Relationship between Parental Socioeconomic Status and Cardiovascular Parameters of Primary School Pupils in Ile-Ife, Nigeria

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ABSTRACT

Socioeconomic status has been reported to affect the blood pressure of adults in Nigeria. However, it is yet to be confirmed if it also affects the blood pressure of Nigerian children. The objective of this study was therefore to investigate the effect of parental socioeconomic status on the cardiovascular parameters of primary school pupils in Ile-Ife, Nigeria. The weight, height, abdominal circumference, systolic blood pressure, diastolic blood pressure and heart rate of 1026 primary school pupils in Ile-Ife, Nigeria were measured. The body mass index, rate pressure product and ponderosity index were later calculated. An adapted structured questionnaire which assessed the socioeconomic status of the subjects' parents was administered. The ages of the subjects ranged between 6 and 14 years. The subjects were subsequently classified into three socioeconomic groups (low, middle and upper). The results showed no significant relationship between parental socioeconomic status and systolic blood pressure (r = -0.025, p < 0.05), diastolic blood pressure (r = 0.032, p < 0.05) and heart rate (r = 0.018, p < 0.05). The 95th percentile blood pressure was found to be 130/91 mmHg. It was concluded that parental socioeconomic status has no significant effect on the cardiovascular parameters (systolic blood pressure, diastolic blood pressure, heart rate, rate pressure product and pulse pressure) of primary school pupils in Ile-Ife, Nigeria.

Key words: *Parental socioeconomic status, cardiovascular parameters, school pupils, blood pressure*

INTRODUCTION

Brookes[1] has postulated that approximately 1 in 3 adults aged over 20 years will have hypertension by the year 2025 and that almost three-quarters of the world's hypertensive population will be in economically developing countries. Ari and Raymond[2] in 2005, described blood pressure as a major determinant of health in adult life and that it is significantly determined by both genetic and lifestyle factors. Blood pressure can be low (hypotension) or high (hypertension). It is classified as normotensive if diastolic blood pressure is less than 90 mmHg, as borderline hypertension if systolic blood pressure ranges between 140 and 159 mmHg, and as sustained hypertension if systolic blood pressure is greater than or equal to 160 mmHg and diastolic blood pressure is greater than or equal to 95 mmHg.[3-5]

In many studies, hypertension in children and adults has been linked to the increasing prevalence of obesity worldwide by many studies. Barbara et al.[6] and Mona[7] have shown that fat located in the abdominal region is associated with greater health

risks than that in the peripheral regions. These studies also showed that accurate measurement of total abdominal fat can be made by magnetic resonance imaging or computed tomography. However, because of the high cost of these methods, as well as their unavailability for clinical practice, abdominal circumference can be used as an indicator of the severity of abdominal obesity since it has been shown to correlate with the amount of fat in the abdomen.

Steptoe et al.[8] and Pulkki et al.[9] have reported the relationship between socioeconomic status and the incidence of hypertension among blacks. Balogun et al.[10] investigated the influence of parental socioeconomic status on casual blood pressures of Nigerian school children in 1990. They reported that parental socioeconomic status has no effect on the systolic and diastolic blood pressure, heart rate, rate pressure product and pulse pressure of Nigerian children. They finally concluded that hypertension in Nigerian children may not be attributed to socioeconomic factors alone, but genetic and environmental factors might also contribute to it.

Poulton et al.[11] conducted a study on the association between children's experience of socioeconomic disadvantage and adult health in New Zealand. They reported that children that grew up in low socioeconomic status families tended to have poorer cardiovascular health compared with those from high socioeconomic status backgrounds. Adedoyin et al.[12] reported that socioeconomic status had an inverse significant effect on the systolic blood pressure, heart rate and pulse pressure of adult Nigerians. They concluded that low socioeconomic status was associated with the development of hypertension among Nigerian adults. Furthermore, almost all the studies involving evaluation of the relationship between parental socioeconomic status and blood pressure of Nigerian children had been done some years back. Since the Nigerian economy is still in transition, it is intuitive to correlate the present parental economy of school children with their cardiovascular parameters. This study was therefore aimed at investigating the relationship between parental socioeconomic status and the cardiovascular parameters of primary school pupils in Ile-Ife,

Nigeria. It was hypothesized that there would be no significant relationship between parental socioeconomic status and the cardiovascular parameters of the pupils.

