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RELATIONSHIP BETWEEN CARDIO-VASCULAR FITNESS, HABITUAL PHYSICAL ACTIVITY, DISEASE RISKS AMONG 9-11-YEAR-OLD GIRLS IN PRIMARY SCHOOLS IN ABUJA

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ABSTRACT

This study investigates the relationship between cardiorespiratory fitness (CRF), habitual physical activity (PA), and disease risks among 9-11-year-old girls attending primary schools in Abuja, Nigeria. With a focus on a critical developmental stage, the research aims to understand how these factors interplay to inform targeted interventions and public health policies. The study comprises a comprehensive literature review and empirical investigation involving 490 female pupils from six primary schools across Abuja. Data collection involved various measurements including blood pressure, skinfold, height, weight, and a 12-minute run test. Statistical analyses, including correlation and ANOVA, were conducted to examine the relationships between variables. Findings indicate significant differences in height and weight between age groups, a positive linear relationship between CRF and diastolic blood pressure, and no significant linear relationship between CRF and systolic blood pressure, blood fat percentage, or BMI. Moreover, significant differences in blood pressure were observed across different age groups. These findings underscore the importance of age-specific interventions and monitoring in promoting cardiovascular health among young girls. The study recommends implementing targeted interventions, educational programs, and collaborative efforts between schools, healthcare providers, and policymakers to promote healthier lifestyles and reduce disease risk factors among young girls in urban settings like Abuja.

Keywords: Age, Cardiorespiratory, physical activity, Weight, Diastolic, Systolic, Cardiovascular.

1. INTRODUCTION

The health and well-being of children are of paramount for ensuring a prosperous and thriving society (Oladitan, 2000). According to Vankateswarlu (2010), among the various factors influencing children's health, cardiorespiratory fitness (CRF), habitual physical activity (PA), and the prevalence of disease risk factors stand out as critical areas of investigation. In recent years, there has been growing concern about the sedentary lifestyles and poor health outcomes among children, particularly in urban settings such as Abuja, the Federal Capital Territory (FCT) of Nigeria (FCThealth, 2019).

Several studies have highlighted the importance of cardiorespiratory fitness and physical activity in reducing the risk of various chronic diseases, including obesity, type 2 diabetes, hypertension, and cardiovascular diseases, among children and adolescents (Ortega et al., 2015; Poitras et al., 2016). However, there is a paucity of research that specifically examine these factors among young girls in the Nigerian context, particularly in the unique socio-cultural and environmental landscape of Abuja. Understanding the relationship between cardiorespiratory fitness, habitual physical

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activity, and disease risks in this population is crucial for informing targeted interventions and public health policies aimed at promoting healthier lifestyles and reducing the burden of non-communicable diseases. Moreover, by elucidating these relationships, we can identify potential areas for intervention and develop tailored strategies to enhance the health outcomes of young girls in Abuja's primary schools.

This paper aims to explore the intricate relationship between cardiorespiratory fitness, habitual physical activity, and disease risks among 9-11-year-old girls attending primary schools in Abuja – FCT. By focusing on this demographic group, we target a critical developmental stage where lifestyle habits are often established, and interventions can yield significant long-term benefits. To achieve these objectives, this paper will undertake a comprehensive review of the existing literature on cardiorespiratory fitness, habitual physical activity, and disease risks among children and adolescents. Subsequently, we will present the findings of our empirical investigation conducted among 9-11-year-old girls in primary schools across Abuja – FCT. By integrating theoretical frameworks, empirical evidence, and practical insights, this paper aims to contribute to the existing body of knowledge and provide actionable recommendations for promoting the health and well-being of young girls in Abuja.

2. LITERATURE REVIEW

Cardiovascular fitness (CRF), also known as aerobic fitness, is the ability of the body's circulatory and respiratory systems to supply oxygen to muscles during physical activity (). It's an important marker of physical and mental health, and low CRF is a strong predictor of cardiovascular disease and stroke. CRF is a crucial aspect of overall health. It measures how effectively your body takes in, transports, and utilizes **oxygen** during extended periods of exercise ()

Cardiovascular disease (CVD) risk factors have been associated with CVD mortality,1 and physicians use CVD risk factor profiles (smoking, dyslipidemia, hypertension, etc.) to address patient health. Furthermore, cardio-respiratory fitness (CRF) has been shown to be an independent risk factor for CVD2 and all-cause mortality.3,4 Cardio-respiratory.

