Original Article

Urban-rural contrasts in motor fitness components of youngster footballers in West Bengal, India

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ABSTRACT

Das, P. & Chatterjee, P. (2013). Urban-rural contrasts in motor fitness components of youngster footballers in West Bengal, India. *J. Hum. Sport Exerc., 8*(3), pp.797-805. In the present world sport and exercise should be well-matched with the surroundings and public healthiness. This study aims to examine whether urban-rural environment have any impact on motor fitness components of footballers as well as sedentary boys of the age group 14 to 16 years. The sample consisted of 60 football players (30 urban and 30 rural) and 160 sedentary boys (80 urban and 80 rural). The parameters included height, weight, body surface area (BSA) and body mass Index (BMI), agility, flexibility, leg muscle power (LMP), speed, hand grip strength (HGS). Standard techniques and procedures were followed for all the tests. Results were expressed as mean ± SD and independent samples T test was conducted to compare between the groups. Results of the study revealed that agility, flexibility, LMP, speed and HGS were significantly higher in rural boys including both of footballer ($p<0.05$) and sedentary ($p<0.01$) group compared with urban boys. From the study, it might be concluded that rural boys showed greater motor fitness comparing to their urban counterparts. However, regular training can reduce this urban-rural difference in motor fitness and lifestyle, habitual activities, living environment had great impact on motor fitness that was clearly understood from control group (sedentary boys). **Key words**: MOTOR FITNESS, URBAN-RURAL, FOOTBALLER, SEDENTARY.

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INTRODUCTION

It is now widely accepted that urbanization is as much a social process where societal and biological alterations of populations are occurred. Urban and rural environmental differences in growth of children have come into focus of interest in the last few years. Contradictory evidences in growth have been reported from several studies from various countries and cultures and with various age ranges. Many studies showed significant differences in growth and maturity status (Lin et al., 1992; Peña Reyes et al., 2003). Data from other studies also revealed that urban-rural contrasts are evident in the growth and body size status (Pawloski, 2002; Cameron et al., 1992). Malina et al. (2004) pointed out that body size is related to performance of many physical fitness components. Hence, the size advantage commonly observed in urban children might also be reflected in better levels of physical fitness. Changes in lifestyle with residence in urban centers may also influence physical fitness. Pilicz & Sadowska (1973) indicated that urban children from Poland favoured the better performance in physical fitness tests such as dash, ball throw and vertical jump where as rural Tswana children had superior endurance performance but inferior grip strength compared to urban children (Corlett & Mokgwathi, 1987; Corlett, 1988). Environmental and societal alteration connected with urban dwelling, e.g., changing neighbourhoods, crowding, concern for protection, lack of sufficient space for play and physical activity, and others, may contribute to reduced levels of physical activity and physical fitness (Peña et al., 2003). In contrast, rural residence is commonly associated with a more dynamic, physically active lifestyle, which is beneficial to physical fitness. According to Dollman et al. (2002) growth and fitness requires to be studied in different climate, economic and cultural circumstance and investigation of the growth and fitness of children resident in rapidly expanding urban areas and in rural communities in the same general region in different countries are potentially of interest.

Concept of physical fitness is as old as humankind. Throughout the history of mankind physical fitness has been considered an essential of daily life having two components like health related fitness and motor or skill related fitness (Corbin & Lindsey, 1994). The ancient people were mainly dependent upon their individual strength, vigor and vitality for physical survival. This involved some basic skill like strength, speed, endurance, agility for running, jumping, climbing and other skills employed in hunting for their livings. Study of skill related or motor fitness gathered lots of interest from earlier. The athletic traits and characteristics of an individual can be explored depending upon physical fitness having different components (Chatterjee et al., 1993) and various factors like race, ethnicity, habitual physical activity and environment may have reflection on these parameters. The present study has been taken to make an urban rural comparison of motor fitness of youngster footballers of West Bengal, India as well as in sedentary boys and to elucidate what extent the effect of training can influence motor fitness of boys living in urban and rural environment.

METHODS

Selection of place

The study is based on boys of the age group of 14-16 yrs. from two communities in West Bengal, India. The urban community was from Tollygunge area - a part of core Kolkata which was included in the city of Kolkata (core) in the year of 1951 (Kolkata proper) (Munsi, 1975; Chaudhuri, 1990) and rural community was located about 123 km from Kolkata city named as Koshigram village of Tehsil- Katwa, Dist: Burdwan.

