ANTHROPOMETRY AND BLOOD PRESSURE IN NIGERIAN CHILDREN

By

EGBUNA O. OBIDIKE

Department of Paediatrics, College of Medicine, University of Nigeria, Enugu Campus

SUMMARY

Objective:
To determine if there is a correlation between blood pressure and anthropometry in children of Igbo ethnicity.

Subjects, Materials and Methods:
One thousand, six hundred and thirty-four boys and 1669 girls were studied. Their ages ranged from 6 to 14 years. Their blood pressures, weights and heights were measured. The Quetelet's indices were determined and the correlation coefficients, r, found.

Results:
For boys, weight correlated (r=0.3205) more than height (r=o.2585) with systolic blood pressures. These values were nonetheless statistically significant. For their diastolic blood pressures, it was observed that all the variables showed weak correlation; weight (r=0.1785), height (r=0.1504), Quetelet's index (r=0.0828)
The values for the girls showed moderate correlation of all the variables with their systolic blood pressure; weight (r=0.4249), height (r=0.3972), Quetelet's index (r=0.3915). Their diastolic blood pressures showed statistically significant though weak correlation with the variables; height and Quetelet's index (r=0.1667) each, weight (r=0.1656).

Conclusion:
This study shows that in the Nigerian children examined, blood pressure is affected by anthropometry, and of all the anthropometric values, weight affected blood pressures most. Anthropometry influenced systolic blood pressure more than diastolic blood pressure.

KEYWORDS: *Anthropometry, Blood Pressure, Nigerian Children*

Correspondence Address:
Dr. E. O. Obidike,
Department of Paediatrics
University of Nigeria Teaching Hospital,
P.M.B. 01129,
Enugu.
Nigeria.
Accepted for Publication: *27th July 2000*

INTRODUCTION

Comparison of cohort blood pressures is known to be influenced by race [1,2] and environment [3-5]. For any individual however, other factors are also important. These include errors in blood pressure measurement[6,7], inheritance[8], level of salt intake[9,10], level of physical activity[11,12], and time of day when measurement was made[13].

The individual variables, however, tend to be constant for any child or adult. In paediatric practice, practitioners are faced with constant changes in body weight and height with increasing age. Weight has been shown to correlate positively with blood pressures in adults[14], adolescents[15], and also in paediatric population studies[4,5,16,17]. Some of these latter studies show correlation to be more with systolic blood pressures[16,17]. This was however not the experience of Akinkugbe[18] in an adult population study in a rural area. Height on the other hand tended to be more inconsistent than weight in blood pressure correlation studies[3-5,17,19,20].

This study was therefore conducted to determine the relationship between blood pressure and anthropometric indices in Nigerian children of Igbo ethnicity in Enugu Local Government Areas.

SUBJECTS, MATERIALS AND METHODS

A multi-staged random sampling was done, first to select the primary schools to be used and secondly to select the streams of classes to be used in each class grade (representing different ages) in the selected schools. A total of six primary schools were selected; 4 from the urban area and 2 from the rural area of Enugu local government areas. From the selected streams of classes 1634 boys and 1699 girls of ages 6 to 14 years were studied.

Their ages were obtained from the class register or where not possible, the baptismal certificates.

Their blood pressures were measured using a standard mercury sphygmomanometer (Accousons) with cuff sizes 9cm and 12cm, while their weights were obtained using a standing scale (WESTA) with an adjustable mechanism for returning pointer to zero. Their heights were measured using a standiometer (C.M.S. weighing Equipment).

The author measured the blood pressure, while a staff nurse midwife assisting, measured the weights and heights.

Measurements were carried out after explanation and demonstration in the general class view first and subsequently with each group that came out for the measurements.

The blood pressure was measured, using the appropriate cuff size to cover 2/3 of the upper arm of each pupil.

The first and fourth Korotkoff sounds were used as the systolic and diastolic blood pressure points respectively with the reading taken to the nearest 2mmHg. Two readings, 10 minutes apart, were taken from each pupil and the average calculated.

Their weights were measured to the nearest 0.5cm. The Quetelet's' index was calculated from the formula:

$$QI = \frac{\text{Weight (kg)}}{\text{Height (cm)}^2}$$

STATISTICAL ANALYSIS

The means and standard deviations of systolic and diastolic blood pressures, weights, heights and the Quetelet's' index were calculated.

The product moment correlation coefficients, r, were calculated and the t-test at $p<0.05$ level of significant were determined.

