years of age, after that the trend seems to be slow or stagnated or deteriorated.

Key Words: Motor development pattern, Strength, Flexibility, Speed, Agility Endurance, Trained, Untrained.

Introduction

The keen struggle among the nations of the world to win more and more medals in competitions has led to profound changes in the training and competition system. Sports Coaches, Teachers of Physical Education, Sports Scientists, etc. all over the world are in search of better ways and means for sporting talent and for systematic and scientific training to them. It is an established fact that high performances are possible only after a regular and systematic training of about 8-10 years. *Singh (1991)* suggested that the systematic training must begin in childhood itself. Therefore, the science of growth and development has become an important aspect for performance sports. It is being studied from difficult aspects to utilize the children and youth to achieve world level performance when they grow up.

The growth and development of motor abilities and their accurate assessment definitely helps in identifying the talented children and also in

formulating scientific training programme for the children and youth of various ages, so that it leads to the achievement of high performance at the right age and also to minimize any negative effect of training on them.

India, unlike the countries of Europe and America is a vast country inhabited by people of different racial origins, and living under vastly different geographical, economical and social-cultural conditions. This feature, therefore, make the study of motor development pattern of Indian children more important.

Espenschade (1968) observed that the general motor ability of girls did not improve after the age of 14, whereas, body shows steady improvement up to 18 year of age. *Morehouse and Miller (1968)* concluded that the athletic ability in girls reached a maximum at the age of 13 or 14 years then tended to decline up to 18 years of age. *Berry (1974)* concluded in his study that the power performance of girls improves up to the 13 years. *Anyanwu*

(1977) and Bennett et al. (1983), concluded in their studies that trained girls possess better fitness levels at every age in comparison to untrained girls. Therefore, there is a need to study the motor development patterns of trained and untrained Indian girls of 10-16 years of age, so that their rate of development is properly utilized to improve sports performance in different games and sports.

Materials and Methods

The study has been conducted on a cross sectional sample of One Thousand Seven Hundred & Nine trained and untrained girls of 10-16 years. The total sample includes 752 trained and 957 untrained girls. The trained girls for the study were selected from various sports promotion schemes of Sports Authority of India, Sports Schools, Sports Hostels, Sports Wing, Regional and District Coaching Centres, Sub-junior and Junior National Coaching Camps. Whereas, the untrained girls were selected randomly from the various schools those who have not been undergoing any systematic and regular sports training.

Various components of motor development pattern were measured using standard techniques as mentioned in table-1.

Table 1: Measured motor components

Motor Development Components	TEST USED
Explosive Strength – Leg	Standing Broad Jump
Abdominal Strength	Bent Knee Sit-ups
Trunk Flexibility	Forward Bend and Reach
Speed	40 Meters Dash
Agility	6x10 Meters Shuttle Run
Endurance	800 Meters Run/walk

Results

Descriptive Statistics and Comparative Statistics were use to analyse the data in relation to motor development pattern of trained & untrained Indian girls. The mean and standard deviation of each individual age group for trained girls have been presented in Table-2. Results and analysis pertaining to each selected motor performance components have been presented separately.

Explosive Strength–Legs

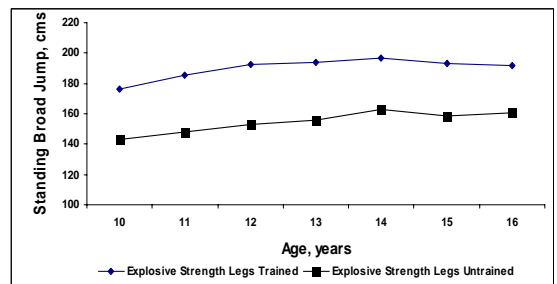


Figure 1: The Pattern of abdominal strength development in untrained and trained Indian girls

An examination of Leg-strength pattern clearly shows that the trained girl’s performance improves progressively up to 14 years of age. From 14 to 16 there is deterioration in the performance of leg strength. This deterioration is not in accordance with the general agreement. However, this might be because of the fact that the girls seems to reach their peaks in performance around 12 or 13 years. This is also the age of Menarche for many girls. The another factor which the investigators feels is, that in this age group of growth and development, enough stress to develop explosive leg strength might not have been given in their day-to-day training programme.

The similar trend is also seen in case of untrained girls. It might be

attributed to the fact that there is a continuous increase in height, body weight and different circumferences taking place and energy is diverted towards the process of growth and development. The untrained girls due to the social and cultural factors tend to avoid physical activities and

become physically more inactive than the early age.