Subjects

A total of 220 healthy boys (14-16 years) volunteered and this sample consisted of 60 football players (30 urban & 30 rural) and 160 sedentary boys (80 urban & 80 rural). All the football players were in regular

practice and they had a training background of minimum 3 years. Boys of the control group (sedentary boys) were healthy individuals with no athletic or sports training. All the boys were from the same economic status. A subject was considered to be normal and healthy according to the criteria stated by Gill et al. (1968). The tests were demonstrated to the subjects before an actual administration. All institutional policies concerning the human subjects in research were followed. Ethical approval was taken from the competent authority.

Data Collection

The data collected included anthropometric and motor fitness parameters.

- Anthropometric parameters
  Standing height in cm was measured with shoes removed, feet together. Weight in kg was measured with shoes and Jackets removed.
  Body surface area (BSA) and Body mass Index (BMI) were calculated by Du-Bois and Du-Bois Formula (Du-Bois and Du-Bois, 1916) and Meltzer's equation (Meltzer et al., 1988) respectively.
- Assessment of motor fitness parameters
  The methods used for the measurement of motor fitness are detailed here in below:
  1. Method employed for the measurement of Agility by Shuttle Run Test (Johnson and Nelson, 1982).
     To assess the agility of the subject, the shuttle run test was administered. The score for each subject is the length of time required to complete the course. Out of three trials the best trial was recorded as the score.
  2. Method employed for the measurement of Flexibility by Wells Sit and Reach Test (Mathews, 1973).
     To measure the flexibility, Wells Sit and Reach Test was conducted. With the feet placed in the footprints on the cross board, the subject reaches forward, palms down, along the scale. The maximum distance (cm) reached is recorded as the measure of flexibility.
  3. Method employed in the measurement of Leg Muscle Power by Sargent Vertical Jump Test (Sargent, 1924).
     To assess leg muscle power subjects were made to perform this test. The number of centimeters between the reach and jump marks was measured as the score.
  4. Method employed for the measurement of Speed by 50-yard Dash (Johnson and Nelson, 1982)
     To assess speed quality subject was allowed to run for a distance of 50 yards. The elapsed time from the starting signal until the runner crossed the finish line was measured in seconds.
  5. Method employed for the measurement of Hand grip strength by Handgrip Dynamometer (Phillips and Hornak, 1979).
     To assess the hand muscle strength subjects were made to perform the hand grip strength test. The best of three trials was recorded as the score for handgrip strength with a 30 sec. rest between trials. The dynamometer scale was read in kg.

Statistical Analysis

All the values are expressed as Mean ± Standard Deviations (SD). To find out the significant difference of those parameters between the two groups, independent samples T test was used. To find out the relation between different parameters of footballers correlation was done. Statistical Package for social sciences (SPSS) MS Windows Release 20 was used for statistical analysis.

RESULTS

Mean values ± SD for each parameter along with level of significance in urban and rural boys are illustrated in Table I & II. Table III indicates the correlation between the parameters of footballers. From table I & II, it was seen that there was no significant difference in height of boys (both footballers and sedentary) between urban and rural region in spite of that weight was significantly higher in case of urban boys. No significant difference was observed in BSA though values were comparatively higher in urban boys. But BMI was significantly higher in urban boys. All the motor fitness parameters (agility, flexibility, LMP, speed, HGS) were significantly higher in both footballers ($p<0.05$) and sedentary groups ($p<0.01$) in rural region comparable to urban region.

Table I. *Level of significance of difference in anthropometric and motor fitness parameters of footballer groups.*

Parameters	Footballer groups		't' – test
	Urban (n =30)	Rural (n=30)	
Height (cm)	157.51± 4.48	158.09± 6.76	NS
Weight (kg)	43.02± 3.95	40.45± 5.55	p<0.05
BSA (m^2)	1.39± 0.07	1.36± 0.12	NS
BMI (kg/m^2)	17.35±1.59	16.13±1.37	p<0.01
Agility (sec)	9.95±0.54	9.71±0.26	p<0.05
Flexibility (cm)	10.62±6.27	7.70±3.53	p<0.05
Leg muscle power (cm)	33.91± 5.10	36.98±5.43	p<0.05
Speed (sec)	7.13±0.37	6.88±0.52	p<0.05
Hand grip strength (kg)	24.88±5.34	28.73 ± 6.36	p<0.05

NS= Not Significant

Table II. *Level of significance of difference in anthropometric and motor fitness parameters of sedentary groups*

