

COMPARISON OF MUSCULAR STRENGTH OF MALE AND FEMALE STUDENTS OF RURAL AND URBAN SECONDARY SCHOOLS OF KADUNA STATE

BY

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Abstract

This study compared muscular strength of male and female students of rural and urban secondary schools of Kaduna State. Research question and research hypothesis were formulated. An expo-facto research design was used. A total of nine hundred and sixty (960) students were used. Stratified random sampling technique was used to select participants from rural and urban schools. A sample of 960 adolescent males and females' students aged 12-17 years. These comprises of 480 males and 480 females (240 males and 240 females each from rural and urban secondary schools). The instruments for data collection was standing broad jump and calibrated wall for height in metres and centimetres. Bioelectrical Impedence Analysis (BIA) (Omron HBF516B), and measuring tape were used to measured muscular strength, body weight and height respectively. Each student was made to perform the standing broad jump, body weight and height test. The data collected was compared in respect of age, sex and location, and analysed using (SAS) statistical package at probability level ($p < 0.05$). Descriptive statistics was used to determine the mean performance values and their variability. Two-way analysis of variance (ANOVA) was used to find if there were significant differences in the performance along location, gender, age, and age groups, Scheffe post-hoc analysis was used to locate the point of differences. The findings revealed that rural female students were better in local muscular strength fitness than their urban peers. Rural male and urban male students differ in local muscular strength fitness. Rural female students and urban female students performed significantly different ($p < 0.05$) in local muscular strength. Rural female students were found to have better muscular strength. Since differences existed between urban and rural students in muscular strength. It was recommended among others that activities that will improve local

muscular strength be emphasized among urban students, and that physical education programme should include specific activities based on gender and location to improve fitness of students.

Keywords: Muscular, strength, fitness, students, Gender, location

Introduction

Physical fitness is defined as the capacity to performed moderate to vigorous level of physical exercises without undue fatigue and still had extra energy to enjoy leisure pursuits and meet unforeseen emergencies (Renaat, et al; 1999). All human movement depends upon minimal levels of strength and endurance. A poorly developed musculature individual finds it very difficult to maintain the upright posture and perform physical activities. Therefore, students who trek, cycle to school may need a much higher degree of strength and endurance than those driven to school. Strength therefore, is necessary to effectively carry out required daily tasks. Jackson, Marrow, Hill, and Dishman (1999), Powers and Howley (1997) and Maud and Foster (1995) believed that adequate level of strength and endurance can improve physical performance and help a person to get greater enjoyment for recreational and sporting activities. Other benefits of strength include reduce chances of developing low back pain, osteoporotic fractures, and other musculo-skeletal disorders, increase resting metabolic rate (when muscle mass increase), prevent or minimize bone mineral density, a person look and feel good and is a motivator to athletes.

Developed countries such as United States of America, Germany, Britain and Japan recognized fitness contributions to economic development and happiness of a nation, they therefore, developed and implement physical fitness (PF) programmes and assessed PF status of their citizens, especially the youths and children (Price, 2016 with Pollock, Jack & Samuel, 1984).Chado, (1990)observed that during the pre-colonial days in Nigeria, people were actively involved predominantly in high energy expenditure physical activities such as farming, fishing, long distance walking, animal chasing (hunting), and many other strenuous activities that greatly contributed to fitness, thus making the citizens physically fit. However, with technologically advancement there is the transformation of a basically hard working, physically active rural-based society into a population of anxious and troubled urban dwellers (Heyward 2014, Heyward, 1998 with Pollock et al; 1984).