MATERIALS AND METHODS
Subjects
One thousand and twenty-six (512 males and 514 females) apparently healthy school-age primary school pupils whose ages ranged from 6 to 14 years in ten public and private primary schools in Ile-Ife, Nigeria were recruited for the study. Ile-Ife is an urban city in Osun State, Nigeria. The participants were physically screened to eliminate any disability that may make measurement of anthropometric and cardiovascular parameters difficult. The assent of the parents of the pupils was sought and obtained before the commencement of the study. Similarly, ethical clearance for the study was obtained from the ethical clearance committee of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife. The data obtained included: age, weight, height, abdominal circumference, systolic blood pressure, diastolic blood pressure, heart rate, rate pressure product and pulse pressure.

INSTRUMENTATION
A Littman stethoscope (USA) was used together with an anaeroid sphygmomanometer (U-MEC, China) for the measurement of the pupils' blood pressures. A weighing scale, manufactured by Hanson Company, Ireland, was used to measure the weights of the pupils. A validated height metre calibrated from 0 cm to 200 cm was used to measure the height of the pupils. An inelastic tape (Butterfly brand, China) was used to measure the abdominal circumference of the pupils. A stopwatch (Hewer, Track Mate brand, USA) was used for taking the subjects' heart rate. A structured questionnaire was used to obtain the socioeconomic status of the subjects' parents. A questionnaire adapted from Adedoyin et al. (2005) was used for this study.

PROCEDURE
Ethical clearance for the study was given by the

Obafemi Awolowo University Teaching Hospitals Complex Ethics and Research Review Committee. All measurements were taken within the school premises of the selected primary schools between 9.00 a.m. and 12.00 noon. The subjects were randomly selected. Official permission was sought from the authorities of the selected schools. Prior to the commencement of the study, the parents' informed consent was sought. Only those pupils whose parents gave informed consent for the study were allowed to participate in the study.

Height was measured using a validated height metre with the pupil standing barefoot, with the heels, the back and occiput touching the height metre. Weight was measured with a bathroom weighing scale (Hanson Company, Ireland) in kilogrammes. Abdominal circumference was measured below the rib cage and above the umbilicus at the end of normal expiration, using an inelastic tape. Measurements were taken with minimal clothing. The blood pressure was measured after ten minutes of quiet sitting with a standardized aneroid sphygmomanometer and a stethoscope. The subject was comfortably seated in a chair with the arm well supported with a pillow. The sphygmomanometer cuff was wrapped snugly around the upper arm above the antecubital area with the cuff bladder centered over the brachial artery. The gauge of the aneroid sphygmomanometer levelled with the patient's arm. The subject's arm was kept level with the heart by placing it on the arm of the chair. The brachial pulse was palpated just below and slightly medial to the antecubital area. Then the earpieces of the stethoscope were placed in the examiner's ears and the stethoscope was positioned head over the brachial artery just distal to the cuff. The bulb was pumped until the aneroid gauge reached approximately 20 mm Hg above the point at which the pulse disappeared. Then the air valve was slowly opened and the gauge needle was watched as it descended. The pressure was released at a rate of about 3 mm Hg per second, and the examiner listened for pulse sounds (Korotkoff's sounds). The heart rate was measured by auscultation with the subject lying supine. The stethoscope was placed between the second and third intercostal spaces at the sternal border. Then the earpieces of the stethoscope were placed in the examiner's ears and the sound was counted for fifteen seconds. The value obtained was multiplied by four to get the heart rate per minute. Each measurement was taken by the same examiner to minimize inter-tester error.

The pulse pressure (PP), which is a good measure of the stroke volume, was evaluated by using the formula: $PP = SBP\text{-}DBP$.[13]

The rate pressure product (RPP), which is a good measure of an individual's myocardial oxygen consumption, was evaluated by this formula: $RPP = SBP \ X \ HR$.[10]

Sociodemographic variables were obtained through a questionnaire that was completed by the parents of the pupils. The questionnaire used by Adedoyin et al. was modified to suit the purpose of this study.[12] The questionnaire sought information on the highest educational attainment of the subjects' parents, the type of housing, the number of rooms and persons in the household and household utensils/appliances like musical stereo, gas cooker, refrigerator, computer and mobile phone. Scores were assigned to each item based on its status in our society (Nigeria). The pupils were subsequently ranked into three socioeconomic classes {low (<9), middle (10-17) and upper (19-27)}.