The trend girls of all ages were superior in leg strength than the untrained girls. Such a pattern of development has been already reported by *Espenschade (1968); Morehouse and Miller (1968) and Malina and Rarick (1973).*

Table 2: Means and Standard Deviations of Selected Motor Development Patterns of Trained and Untrained Indian Girls

M.D.C.	AGE		10	11	12	13	14	15	16
		T	N	79	97	93	92	95	104
No. of Subjects	UT	N	154	148	161	153	113	115	113
		Mean	176.46	185.07	192.75	193.65	196.72	193.03	191.47
Explosive Strength - Legs	T	± SD	±7.07	±9.33	±10.99	±10.33	±13.60	±10.23	±9.27
		Mean	142.81	147.91	152.96	155.75	162.93	158.41	160.41
	UT	± SD	±16.54	±14.69	±16.85	±16.72	±11.57	±10.29	±11.74
		Mean	36.47	37.85	40.67	42.57	42.89	42.42	42.05
Abdominal Strength	T	± SD	±6.12	±6.21	±5.97	±6.73	±6.11	±7.32	±6.78
		Mean	13.95	16.57	17.86	19.56	20.81	20.01	21.77
	UT	± SD	±3.56	±4.15	±4.42	±4.71	±4.32	±4.87	±4.27
		Mean	13.44	14.12	13.92	15.21	14.39	13.17	12.67
Trunk Flexibility	T	± SD	±2.96	±3.63	±4.16	±4.54	±3.96	±4.01	±4.16
		Mean	5.57	5.53	5.89	5.71	5.82	4.94	4.89
	UT	± SD	±3.39	±3.27	±3.29	±3.82	±3.85	±3.61	±3.21
		Mean	7.04	6.78	6.63	6.64	6.61	6.61	6.67
Speed	T	± SD	±0.31	±0.26	±0.34	±0.30	±0.28	±0.24	±0.26
		Mean	8.06	7.89	7.78	7.69	7.66	7.64	7.51
	UT	± SD	±0.42	±0.45	±0.46	±0.42	±0.49	±0.44	±0.40
		Mean	17.02	16.71	16.61	16.57	16.54	16.52	16.60
Agility	T	± SD	±0.30	±0.41	±0.42	±0.40	±0.43	±0.41	±0.37
		Mean	18.78	18.60	18.40	18.22	18.08	18.70	18.70
	UT	± SD	±0.80	±0.78	±0.90	±0.83	±0.68	±0.84	±0.81
		Mean	198.63	190.48	183.84	184.96	182.38	186.33	185.69
Endurance	T	± SD	±9.80	±12.80	±13.79	±14.91	±14.48	±15.70	±18.21
		Mean	256.83	255.78	254.01	251.33	256.08	248.33	243.69
	UT	± SD	±17.41	±23.81	±27.95	±32.04	±28.18	±19.65	±17.13

UT stands for untrained girls, T stands for trained girls & S.D. for Standard Deviation

Abdominal Strength

An examination of table-2 & fig 2, clearly depict that the abdominal strength of trained girls of 10-16 years of age improves with age. Abdominal Strength in trained girls improves steadily up to 14 years and after that the rate of improvement either decreases or stagnates. It is highly training dependent ability, the reason for the deterioration or stagnation in the performance might be less stress on abdominal strength training being given to the trained girls in their day-to-day training programme.

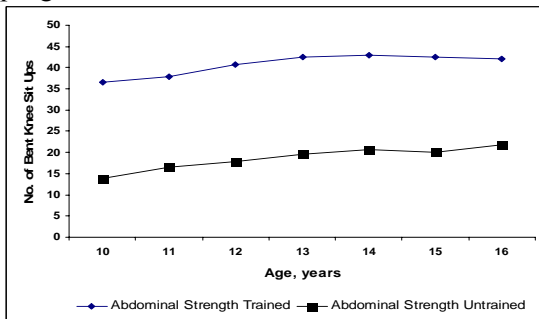


Figure 2: The Pattern of abdominal strength development in untrained and trained Indian girls

The abdominal strength of untrained girls also improves progressively with age. The rate of increase is not quite visible at the age of 14 and 15 years. It is observed from the figure 2 as well as the results that the trained girls show remarkable dominance over the untrained girls in all the age groups. For a good performance in abdominal strength the individual should have sound abdominal muscles. Apart from these facts abdominal muscles grow till adolescence. *Stemmler and Pavok (1971)* have pointed out that abdominal muscles are normally less used muscles; hence, with adequate training their strength performance improves very slowly. However, the increase in the lean

body mass and anaerobic capacity of muscle fiber may contribute towards the improvement in abdominal muscle strength (*Fox et al., 1989*).