This makes the present day society to exist in a world where the concept of hard or even moderate physical work is obsolete and unfashionable. Most jobs that once demanded hours of hard and vigorous work are now being replaced by automation. This is observed through improved modes of travels and communication, whereby a walk to school or market has been replaced by a short drive and other activities are done within blinks of seconds by pressing buttons, voice command and so on. Students have reduced active participation in sports with watching television operated by remote and play computer games and supporters of various European soccer clubs, as observed every weekend where youths are seen watching football in viewing centres. These channeled them into increasingly sedentary life style and decline in physical activity (Madzima, Richardson, & Nepocatych, 2019; Price, 2016) and this fosters unfitness. Shifan, Darwin, Grumbaum, Ronal and William, (2002), June, Jianwan, Kelly and Ratna, (2002), Betty, Maritza & Maura, (2002); Anu, Jacob, Susana, Jaakko & Kari, (2000), Willett, Dietz & Colditz, 1999; Goran, (1999); Nieman (1998) and Blair & McCloy, (1993) further stated that the evidence linking certain disease conditions to a

lack of physical activity and fitness is strong. This is the case for arthritis, coronary heart disease, hypertension, stroke, obesity, cancer of the breast, prostate and lung, diabetes, and osteoporosis. Gilliam et al; (1999) further observed that these diseases develop over time and quite often begins at youthful age.

Nigeria as a developing nation, recognized the importance of sports and physical education in building physical fitness as indicated in the National Policy on Education that sports and physical education must be emphasized at all levels of our educational system. However, it has been observed that over the years, there has been increased in student's enrolment, establishment of more schools in urban and rural locations, with less or no sporting facilities and equipment and sports participation no longer compulsory and this foster unfitness. However, before this development, secondary schools were concentrated mostly in urban and semi-urban areas and mostly boarding schools with sporting facilities and equipment and participation in sports and physical activity was compulsory making them more fit.

Kanwar, Mandeep and Sukhdev, (2016), Kehack et al; (2002) and Malina, (2001) observed that greater physical fitness of children had a significant relationship with larger living space and residing in rural areas. Rural area is generally linked to a more strenuous, physically dynamic way of life that is advantageous to attaining physical fitness. On the other hand environmental and social changes related to living in urban areas such as overcrowding, environmental pollutions in neighborhood, safety worries and inadequate playgrounds may contribute to lower level of physical fitness among children (Pena, Tan & Malina, 2003; Jackson et al; 1999 & Macauley, 1999). Today in Nigeria, participation in sport and physical activity is optional and this development may have negative impact on the physical fitness status of students.

In light of the above observations therefore, this study compared physical fitness status of secondary school students based on muscular strength of rural and urban secondary schools of Kaduna State and see how location of residence affects their level of muscular fitness.

Research question

Will male and female students differ in their muscular strength based on location (rural and urban)?

Hypothesis

There is no significant difference in muscular strength of male and female students of rural and urban secondary schools.

Methodology

Research design

The **expo-facto** research design was used in this study. Each student was made to perform the muscular strength and endurance test. The data collected was compared in respect of their age, sex and location.

Population

The population of this study comprises of all males and female students aged 12-17 years in government secondary schools in Kaduna State with a population of 260,759 students found in twelve inspectorate zones. Three of these zones namely Kaduna, Riga chukun and Sabon Tasha inspectorate zones were **purposively** selected, because they all have schools located within Kaduna metropolis and its environs. This population was therefore, grouped into two strata namely: -Urban

schools (Government secondary schools within Kaduna town) and Rural schools (Government secondary school outside Kaduna town).

A total of sixteen (16) government secondary schools within Kaduna metropolis with student population of 18,226 constitute the urban schools and total of fourteen (14) government secondary schools outside Kaduna metropolis with a total population of 15,775 students constituted the rural schools located in Sabon Tasha and Rigachukun inspectorate zones.

Sample

A sample of eight (8) government secondary schools were randomly selected, four (4) each from urban and rural schools' location with a total population of 9,605 students. From these schools a sample of 480 male students (240 male each from rural and urban secondary schools) and 480 female students (240 females each from rural and urban secondary schools) making a total of 960 students aged 12-17 years.