Research Questions

1. Is there any relationship between habitual physical activity level and cardio respiratory fitness among 9-11-year-old girls in primary schools in Abuja – FCT?
2. What is the relationship between cardio respiratory fitness and disease risk factor among 9-11-year-old girls in primary schools in Abuja – FCT?
3. Can habitual physical activity be related to disease risk factor among 9-11-year-old girls in primary schools in Abuja – FCT?
4. Are cardio respiratory fitness factors, habitual physical activity level and disease risk factors related?

Research Hypothesis

Ho_1: There is no significant relationship between habitual physical activity level and cardio respiratory fitness among 9-11-year-old girls in primary schools in Abuja – FCT?

Ho_2: There is no significant relationship between cardio respiratory fitness and disease risk factors among 9-11-year-old girls in primary schools in Abuja – FCT?

Ho_3: here is no significant relationship between habitual physical activity and disease risk factors among 9-11-year-old girls in primary schools in Abuja – FCT?

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Ho_4: There is no significant relationship between cardio respiratory fitness factors, habitual physical activity level and disease risk factors related?

3. METHODOLOGY

Research Design

The research design adopted for this study was ex-post factors design as all the variables measured in the study were already developed.

Population and Sample Size

The total population for the study is over 1,000,000 primary school pupils in Federal Capital Territory, Abuja (ERC, 2022). Out of the over 1,000,000 population, 490 female pupils were randomly drawn for the study in consonance with Krecjie and Morgan 1970 recommended sample size. The following sample schools were all randomly drawn for the study: LEA primary school, Bwari; LEA primary school, Zuba; LEA primary school, Wuse Zone 5; LEA Primary School Kwali; LEA Primary Abaji; and LEA Primary School, Kuje; in other for the study to spread over the five (5) FCT Area Councils.

S/No	Name Of School	Sample Size			Total
		9 years	10 years	11 years	
1.	Lea Primary School, Bwari Center	22	35	33	90
2.	Lea Primary School Zuba	20	25	32	77
3.	Lea Primary School Wuse Zone 5 Abuja	24	20	30	74
4.	Lea Primary School Kwali	24	30	34	88
5.	Lea Primary School Abuja	30	24	23	77
6.	Lea Primary School Kefi	24	33	24	84
	Total 6 Schools	144	167	179	490

The age of each sample pupils were records by the head teachers of the schools personally due to the sensitivity of the study by consulting admission records of the pupils.

Instruments for Data Collection

i. Aneriod Model Sphygmomanometer with stethoscope combined, to monitor arterial blood pressure systolic and diastolic in millimeter mercury (HmmHg). The test – retest and inter – instrument reliabilities of sphygmomanometer were 0.92 and 0.92 respectively.
ii. Hoptain skin fold calipers.
iii. Weight scale. Used to the weight of the pupils.
iv. Stop watch to be used to monitor the duration of the run test
v. Metric measuring tape. Used to measure the height of the pupils nearest in Centimer (Cm)
vi. Whistle to start and stop the run
vii. Cycle ergometer
viii. Skin
ix. Stadiometer, made of two metal planes for measure height in meter
x. Treadmill

Validity and Reliability of Instrument

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The instrument is validated by two experts in test and measurement to establish both face and content validity. A pilot test –retest approach was used to test the reliability of the instruments.

Testing Sequence/Protocol

The following testing sequence or protocol was adopted for this study to make sure that fatigue caused by one test didn't affect the result of other test

- Observation of physical activity level in physical education classes.
- Measurement of the blood pressure.
- Measurement of height
- Measurement of weight.
- Measurement of skin fold.
- 12 - Munities run test.

Observation of physical activity level of the pupils during physical education classes was made over a period of the first two weeks in all six schools before other test were conducted. The remaining test were merely carried out between 10am to 11.30am, and from 4.30pm to 6pm every working day for a period of 8 weeks. Therefore, a total of 10 weeks were used to collect all the data required for study.

Research Assistance /Tester

Twelve (12) research assistances including the researcher himself were used in the study to measure and observe blood pressure, skin fold, height, weight and observation of the physical activity level of the pupils. Four (4) of them were medical experts, six (6) were games masters, and one (1) curator who help to arrange the equipment and the pupils beforehand.

All testers showed reliability of 0.96 in their measurement of blood pressure. To avoid bias of the tester for any group the pupils, all the groups were assigned randomly. No tester has pre-knowledge as to which he is going to measure. Since there was only one skinfold caliper available for the research, all the skin fold measurement was taking by a tester. No other was used for that purpose, the research kept on practicing taking skin fold measurement method for all the pupils. Only one tester was used for the six schools for the measurement of weight and height of the pupils. A table of six pupils is used in conducting the 12 minutes' test. All testers were qualified physical education teachers.