Parameters	Sedentary groups		't' – test
	Urban (n =80)	Rural (n=80)	
Height (cm)	159.25± 8.62	160.98±6.82	NS
Weight (kg)	52.38± 10.84	46.9875± 8.03	p<0.01
BSA (m^2)	1.52±0.18	1.47±0.14	NS
BMI (kg/m^2)	20.54±3.34	18.11±2.81	p<0.01
Agility (sec)	10.54±0.69	10.21±0.59	p<0.01
Flexibility (cm)	4.07±5.97	6.59±6.10	p<0.01
Leg muscle power (cm)	26.91±6.11	31.10±6.00	p<0.01
Speed (sec)	7.55±0.67	7.22±0.57	p<0.01
Hand grip strength (kg)	21.19±6.48	23.79±5.78	p<0.01

NS= Not Significant.

From the Table III, it was cleared that height, weight and BSA have significant positive correlation with LMP where as BMI also showed significant positive correlation with agility and speed.

Table III. *Correlation coefficients among anthropometric and motor fitness parameters of footballers group (combined: Urban and Rural region) (n=60)*

Parameters	Height	Weight	BSA	BMI	Agility	Flexibility	LMP	Speed	HGS
Height	-								
Weight	.610**	-							
BSA	.818**	.946**	-						
BMI	.004	.793**	.565**	-					
Agility	-.205	.105	-.001	.302*	-				
Flexibility	-.026	.138	.104	.211	.137	-			
LMP	.262*	.353**	.323*	.239	-.179	.187	-		
Speed	.000	.196	.146	.258*	-.106	.154	-.014	-	
HGS	.091	-.077	.005	-.168	-.056	.037	-.002	-.140	-

***Correlation is significant at the 0.01 level (2-tailed)*
**Correlation is significant at the 0.05 level (2-tailed)*

DISCUSSION

Results of the urban-rural comparisons in motor fitness may vary with age and body size. Several studies have shown that physical fitness measurements depend upon age, sex, height, weight, body size, and occupational habits (Andersen et al., 1984). Chatterjee et al. (1993) reported that Bengalee boys were inferior in shuttle run test scores and Sargent vertical jump to American boys due to their shorter stature, which influenced those components. According to them, Bengalee boys also have lower values in handgrip strength in comparison to boys of the U.S.A. due to their reduced weight. Motor fitness parameters of both footballers and sedentary boys of rural area were significantly higher and LMP showed significant positive correlation with weight. Both footballers and sedentary boys in urban zone showed significantly higher weight than their rural counterparts though there was no significant difference in height which was similar to the study by Peña et al. (2003) in which urban children were heavier than rural children. Value of BSA of both footballers and sedentary boys in urban region was higher, though no significant difference was observed in both cases. On the other hand, urban footballers and sedentary boys showed significantly higher BMI than rural boys. This finding was in agree with the study by Hodgkin et al. (2010) where urban children of New Zealand had significantly higher BMI than rural children. Dana et al. (2011) stated that boys and girls as well as urban and rural children had no significant differences in the case of BMI. Further research by Sobal et al. (1996) indicated that white, rural men and women were more likely to be overweight than those who live in urban areas (with other demographic factors controlled for). McMurray et al. (1999) also observed that rural school children in North Carolina have a significantly higher BMI. This inconsistency among different reports could be related to the demographic differences in rural and urban populations in the different studies. This is as due to the fact that socioeconomic status and ethnicity have

been found to be correlated to obesity (Wang et al., 2007) although in our study, participants from both rural and urban region were from same economic background. Other explanations for the reported rural-urban discrepancies in body composition could be differences in the physical or social environment (Bruner et al., 2008), which demands further investigation.

Present study revealed that all motor fitness parameters like agility, flexibility, LMP, speed, HGS showed significantly higher values in footballers ($p<0.05$) and sedentary boys ($p<0.01$) of rural areas than their urban counterparts though weight was significantly higher in urban boys which do not support the study by Chatterjee et al. (1993). According to Peña et al. (2003), absolute grip strength did not consistently differ between rural and urban children, but when adjusted for age and body size strength was greater in rural children in Oaxaca, Mexico. In contrast, according to that study, explosive power (standing long jump) and abdominal strength were better in urban than in rural children without and with adjustment for age and body size where as comparisons of running speed (dash), flexibility (sit and reach) gave variable results by age group and sex. Urban-rural comparisons of motor fitness in different areas of the world give variable results. Comparisons of Japanese children and adolescents from four rural areas with those from urban centers gave variable results for strength and performance-related tests (Tamura, 1975) in which urban children in the Gifu prefecture performed better than rural children in a dash, standing long jump, and strength, but the opposite trend was noted in the Kyoto prefecture. In a study in Poland from the 1960s, urban boys 7-15 years of age achieved better than rural boys in vertical jump and agility, but there were no consistent urban-rural differences across the age range in speed and grip strength (Miernik, 1965). Another study by Pilicz & Sadowska (1973) revealed that 10-year-old urban Polish boys and girls performed better than rural peers in speed, vertical jump, agility. But as per study by Wilczewski et al. (1996) rural boys and girls in Poland of 11-15 years were more flexible (sit and reach); rural boys performed more sit-ups, rural girls ran faster in a shuttle run.