Sampling Technique

Stratified random sampling method was employed. Two main strata are: Urban schools (situated in Kaduna town) and rural schools (situated outside Kaduna town). At the first stage a random sample of four schools were selected from each stratum using the lottery method. Using lottery method, the names of schools from each stratum were written in pieces of papers, folded and put in two containers, one for each cluster. After shuffling the picking was done by two volunteers without replacement. Sample from Urban schools are Capital school Kaduna (KCS), GSS Doka, Kaduna Polytechnic Demonstration Secondary School Kaduna and GSSS Sabo Tasha Senior/Junior Kaduna. Sample from rural schools are, GSSS Kufana, GSS ZongoAya, GSSS Kasuwa Magani and GSSS Gadan Gaya. At the second stage from each school random sample of ten (10) boys and ten (10) girls whose age fall within the specified age bracket (12-17 years) of this survey were drawn from each school. Thus, 960 students were sampled to serve as participants in this study.

Measurement procedure

Local muscular strength

Test instrument: standing broad jump.

Materials and equipment: Long jump-pit with the feet slightly apart and kept parallel to each other. Simultaneously with free double arm swing, the subject take off and land in the sand pit with both feet. Three trails were allowed.

Scoring: The distance was measured from the front edge of the take-off board to the point the heels or any part of the body contacts the sand nearest to the take-off board. Measurements were in meters and centimeters. The best distance of the three trails was recorded for each participant.

Physical Characteristics of the Participants:

Participants' physical characteristics (height and weight) were determined in accordance with the protocol of International Working Group on Anthropometry as described by Ross and Marfell-Jones (1982), height was measured, while standing erect looking straight ahead and bare-footed against the calibrated wall. Horizontal broad blade wooden ruler was rested on the head of each participant

against the instrument to measure height to the nearest 0.1 cm. Weight were measured using Omron HBF 516B and recorded to the nearest 0.5 kg

Table 1: Physical Characteristics of the Participants (n=80)

Age	Variable	Gender	Mean	SD	Mean	SD
			RUS	RUS	URS	URS
12	HT (m)	M	1.4317	0.0413	1.4528	0.0452
		F	1.4950	0.0581	1.4748	0.0572
	WT (kg)	M	37.7000	2.6814	38.4000	3.5214
		F	37.1256	3.5962	35.9250	5.4744
13	HT (m)	M	1.4290	0.0477	1.4853	0.0725
		F	1.5558	0.0532	1.5422	0.0577
	WT (kg)	M	37.3500	3.9390	37.5250	6.4846
		F	44.6250	3.5712	44.3750	6.0667
14	HT (m)	M	1.5160	0.0786	1.5550	0.0740
		F	1.5458	0.0547	1.5340	0.0914
	WT (kg)	M	42.0750	7.6238	43.5000	5.8045
		F	46.2250	5.5075	45.4250	5.7641
15	HT (m)	M	1.5540	0.0703	1.6157	0.0830
		F	1.5520	0.0609	1.5753	0.0997
	WT (kg)	M	48.7250	7.7194	48.8500	6.4233
		F	48.3250	5.7797	48.7250	7.7987
16	HT (m)	M	1.5920	0.0797	1.6778	0.0789
		F	1.5510	0.0463	1.5863	0.0544
	WT (kg)	M	51.3000	7.8355	54.3750	8.3010
		F	48.9500	2.7170	51.4500	6.5592
17	HT (m)	M	1.6375	0.0514	1.6992	0.0681
		F	1.5628	0.0494	1.6035	0.0622
	WT (kg)	M	56.1750	7.6322	58.1000	7.1209
		F	51.2750	4.1694	53.6000	7.8375