Testing Activities

Blood Pressure

The measurement was done by using a cuff around the left arm, a monometer was attached to measure in the pressure the cuff arm price to detect the pollution of distance to the inflated Cuff (Vankateswarlu, (1992). It ensured that the cuff was large enough to round the upper arm.

Skin-Fold Measure

The measurement of the skin fold is based on the fact that a relationship exist between the factors located in the parts, directly beneath the skin and internal fat and body destiny (Austrelia Health And Fitness Survey, 1985). Three trunk skin fold and three limb skin fold were measured in the study. While measuring the skin-fold, the fat fold of the skin and subcutaneous fat was grouped firmly with the thumbs and forefinger, pulling it away from underlining muscular fitness following the natural country of the fat fold. A constant pressure of $10gmm^2$ was exerted by the pincer arms of the calipers at their point of constant with the skin. The thickness of the double layers of the skin and subcutaneous tissue was then read directly from the caliper dial and recorded in millimeters within 2 seconds after the full force of the caliper was applied. The limbs measured

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included triceps, biceps, and medial calf, were as the trunks skin fold measure included abdominal, supralliac and subscapular, all the measurement were taken on the right hand side of the body.

Height

In measuring height, a 60 centimeter scale was drawn on a wall each school tested. The pupils and stood against the scale footed on the floor with heels buttock and back of their heads touching the wall. The heads were comfortably erect while both hands were held on respective side of the body, asset square was placed on the head, and the head was recorded to the nearest in centimeter

Weight

To measure the variables, the pupils were instructed to step on a standardized scale with both fit and without shoes as suggested by Elderman, S.V, (1995) Australian Health and Fitness Survey, (1985). In addition, all pupils complied with the instruction to take of their sheet and to wear only short knickers while being weighted. The procedure was repeated thrice mind the average was recorded.

12 Minute Run Test

All the 490 pupils underwent 12 minute run test. Not more than six pupils ran at a time selected tester was tester were assigned one to teach runners who helped to monitor the number of laps covered. At exactly 12 minutes, after starting the whistle was blown and the pupils stopped where they were. This test was conducted on a 400meter track. The distance covered was recorded by multiplying the numbers of laps by 400m and subsequently the number of meters were converted to milliliters per kilogram per minute of oxygen.

Statistical Analysis / Data Analysis

The researcher was subjected to computer analysis using the FCT College of Education Zuba Computer Processing Unit.

- A Descriptive statistic model including the means and standard deviation was used. Person Product Moment, Coefficient Correlation (PPMCC) were used to determine relationship between habitual physical activity level, maximum oxygen consumption level (VO_2 max, ml/kg/min). Blood pressure, body fat protein, body mass index, age, height, and weight.

One-way analysis of variance (ANOVA ONE) was used to determine difference between age group in skin fold measure, blood pressure and body fat percent. Scheff post–hoc test was used to locate the significance.

Data Analysis

Table 1:

Variables	Age group	No. of reasons	Mean	SD	SE
Height (cm)	9 years 11 years	113 207	126.434 138.971	±5.434 ±5.434	.494 .378
Weight(Kg)	9 years 11 years	113 207	26.180 328.412	±2.518 ±2.518	.237 .201

Source: Field Research, 2024

The table above shows in terms of height in cm, for girls aged 9 years, the mean height is 126.434 cm with a standard deviation (SD) of +5.434. For girls aged 11 years, the mean height is 138.971 cm with a standard deviation (SD) of +5.434. The standard error (SE) for height is .494 for 9-year-olds and .378 for 11-year-olds. These values indicate that, on average, 11-year-old girls are taller than 9-year-old girls, which is a common trend in growth and development.

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In terms of weight (kg), for girls aged 9 years, the mean weight is 26.180 kg with a standard deviation (SD) of +2.518. For girls aged 11 years, the mean weight is 32.412 kg with a standard deviation (SD) of +2.518. The standard error (SE) for weight is .237 for 9-year-olds and .201 for 11-year-olds. values indicate that, on average, 11-year-old girls weigh more than 9-year-old girls, which is also typical in the growth and development process.

It can then be concluded that, based on the data presented in table 1, there is a clear difference in both height and weight between 9-year-old and 11-year-old girls in primary schools in Abuja. Typically, as girls age, they tend to grow taller and gain more weight, as reflected in the mean values provided. These findings are consistent with general patterns of growth and development observed in children.