STATISTICAL ANALYSES

Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 10.0. (SPSS Inc., Chicago, IIIinois, USA). Both descriptive (range, mean, median, mode, standard deviation) and inferential statistics were used for the analysis. Pearson product-moment correlation coefficient was computed to determine the relationship between the total parental socioeconomic score and the dependent variables of the pupils. A one-way analysis of variance was used to determine any significant difference in the dependent variables between the children in the three socioeconomic classes. The level of significance was set at $p < 0.05$.

RESULTS

A total of 1026 apparently healthy school-age pupils

from Ile-Ife participated in this study with the mean age of 10.12 ± 2.46 years. The physical characteristics and the resting physiological responses of all the subjects are presented in table 1. The mean systolic and diastolic blood pressures of the pupils were 98.63 ± 12.38 mmHg and 62.85 ± 10.18 mmHg respectively. The mean resting heart rate was 88.38 ± 14.63 beats per minute. The mean rate pressure product was 8725.54 ± 1828.1 mmHg beats per minute, while the mean pulse pressure was 35.79 ± 8.64 mmHg. The relationship between parental socioeconomic score and the dependent variables are shown in table 2. No significant relationship was found between parental socioeconomic scores and the cardiovascular parameters [systolic blood pressure ($r = -0.025$, $p < 0.05$), diastolic blood pressure ($r = 0.032$, $p < 0.05$) and heart rate ($r = 0.018$, $p < 0.05$) of the pupils. Similarly, the relationship between parental socioeconomic scores and other cardiovascular parameters (rate pressure product and pulse pressure) was also not significant ($r = 0.031$, $p < 0.05$, $r = -0.01$, $p < 0.05$ respectively).

Table 1. The physical characteristics and resting physiological responses of the subjects (N= 1026)

| Variable | Range | | Mean ± SD | 95th |
	Min.	Max.		percentile
Age (Yrs)	6.0 0	14.0 0	10.12 ±2.46	14
Height (m)	0.97	1.4	1.31±0.13	1.53
Weight (Kg)	15	70	26.55±7.87	42
AC (cm)	49	92	59.37±5.50	69
BMI (Kg/m²)	6.17	27.34	15.22±1.97	18.67
PI (Kg/m³)	3.43	22.46	11.69±1.56	14.55
SBP (mmHg)	51	137	98.63±12.38	130
DBP (mmHg)	27	98	62.85±10.18	91
HR (bpm)	42	140	88.38±14.63	112
RPP (mmHgbpm)	2397	15540	8725.54±1828.1	11704.8
PP (mmHg)	8	69	35.79±8.64	52

Table 2. Relationship (r) between parental socioeconomic score and the dependent variables

Dependent Variables	Pearson product moment Correlation
Age (yrs)	-0.003
Height (m)	0.03
Weight (kg)	-0.024
Abdominal circumference (cm)	0.038
Body mass index (kg/m²)	0
Ponderoxity index (kg/m³)	-0.023
Systolic blood pressure (mmHg)	-0.025
Diastolic blood pressure (mmHg)	0.032
Heart rate (b.p.m.)	0.018
Rate pressure product (mmHgbpm)	0.031
Pulse pressure (mmHg)	-0.01

*$p < 0.05$

The results of the one-way analysis of variance are summarized in table 3. The F ratios found for age, weight, height, abdominal circumference, body mass index and ponderosity index were not significantly ($p > 0.05$) different. The systolic blood pressure, diastolic blood pressure, heart rate, rate pressure product and pulse pressure responses between the children in the three socioeconomic classes were also not significantly ($p > 0.05$) different.

DISCUSSION

This study found no significant relationship between parental socioeconomic status and the cardiovascular parameters of primary school pupils in Ile-Ife, Nigeria. The hypothesis that there would be no significant relationship between parental socioeconomic status and the cardiovascular parameters of the pupils was therefore accepted. This finding agrees with the report of Balogun et al.[10] who reported that parental socioeconomic status had no effect on systolic and diastolic blood pressure, heart rate, rate pressure product and pulse pressure of Nigerian children. However, this finding is contrary to the report from the study conducted in a homogeneous population by Adedoyin et al.[12] among adult Nigerians.