Table 1 Shows that rural male students at age 12 years had a mean score of 1.4317m height and weight 37.7000kg; on the other hand their urban peers had a mean score of 1.4528m height and weight 38.4000kg. This shows that urban males at age 12 years were taller and heavier than their rural peers. Rural female students at age 12 years had a mean score of 1.4950m height and weight 37.1256kg; on the other hand their urban female peers had a mean score of 1.4748m height and weight 35.9250kg. This shows that rural female at age 12 years were taller and heavier than their urban peers. Rural male students at age 13 years had a mean score of 1.4290m height and weight 37.3500kg; on the other hand, their urban peers had a mean score of 1.4853m height and weight 37.5250kg. This shows that urban male at age 13 years were taller and heavier than their rural peers. Rural female students at age 13 years had a mean score of 1.5558m height and weight 44.6250kg

while their urban peers had a mean score of 1.5422m height and weight 44.6250 while their urban peers had a mean score 1.5422m height and weight 44.3750kg. This shows that rural female at age 13 years were taller and heavier than their urban peers. Rural male students at age 14 years had a mean score of 1.5160m height and weight 42.0750kg on the other hand their urban peers had a mean score of 1.5550m height and weight 43.5000kg. This shows that urban male at age 14 years were taller and heavier than rural peers. Rural female students at age 14 years had a mean score of 1.5458m height and weight 46.2250kg on the other hand their urban peers had a mean score of 1.5340m height and weight 45.4250kg. This shows that rural females at age 14 years were taller and heavier than their urban peers. Rural male students at age 15 years had a mean score of 1.5540m height and weight 48.72500kg, while their urban peers had a mean score of 1.6157m height and weight 48.8500kg. This shows that urban males at age 15 years were taller and heavier than their rural peers. Rural female students at age 15 years had a mean score of 1.5520m height and weight 48.3250kg; on the other hand, their urban peers had a mean score of 1.5753m height and weight 48.7250kg. This shows that urban females at age 15 years were taller and heavier than their rural peers. Rural male students at age 16 years had a mean score of 1.5920m height and weight 51.3000kg, on the other hand their urban peers had a mean score of their urban peers had a mean score of 1.6778m height and weight 54.3750kg. This shows that urban males at age 16 years were taller and heavier than their rural peers. Rural female students at age 16 years had a mean score of 1.5510m height and weighed 48.9500kg; on the other hand, their urban peers had a mean score of 1.5863m height and weight 51.4500kg. This shows that urban females at age 16 years were taller and heavier than their urban peers. Rural male students at age 17 years had a mean score of 1.6375m height and weight 56.1750kg; on the other hand, their urban peers had a mean score of 1.6992m height and weight 58,1000kg. This shows that urban males at age 17 years were taller and heavier than their rural peers. Rural female students at age 17 years had a mean score of 1.5628m height and weight 51.2750kg; on the other hand their urban peers had a mean score of 1.6035m height and weight 53. 6000kg. This analysis shows that urban females at age 17 years were taller and heavier than their rural peers.

Data Analysis: The data collected were analyzed using descriptive statistics of mean score, standard deviation. 2-way Analysis of Variance, Scheffe post -hoc test was applied to the result of analysis of variance (ANOVA) where “F” was found to be significant to locate where the point of difference lies.

RESULTS

Table 2 Performance of students aged 12-17 years in rural and urban secondary schools on standing broad jump in meters (n=80)

Age	Gender	Mean	SD	Mean	SD
		RUS	RUS	URS	URS
12	M	1.6470	0.069	1.6365	0.168
	F	1.5075	0.202	1.4904	0.108
13	M	1.6982	0.179	1.6770	0.169
	F	1.6758	0.163	1.5620	0.210
14	M	1.7833	0.208	1.8270	0.234

	F	1.6735	0.281	1.5707	0.197
15	M	1.9037	0.239	1.9100	0.230
	F	1.7690	0.202	1.5753	0.150
16	M	2.0472	0.227	2.1750	0.202
	F	1.6670	0.113	1.5360	0.165
17	M	2.1640	0.175	2.1715	0.214
	F	1.5245	0.149	1.5193	0.144