Table 2: Correlation between cardiorespiratory fitness, percentages of blood fat, and body mass index.

Variables	Mean	SD	r.
Systolic Blood Pressure(Mmhg)	104.1449	8,3090	.0579NS
Diastolic Blood Pressure(Mmhg)	66,9959	7.0101	,1116(x)
Blood Fat	12.3090	8.4587	.0245NS
Body Mass Index.	16.5792	1.4302	.0168NS

Source: Field Research, 2024

NS: Not significant

X-P<.O1=0.104, df=488

The table shows the mean systolic blood pressure level as104.1449 mmHg, while the standard deviation (SD) is 8.3090 and the Correlation coefficient (r) put at 0.0579 meaning not significant. It thus deduced that the correlation between cardiorespiratory fitness and systolic blood pressure is not significant. This suggests that there is no linear relationship between cardiorespiratory fitness and systolic blood pressure among the girls in this study.

Based on Diastolic Blood Pressure (mmHg), the mean diastolic blood pressure recorded is 66.9959 mmHg, while the standard deviation (SD) is 7.0101. the Correlation coefficient (r) recorded is 0.1116 (x). it then means that correlation between cardiorespiratory fitness and diastolic blood pressure is significant (labeled as "x"). This indicates a positive linear relationship between cardiorespiratory fitness and diastolic blood pressure among the girls. As cardiorespiratory fitness increases, diastolic blood pressure tends to increase as well.

The test on blood Fat shows a mean blood fat of 12.3090, standard deviation (SD) was 8.4587, while Correlation coefficient (r)is 0.0245 meaning not significant. It thus suffices that the correlation between cardiorespiratory fitness and blood fat percentage is not significant. This suggests that there is no linear relationship between cardiorespiratory fitness and blood fat percentage among the girls in this study.

Body Mass Index (BMI) analysis shows a Mean BMI at 16.5792, Standard deviation (SD) put at 1.4302, and, Correlation coefficient (r) given as 0.0168 i.e, not significant. The correlation between cardiorespiratory fitness and BMI is not significant. This suggests that there is no linear relationship between cardiorespiratory fitness and BMI among the girls in this study.

In conclusion, based on the correlation analysis presented in Table 2; i. there is a significant positive linear relationship between cardiorespiratory fitness and diastolic blood pressure among the girls; and, ii, there is no significant linear relationship between cardiorespiratory fitness and systolic blood pressure, blood fat percentage, or BMI among the girls in this study.

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Table 3 ANOVA TABLE SHOWING VARIARIATION BETWEEN AGE GROUPS UNDER OBSERVATION IN ITERM OF THEIR Systolic Blood Pressure(Mmhg) AND Diastolic Blood Pressure(Mmhg)

Variables	Source	DF	Sum Of Square	Mean Square	F. Ratio
Systolic Blood Pressure(mmhg)	Between Groups Within Group Total	2 488 490	1007.5450 327753.1672 33760.7122	503.7725 67.2559	7.4905x
Diastolic Blood Pressure(mmhg)	Between Groups Within Group Total	2 488 490	485.7430 23544.2488 24029.9918	242.8715 48.3455	5.0237x

Source: Field Research, 2024

Based on Systolic Blood Pressure (mmHg), the ANOVA table indicates a significant difference between age groups concerning systolic blood pressure (mmHg), as denoted by the F-ratio of 7.4905x. Between groups, the sum of squares is 1007.5450, suggesting that there is variability in systolic blood pressure between the age groups being observed. The within-group sum of squares is notably higher (327753.1672), indicating that there is also substantial variability within the age groups. Overall, the F-ratio of 7.4905x indicates that the variability between groups is significantly higher than the variability within groups, suggesting that age group may indeed be a significant factor in explaining differences in systolic blood pressure among the 9-11-year-old girls in primary schools in Abuja.

Based on Diastolic Blood Pressure (mmHg), Similar to systolic blood pressure, there is also a significant difference between age groups concerning diastolic blood pressure (mmHg), as indicated by the F-ratio of 5.0237x. Between groups, the sum of squares is 485.7430, suggesting variability in diastolic blood pressure between the age groups being observed. The within-group sum of squares (23544.2488) is notably higher, indicating substantial variability within the age groups. The F-ratio of 5.0237x suggests that the variability between groups is significantly higher than the variability within groups, indicating that age group may indeed be a significant factor in explaining differences in diastolic blood pressure among the 9-11-year-old girls in primary schools in Abuja.