The most distinctive difference in the activity pattern between the rural and the urban sedentary boys may be expressed through their natural participation in different games as well as working in the field after school time and during the weekends. Even though the motor fitness parameters of the rural sedentary boys was somewhat higher than urban sedentary boys, it is much lower than the level reported by the trained footballers of two zones that ultimately clear our concern regarding the difference in level of significance in agility, flexibility, LMP, speed, HGS of footballers ($p<0.05$) and sedentary groups ($p<0.01$) between two zones. This means that the daily physical activity of the boys in the rural area does not give sufficient physiological stimulus in order to reach the level needed to become a trained footballer. Kim (2010) showed that 12 weeks' combined core muscle training had positive effects on flexibility and strength of core muscle. In our study, regular participation of footballers in game specific physical training in urban area as well as in rural area improved their motor fitness. However, it is observed that magnitude of improvement is greater in urban boys. It may be due to the fact that initial fitness level was lower in case of urban boys in comparison to their rural counterparts. On the other hand, the better motor fitness of the rural sedentary boys may be due to the impact of their regular involvement in habitual physical activities or favorable environmental influence.

CONCLUSIONS

From the study, it might be concluded that rural boys showed greater motor fitness comparing to their urban counterparts in spite of the fact that regular participation in training programme may improve motor fitness. It might also be concluded that regular training can reduce this urban-rural difference in motor fitness and lifestyle, habitual activities and living environment had great impact on this.

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REFERENCES

1. Andersen, K.L., Rutenfranz, V.S., Ilmarinen, J., Berndt, I., Keylian, H. & Ruppel, M. (1984). The growth of lung volumes affected by physical performance capacity in boys and girls during childhood and adolescence. *Eur J Appl Physiol Occup Physiol, 52*, pp.380-384.
2. Bruner, M.W., Lawson, J., Pickett, W., Boyce, W. & Janssen, I. (2008). Rural Canadian adolescents are more likely to be obese compared with urban adolescents. *International Journal of Pediatric Obesity, 3*(4), pp.205-211.
3. Cameron, N., Kgamphe, J.S., Leschner, K.F. & Farrant, P.J. (1992). Urban-rural differences in the growth of South African black children. *Ann Hum Biol, 19*, pp.23-33.
4. Chatterjee, S., Mandal, A. & Das, N. (1993). Physical and motor fitness level of Indian school going boys. *J Sport Med Phys Fit, 33*(3), pp.268-277.
5. Chaudhuri, S. (1990). Calcutta: The living city: The present and future. An article by S.C. Chakraborty. *The growth of Calcutta in the twentieth century*, pp.1-14. New York: Oxford University press.
6. Corbin, C.B. & Lindsey, R. (1994). *Concepts of physical fitness with laboratories*. 8th Ed. Madison, Wis.: Brown & Benchmark Publishers.
7. Corlett, J.T. & Mokgwathi, M.M. (1987). Running performance of Tswana children. *Phys Educ Rev, 10*, pp.110-113.
8. Corlett, J.T. (1988). Strength development of Tswana children. *Hum Biol*, *60*, pp.569-577.
9. Dana, A., Habibi, Z., Hashemi, M. & Asghari, A. (2011). A Description and Comparison of Anthropometrical and Physical Fitness Characteristics in Urban and Rural 7-11 Years Old Boys and Girls in Golestan Province, Iran. *Journal of Applied Sciences Research*, *7*(6), pp.826-832.
10. Dollman, J., Norton, K. & Tucker, G. (2002). Anthropometry, fitness and physical activity of urban and rural south Australian children. *Pediatric Exercise Science*, *14*, pp.297-312.
11. Dubois, D. & Dubois, E.F. (1916). Clinical colorimetry. A formula to estimate the approximate surface area if weight and height is known. *Arch Int Med*, *17*, pp.863-871.
12. Gill, P.S., Prasad, B.G. & Srivastava, R.N. (1968). Nutritional status of primary school children in a rural area of Lucknow. *Indian J. Pediat*, *35*, pp.314.
13. Hodgkin, E., Hamlin, M.J., Ross, J.J. & Peters, F. (2010). Obesity, energy intake and physical activity in rural and urban New Zealand children. *Rural and Remote Health*, *10*, pp.1336.
14. Johnson, B.L., Nelson, J.K. (1982.). *Practical measurements for evaluation in physical Education*, 3rd Ed. Delhi: Surjeet Publications.
15. Kim, K.J. (2010). Effects of Core Muscle Strengthening Training on Flexibility, Muscular Strength and Driver Shot Performance in Female Professional Golfers. *International Journal of Applied Sports Sciences*, *22*(1), pp.111-127.
16. Lin, W.S., Chen, A.C.C., Su, J.Z.X., Zhang, Y.Q., Zhu, F.C., Zing, W.H. & Li, J.Y. (1992). Developmental perspective of pulse rate, blood preassure and vital perspective of pulse rate, blood pressure and vital capacity in Chinese children. *Ann Hum Biol, 19*, pp.387-402.
17. Malina, R.M., Bouchard, C. & Bar-Or, O. (2004). *Growth, maturation and physical activity*, 2nd Ed.Champaign,IL: Human Kinetics.