Table 2 shows that rural male students at age 12 years, had a mean score of 1.6490m, on the other hand urban peers had a mean score of 1.6356m. Rural male students jump the longest distance. Rural female students had a score of 1.5075m, and on the other hand urban peers had a mean score of 1.4904m. This shows that rural female students jump the longest distance. Rural male students at age 13 years had a mean score of 1.6982, on the other hand urban peers had a mean score of 1.6770m. Rural male students jump the longest distance. Rural female students had a mean score of 1.6758m, on the other hand urban peers had a mean score of 1.5620m, rural female students jump the longest distance. Rural male students at age 14 years had a mean score of 1.7833m on the other hand urban peers had a mean score of 1.8270m. This shows urban male jump the longest distance. Rural female students at age 14 years had a mean score of 1.6735, on the other hand urban peers had a mean of 1.5707m. This shows rural female students jump the longest distance. Rural male students at age 15 years had a mean score of 1.9037m, and on the other hand their urban peers had a mean score of 1.9100m. This shows that urban male jumps the longest distance. Rural female students at age 15 years had a mean score of 1.7690m, on the other hand urban peers had a mean score of 1.5753m. Rural female students jump the longest distance. Rural male students at age 16 years had a mean score of 2.0472m; on the other hand, urban peers had a mean score of 2.1750m. This shows urban male students jump the longest distance. Rural female students at age 16 years had a mean score of 1.6670m, on the other hand urban peers had a mean score of 1.5360m. This shows rural female students jump the longest distance. Rural male students at age 17 years had a mean score of 2.1640m, and on the other hand urban peers had a mean score of 2.1715m. This shows that urban male students jump the longest distance. Rural female students at age 17 years had a mean score of 1.5245m, on the other hand urban peers had a mean score of 1.5193m. This shows that rural female students jump the longest distance.

Hypothesis 1

There is no significant difference in muscular strength of male and female students of rural and urban secondary schools.

To test the hypothesis the data collected from male and female students aged 12-17 years from rural and urban secondary schools were analyzed using two-way ANOVA and Scheffe test. The result of which are presented in Table 3 and 4

Table 3: 2-way ANOVA for differences in performance between rural males and urban males at age 12-17 years on standing broad jump

Source	Df	SS	MS	F-ratio
Location	1	0.1	0.1	3.2*
Age	5	19.6	3.9	100.6*

Interaction Loca x Age	5	0.2	0.1	1.4ns
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$F(11.468) = 2.21$ at 5% * Significant

Table 3 is the summary of 2-way ANOVA comparing the performances of male student in rural and urban locations at age 12-17 years on standing broad jump test of local muscular strength. The F-ratio 3.2 shows significant difference between rural males and urban male students. The F-ratio 100.6 shows significant difference between males age 12-17 years. The null hypothesis regarding local muscular strength as a function of location and age was rejected.

The interaction between location and age on the performances of males on local muscular strength test shows no significant difference.

Summary of Scheffe test for local muscular strength of males in rural and urban location.

Scheffe grouping	Mean	N	Local
A	1.9	240	Urban
A	1.9	240	Rural

Means with the same letter are not significantly different.

Summary for Scheffe test for local muscular strength for males age 12-17 years

Scheffe grouping	Mean	N	Age
A	2.2	80	17
A	2.1	80	16
B	1.9	80	15
B	1.8	80	14
C	1.7	80	13
C	1.6	80	12

Significant $p < 0.05$

Means with the same letter are not significantly different.

Scheffe test located the difference to be between age 12 and 14, 12 and 15, 12 and 16, 12 and 17, 13 and 14, 13 and 15, 13 and 16, 13 and 17, 14 and 16, 14 and 17, 15 and 16 and 15 and 17 years respectively.

Table 4:2 Way ANOVA for differences in performance between rural female and urban females at age 12-17 years on standing broad jump

Source	Df	SS	MS	F-ratio
Location	1	1.1	1.1	32.8*
Age	5	1.7	0.3	10.7*
Interaction Loca x Age	5	0.5	0.1	3.2*

$F(11.468) = 2.21$ at 5% *Significant

Table 4 is the summary of 2-way ANOVA comparing the performances of female students in rural and urban locations and at age 12-17 years on standing broad jump test of local muscular strength. The F-ratio of 32.8 shows significant differences exist between female students in rural and urban

locations. The F-ratio of 10.74 also shows significant differences between female students age 12-17 years. The null hypothesis regarding local muscular strength was rejected.