Trunk Flexibility

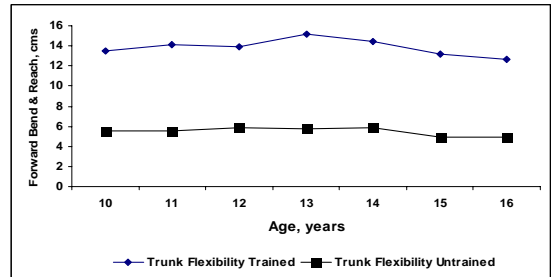


Figure 3: The Pattern of trunk flexibility development in untrained and trained Indian girls

An examination of table-2 & fig 3, clearly shows that the trunk flexibility of trained girls of 10 to 16 years of age improves progressively with age up to 13 years, with some minor fluctuation in between. From 14-16 years there is a drop in the performance of trunk flexibility of trained girls. The investigator presumes that the reason for this might be that the flexibility training being given to the trained girls in their day to day routine might have been less stressed. Non uniform training age of the subjects in different age groups might have influenced the result in the trunk flexibility performance of the trained girls.

It is evident that there is no uniformity in the flexibility scores of untrained girls. The performance from 10-14 years of age does not tend to show any clear cut improvement, there are a lot of ups and downs in the performance score. It seems that the performance in trunk flexibility of untrained girls leveled off at 14 years of age. From above analysis it is clear that the trunk flexibility of untrained girls increases slightly with age upto 14

years. Though this is an established fact that flexibility is a highly training dependent ability, children in early ages are more supple and flexible in comparison with adolescents (*Singh, 1991*). However, flexibility tends to decrease due to the fact that with advancement of age anatomical, physiological and chemical changes take place in the body and the longitudinal growth of bones, muscles, ligaments, tendons and joints restrict/limit the development of flexibility, if not exercised regularly.

The trained girls clearly dominated over the untrained girls in all the age groups. Results show that there are fluctuations and variations in the rate of development of trunk flexibility of both the groups. The trained girls with continuous participation in physical activities develop a good amount of flexibility and maintain it according to the intensity, duration and quality of activities they perform. According to *Sermeev (1966)*, flexibility can be developed at any age given the appropriate training. There is evidence that even adults benefit from flexibility training. The findings of the present study of trunk flexibility development of untrained and trained girls are in consonance with the findings reported by *Leard (1984)*.

Speed

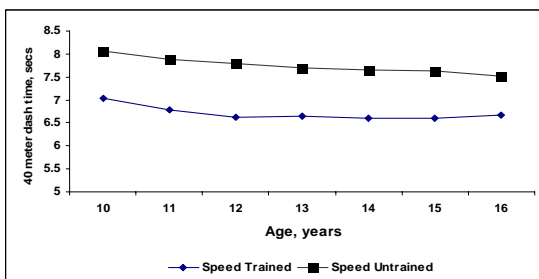


Figure 4: The Pattern of speed development in untrained and trained Indian girls

An examination of table-2 also shows that the speed performance of trained girls of 10-16 years of age improves progressively with age upto 14 years with negligible drop in between. From 14-16 years the speed performance seems to be stagnated and then deteriorates. Speed of untrained girls improves with age from 10-16 years. The pattern of development of the speed performance in untrained girls is as expected. Speed abilities improve at a better pace before puberty. With onset of puberty, speed abilities tend to be negatively affected. Another factor which might have contributed to this trend is the rapid development in strength with onset of puberty. Strength, as well known, is a strong determining factor for speed performance. Rapid increase in leg length (Body height) in 11-12 year old girls might also be one of the contributory factors. Pubescent and adolescent girls, due to social and cultural factors, tend to avoid vigorous physical activity and become physically more inactive. *Singh (1991)* and *Morehouse and Miller (1968)* have reported similar findings in their studies.

It is apparent from figure 4 that the trained girls have dominance over the untrained girls in all the age groups. The maximum development spurt in speed performance was observed between 10-11 years in both trained girls (0.26 Sec.) and untrained girls (0.17 Sec.). Speed is a very complex conditional ability, which depends to a considerable extent on the central nervous system, power, stretch ability, elasticity and recovery level of muscles. Despite less trainability and specificity, it has high importance in games and sports. The better performance of trained girls in all the ages is thought to be due to their regular and systematic physical training. Therefore, increased muscular strength and

explosive power produces an increase in speed performance (Singh, 1991).