18. Mathews, D.K. (1973). *Measurement in Physical Education*, 4th Ed. W.B., 115, pp.327. Philadelphia: Saunders Company.
19. MCMurray, R.G., Harrell, J.S., Bangdiwala, S.I. & Deng, S. (1999). Cardiovascular disease risk factors and obesity of rural and urban elementary school children. *Journal of Rural Health*, *15*(4), pp.65-374.
20. Meltzer, A., Muller, W., Annegers, J., Grines, B. & Albright, D. (1988). Weight history and hypertension. *Clinical Epidermiology*, *41*, pp.867-874.
21. Miernik, Z. (1965). Sprawnosc ruchowa chlopcow z miast i ze wsi w wieku 7.5–15.5 lat. *Rocznik Naukowy, Wyzsza Szkola Wychowania Fizycznego w Krakowie*, *4*, pp.75-113 (in Polish).
22. Munsi, S.K. (1975). *Calcutta metropolitan explosion: its nature and roots*. New Delhi: People's pub.
23. Pawloski, L.R. (2002). Growth and development of adolescent girls from the Segou region of Mali (West Africa). *Am J Phys Anthropol*, *117*, pp.364-372.
24. Peña, M.E., Tan, S.K. & Malina, R.M. (2003). Urban–Rural Contrasts in the Physical Fitness of School Children in Oaxaca, Mexico. *Am J Hum Biol*, *15*, pp.800-813.
25. Phillips, D.A. & Hornak, J.K. (1979). *Measurement and evaluation in physical education,* pp.226-227. New York: John Wiley and Sons, Inc.
26. Pilicz, S. & Sadowska, J. (1973). Z badan nad rozwojem I sprawnoscia fizyczna mlodziezy szkol podstawowych. *Wychowanie Fizyczne i Sport*, *1*, pp.3-10 (in Polish).
27. Sargent, L.W. (1924). Some observations in the Sargent test of neuromuscular efficiency. *American Physical Education Review*, *29*, pp.47-56.
28. Sobal, J., Troiana, R.P. & Frongillo, E.A. (1996). Rural-urban differences in obesity. *Rural Sociology*, *2*(61), pp.289-305.
29. Tamura, Y. (1975). Physical fitness of rural adolescents. In: K. Asahina, R. Shigiya, editors. Human adaptability, vol. 4. *Physiological adaptability and nutritional status of the Japanese. B. Growth, work capacity and nutrition of Japanese*, pp.50-61. Tokyo: University of Tokyo Press.
30. Wang, Y. & Beydoun, M.A. (2007). The obesity epidemic in the United States-gender, age, socioeconomic, racial/ethnic, and geographic characteristics: a systematic review and meta-regression analysis. *Epidemiologic Reviews*, *29*(1), pp.6-28.
31. Wilczewski, A., Salad, M., Krawczyk, B. & Saczuk, M.B. (1996). Physical development and fitness of children from urban and rural areas as determined by the EUROFIT test battery. *Biol Sport*, *13*, pp.113-126.