The interaction between location and age on the performances of female students on local muscular strength test shows significance difference. This indicates that the location of the school has a significant effect on the performance female student on local muscular strength test.

Summary of Scheffe test for local muscular strength of females in rural and urban location.

Scheffe grouping	Mean	N	Local
A	1.6	240	Urban
B	1.5	240	Rural

Significant different existed between rural females and urban females ($1.6 > 1.5$) rural females were better than urban females.

Summary of Scheffe test for local muscular strength for females age 12 -17 years

Scheffe grouping	Mean	N	Age
A	1.5	80	15
A	1.6	80	14
A	1.6	80	13
BA	1.6	80	16
BC	1.5	80	17
C	1.5	80	12

Means with the same letter(s) (ba + a, bc + c) are not significantly different using Scheffe post hoc test at 5% level of significance.

Scheffe test located the differences to be between age 12 and 16, 12 and 13, 12 and 14, 12 and 15, 17 and 13, 12 and 14, 17 and 15 years respectively.

Discussion

The findings from this study, table 3 showed that significant difference ($p < 0.05$) existed between rural males and urban males in local muscular strength. Table 4 showed significant difference ($p < 0.05$) also existed between rural females and urban females' students in their muscular strength. This corroborate Blerim, Nazim, Arben and Seryozba (2019), Suleiman, Eze, Tsauri, Adewale, Abdullahi, et al; (2018), Kanwar, (2017), Narges and Zahra (2015) who reported that rural students were stronger than urban students and concludes that the lifestyles of rural children may be the best reason for their better physical fitness. The interaction between location and age on the performances of males on local muscular strength test shows no significant difference. The possible reason for non-significant difference in muscular strength among males may be that the natural rural life is fast fading away where most of the social amenities enjoy by urban settlers today are also available in the rural areas. However, rural females in all age groups showed better performances in muscular strength test. The explanation to this could be rural female students tend to take part earlier in more vigorous and strenuous activities than their urban peers. Female students in rural schools also take part in most physical activities done by the males such as farming, trekking, cycling, climbing and so forth. This support Tian, Wang, Zhang, Zhai, Wang, Liu (2021); Kanwar, Sing, Sukhdev (2016)

and Aristides, Manuel, Coelho, Jorge, Cristina, Raul, Sean, Chris and Robert (2014) who reported that area of residence was related to aerobic fitness of children. However, males in this study were generally better than their female counterpart in muscular strength test. This agrees with Anyanwu (1977), Otinwa and Ogundare (1995), Nelson (1982), Power and Howley (1997), and Malina (2001) who had earlier reported in their studies that males performed better than their female's peers in muscular strength test. The result of this study also showed that performances of males continued to improve through age 17 years while that of females level off at 14 and 15 years and decrease in performance. This agrees with Nelson (1982), Wilmore and Costill (1999), who suggested that the large deposit of fats and effects of puberty in females and the fact that females tend to shy away from participating in physical exercises and sports as age increases could be responsible for this decline in performance as age increases. The result shows that females in urban schools' level off earlier than their rural peers and could be an indication that urban female students may also reach puberty stage earlier than their rural peers (Kehack, et al; 2002).

Conclusion

Based on the findings the study, it was concluded that Rural male and female students were better in local muscular strength than their urban peers and Rural male and urban male students were better in local muscular strength than their females peers.

Recommendations

Based on the conclusion of this study, the following recommendations are made:

1. Activities that will improve local muscular strength be emphasized among male and female students in urban school
2. Conditioning exercises such as sit-up, press ups, jumps and lifting of weights be emphasize among urban female students.
3. The physical education curriculum to be implemented should include specific program based on gender and location to improve fitness of students.

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