Table 3. Summary of the one-way analysis of variance between the three socioeconomic classes

Dependent Variable	Socioeconomic Status			F ratio	P value
	Lower class (n=468) Mean±SD	Middle class (n=367) Mean±SD	Upper class (n=191) Mean±SD		
Age (Years)	10.2±2.5	10.1±2.5	9.9±2.5	0.53	0.589
Height (meters)	1.3±0.1	1.3±0.1	1.3±0.2	0.67	0.936
Weight (Kg)	26.5±7.2	26.6±8.0	26.6±8.9	0.02	0.979
Abdominal circ. (cm)	59.7±5.3	59.6±5.6	60.0±6.0	0.17	0.844
BMI (Kg/m^2)	15.3±1.9	15.2±2.1	15.2±2.0	0.15	0.865
P I (Kg/m^3)	11.7±1.5	11.7±1.7	11.6±1.3	0.27	0.765
SBP (mmHg)	98.6±12.7	98.6±12.1	98.8±12.2	0.02	0.979
DBP (mmHg)	62.6±10.1	62.9±10.2	63.4±10.5	0.22	0.803
Heart Rate (bpm)	87.3±14.8	90.0±13.5	87.6±16.5	2.8	0.061
RPP (mmHg)	8607.6±1823.0	8878.6±1717.6	8693.0±2080.1	1.73	0.178
PP (mmHg)	35.9±8.9	35.7±8.5	35.5±8.3	0.12	0.886

The study reported a significant inverse relationship between socioeconomic status and systolic blood pressure ($r = -0.131$, $P < 0.01$) in adult Nigerians. The differences in the findings may be due to differences in the ages of the subjects used in each study (age range in this study is was 6 to 14 years, while age range in Adedoyin et al. was 30 to 60 years).[12]

Furthermore, no significant difference was found in the systolic blood pressure, diastolic blood pressure, heart rate, rate pressure product and pulse pressure of school-age pupils in Ile-Ife, Nigeria, from the different socioeconomic groups. This finding was in line with the report of Balogun et al.[10] which reported no significant difference in the blood pressures of Nigerian children from the different socioeconomic strata. However, the result was contrary to that of Adedoyin et al.[12] who found a significant difference in the systolic blood pressure, heart rate and stroke volume of Nigerian adults from the different socioeconomic strata. The variation in the reports may, however, be attributed to the differences in age group (8 to 20 years in Balogun et al.[10] and 30 to 60 years in Adedoyin et al.[12]) of the subjects used in each study. The participants in this

study and those in the study by Balogun et al.[10] were drawn from a homogenous community. The subjects were also from an urban community. These two factors could have affected the result of this study.

Reddy and Rao[15] reported that poverty and affluence were among the causes of hypertension in the low and high socioeconomic stratum respectively. Burt et al.[16] described a level of blood pressure greater than 140/90 mmHg as being hypertensive. Ari and Raymond[2] in 2005 described it as blood pressure equal to or greater than the 95th percentile of a population. According to experts in hypertension, persistent systolic and diastolic blood pressures greater than the 95th percentile of the population are considered as indicators for treatment.

Balogun et al.[10] reported a 4% prevalence of hypertension among Nigerian children. In this study, the 95th percentile blood pressure was found to be 130/91 mmHg. Using this percentile as the 'cut-off', 8% (n = 81) prevalence of hypertension was found. Out of these, 4.4% (20 boys and 25 girls) had systolic blood pressure equal to or greater than 130 mmHg. About 3.6% (13 boys and 23 girls) had diastolic blood pressure equal to or greater than 91 mmHg. It should be noted that the 8% prevalence of hypertension found

in this study is much higher than the 4% reported by Balogun et al.[10] in 1990. This is an indication that hypertension among school-age pupils in Ile-Ife, Nigeria is on the increase. It is therefore recommended, based on the findings from this study, that while using the 95th percentile blood pressure as the diagnostic criterion for hypertension among school-age pupils in Ile-Ife, Nigeria, any child that has a sustained blood pressure equal to or greater than 130/91 mmHg, should be properly examined. This will allow secondary hypertension to be excluded in children.

CONCLUSION

This study concluded that the socioeconomic status of parents has no significant effect on the cardiovascular parameters (systolic blood pressure, diastolic blood pressure, heart rate, rate pressure product and pulse pressure) of primary school pupils in Ile-Ife, Nigeria. Further studies are therefore recommended to investigate the effects of parental socioeconomic status on the cardiovascular parameters of Nigerian multi-racial primary school pupils.

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