Agility

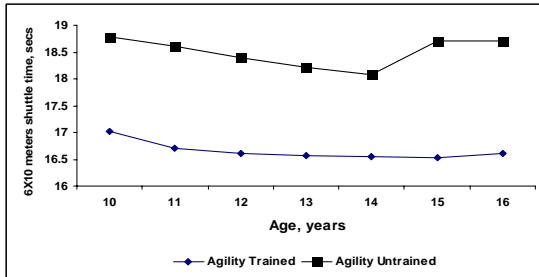


Figure 5: The Pattern of speed development in untrained and trained Indian girls

Table-2 also shows that the agility performance of trained girls of 10-16 years of age improves progressively with age upto 15 years; from 15-16 years there is a slight drop in the performance. With onset of puberty or with advancement of age the rate of yearly development markedly slows down, or rather, it shows a very clear stagnation in the agility performance, which does not seem to be in general agreement of the studies reported. Performance in agility run (Shuttle Run) depends upon factors like speed of movement, acceleration ability, stride length and the ability to change direction quickly in the shortest possible time. The investigator feels that the stagnation observed in case of trained girls in agility performance might be due to two causes. Firstly, enough or proper weightage to this type of agility training may not have been given during these phases in their routine training. Secondly, the specificity of the movement structure of different games and sports might have contributed partly in the stagnation in the agility performance.

Agility of untrained girls improves with age from 10-14 years whereafter a significant deterioration and stagnation in the agility of untrained girls is noticed. This

pattern of development of agility in untrained girls is in accordance with the normal trend. Agility improves at a better pace during childhood and early stage of puberty. During pubescence, girls tend to put on more weight and length of the different body parts also increases which contributes negatively in movement execution. Apart from these factors the social and cultural factors also play a great role.

Figure-5 shows that trained girls have dominance over the untrained girls in agility performance in all the age groups. The maximum rate of agility performance development was observed between 11-12 years (0.20 Sec.) in case of untrained girls while in trained girls between 10-11 years (0.31 Sec.) of age. The better performance of trained girls in all the age group is thought to be due to the fact that coordinative ability (agility) is primarily dependent on neuro-muscular coordination. Improvement of these abilities is only possible through regular and systematic physical training and through participation in multidimensional physical activities of different games and sports.

Endurance

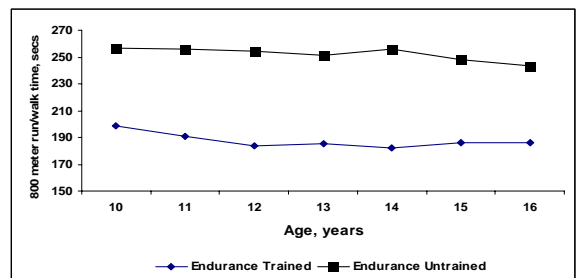


Figure 6: The Pattern of endurance development in untrained and trained Indian girls

An examination of table-2 also shows that the endurance of trained girls of 10-16 years of age improves progressively

with age upto 14 years with a minor drop between 12-13 years of age. From 14-16 years there is a sharp drop in the endurance performance of trained girls. As already investigated, the endurance performance, apart from other factors depends mainly upon physiological factors like heart rate, stroke volume, cardiac output, VO₂max, Hemoglobin concentration and Arterio-venous oxygen differences, etc. The phase of deterioration in trained girls might be due to the fact that enough weightage/stress to develop cardio-respiratory endurance training might not have been given in their sports training programme during this phase.

It is also observed from the table-2 that the endurance performance of untrained girls improves with age upto 14 years, from 14-15 years there is a slight decrease in the endurance performance. But from 15-16 years the performance seems to be increasing. The changes in endurance performance were progressive in nature and were in general line of growth and motor development, because as the age advances the development in heart and respiratory system functions positively affect Cardio-respiratory endurance. As cardio-vascular endurance is a gradual process of development, therefore no significant changes from year to year performance were observed in the untrained girls.

From figure-6, it is apparent that the trained girls have dominance over the untrained girls in endurance performance in all the age groups. As depicted in figure-6, untrained and trained girls performance improves upto 14 years of age and then there is a drop in performance. The maximum development of endurance was observed between 10-11 years (8.15 Sec.) in trained girls while in untrained girls between 13-14 years (5.25 Sec.). The improvement of cardio-vascular endurance

in the trained girls over untrained girls might be attributed to the total improvement in the muscles to undertake training load for longer period. The result of the study of endurance development is in consonance with the studies carried out by *Eriksson and Thoren (1978)*.

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