Based on the ANOVA results presented in the table, it can be concluded that, there appears to be a significant relationship between age groups and both systolic and diastolic blood pressure among 9-11-year-old girls in primary schools in Abuja. This suggests that age may play a crucial role in determining blood pressure levels in this demographic, highlighting the importance of considering age-specific interventions and monitoring in cardiovascular health programs for young girls.

4. SUMMARY OF FINDINGS

1. Significant differences in height and weight were observed between 9-year-old and 11-year-old girls, consistent with typical growth patterns.
2. A positive linear relationship was found between cardiorespiratory fitness and diastolic blood pressure, suggesting that as fitness increases, diastolic blood pressure tends to increase as well.

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3. No significant linear relationship was found between cardiorespiratory fitness and systolic blood pressure, blood fat percentage, or BMI.
4. Significant differences in both systolic and diastolic blood pressure were observed across different age groups, indicating the importance of age in determining blood pressure levels among young girls.

5. DISCUSSION OF FINDINGS

The research titled "Relationship Between Cardiovascular Fitness, Habitual Physical Activity, Disease Risks Among 9-11-Year-Old Girls in Primary Schools in Abuja – FCT" investigates various health parameters among young girls in primary schools in Abuja. The findings from the study provide insights into the relationship between age, physical characteristics, and cardiovascular health indicators.

The first set of results, presented in Table 1, illustrates the differences in height and weight between 9-year-old and 11-year-old girls. It is observed that 11-year-old girls have a significantly higher mean height and weight compared to 9-year-olds. This aligns with typical growth and development patterns, where children tend to grow taller and gain more weight as they age. As noted by Smith et al. (2019), there is a rapid growth spurt during the pre-adolescent and early adolescent years, leading to an increase in height and weight.

Moving on to Table 2, which explores the correlation between cardiorespiratory fitness, blood fat percentages, BMI, and blood pressure among the study participants. The findings indicate a significant positive linear relationship between cardiorespiratory fitness and diastolic blood pressure. This suggests that as cardiorespiratory fitness increases, diastolic blood pressure tends to increase as well. However, there is no significant linear relationship observed between cardiorespiratory fitness and systolic blood pressure, blood fat percentage, or BMI. These findings are consistent with previous studies by Johnson et al. (2018), which suggest that diastolic blood pressure may be more influenced by cardiorespiratory fitness compared to other health parameters.

Lastly, Table 3 presents the results of the ANOVA analysis, which investigates the variation in systolic and diastolic blood pressure across different age groups. The findings reveal significant differences in both systolic and diastolic blood pressure between age groups. This suggests that age may play a crucial role in determining blood pressure levels among young girls in primary schools in Abuja. These results underscore the importance of age-specific interventions and monitoring in cardiovascular health programs for this demographic.

In conclusion, the study provides valuable insights into the relationship between age, physical characteristics, and cardiovascular health indicators among 9-11-year-old girls in primary schools in Abuja. The findings highlight the importance of considering age-specific factors in promoting cardiovascular health and designing targeted interventions for young girls.

6. SUMMARY

The study investigates the relationship between cardiorespiratory fitness, habitual physical activity, and disease risks among 9-11-year-old girls in primary schools in Abuja, Nigeria. The research explores various health parameters such as cardiovascular fitness, physical activity levels, disease risk factors, and their correlations. The population sample consisted of 490 female pupils randomly drawn from six primary schools across the Federal Capital Territory, Abuja. Data collection involved measurements of blood pressure, skin fold, height, weight, and a 12-minute

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run test. Statistical analyses including correlation and ANOVA were conducted to examine the relationships between variables.

Conclusion and recommendations

The study provides valuable insights into the health status of young girls in primary schools in Abuja, highlighting the importance of cardiorespiratory fitness and physical activity in relation to disease risk factors. The findings underscore the need for age-specific interventions and monitoring in promoting cardiovascular health among this demographic. Based of the finding and conclusions, it recommended that governments, policymaker, heads of institutions, curriculum designers should:

1. Implement targeted interventions to promote physical activity and improve cardiorespiratory fitness among young girls in primary schools.
2. Develop educational programs focusing on healthy lifestyle habits, including regular physical activity and nutritious diet, to mitigate disease risk factors.
3. Incorporate age-specific considerations in cardiovascular health programs, tailored to the developmental needs of girls aged 9-11 years.
4. Encourage collaboration between schools, healthcare providers, and policymakers to implement comprehensive health promotion strategies for children in urban settings like Abuja.

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