RESULTS

The product moment correlation coefficient value, r (table 1) show that for boys, it ranged from a value of 0.3205 between weight and SBP as highest and 0.0292 between QI and SBP as lowest. All the values were statistically significant except the least value.

For the girls, the r-values (table 2) ranged from 0.4249 between weight and SBP as highest to 0.1656 between weight and DBP as the least. All values were however statistically significant.

TABLE 1: Product Moment Correlation Coefficient of Boys

	AGE (YEAR)	WT (KG)	HT (CM)	SBP mm Hg	DBP mm Hg	QI
AGE	r = 1					
WT	r = 0.724 t = 42.40094 p 0.05 (S)	r = 1				
HT	r = 0.771 t = 48.90885 p 0.05 (S)	r = 0.91625 t = 92.3965 p 0.05 (S)	r = 1			
SBP	r = 0.15 t = 6.1291 p 0.05 (S)	r = 0.3205 t = 13.6686 p 0.05 (S)	r = 0.2585 t = 10.8103 p 0.05 (S)	r = 1		
DBP	r = 0.004 t = 0.1616 p 0.05 (NS)	r = 0.1785 t = 7.3288 p 0.05 (S)	r = 0.1504 t = 6.1458 p 0.05 (S)	r = 0.5427 t = 26.1023 p 0.05 (S)	r = 1	
Q1	r = 0.046 t = 1.8603 p 0.05(NS)	r = 0.0852 t = 3.4545 p 0.05 (S)	r = 0.0498 t = 2.0143 p 0.05 (S)	r = 0.0292 t = 1.18013 p 0.05 (NS)	r = 0.0828 t = 3.3565 p 0.05 (S)	r = 1

TABLE 2: Product Moment Correlation Coefficient of Girls

AGE	(YEAR)	WT (KG)	HT (CM)	SBP mm Hg	DBP mm Hg	QI
AGE	r = 1					
	r = 0.7622 t = 48.5039 p <0.05 (S)	r = 1				
HT	r = 0.8143 t = 57.79162 p <0.005 (S)	r = 0.88457 t = 78.12817 p <0.05 (S)	r = 1			
SBP	r = 0.3030 t = 13.0977 p <0.05 (S)	r = 0.4249 t = 17.8293 p <0.05 (S)	r = 0.3972 t = 17.8293 p <0.05 (S)	r = 1		
DBP	r = 0.0501 t = 2.06645 p <0.05 (S)	r = 0.1656 t = 6.9173 p <0.05 (S)	r = 0.1667 t = 6.9646 p <0.05 (S)	r = 0.5766 t = 290723 p <0.05 (S)	r = 1	
QI	r = 0.5273 t = 25.5532 p <0.05 (S)	r = 0.8529 t = 67.2987 p <0.05 (S)	r = 0.5742 t = 28.8916 p <0.05 (S)	r = 0.3915 t = 17.5267 p <0.05 (S)	r = 0.16674 t = 6.96632 p <0.05 (S)	r = 1

Legend to tables

WT	(kg)	=	WEIGHT (KILOGRAMMES)
HT	(cm)	=	HEIGHT (CENTIMETERS)
SBP mm Hg		=	SYSTOLIC BLOOD PRESSURE (MILLIMETER MECURY)
DBP mm Hg		=	DIASTOLIC BLOOD PRESSURE (MILLIMETER MECURY)
QI		=	QUETELET'S INDEX
(N.S.)		=	NOT SIGNIFICANT
(S)		=	SIGNIFICANT

DISCUSSION

This study showed that there is a statistically significant correlation between weight and systolic blood pressures in both sexes. Although weak, a similar correlation exists between weight and diastolic blood pressures ($p<0.05$). Previous researchers had long established this association between weight and blood pressure[3-5,16,17,20,21]. This relationship has been well documented between obesity and hypertension[22,23] and in fact, Johnson et al[27] had shown that weight is an important predictor of behaviour of blood pressure.

The association of height with blood pressure had also been established, though not as defined as weight. In this present study, while height correlated fairly well with systolic blood pressure in both sexes, its correlation with diastolic blood pressure in both sexes were weak though statistically significant ($p<0.05$).

Antia-Obong[4] and Voors et al[3] both had documented some correlation between height and blood pressures in both sexes. Okonofua[5] and Ayoola[25] were however unable to show the diastolic blood pressure correlation with height in girls while Antia et al[16] showed only a height and blood pressure correlation in boys.

The Quetelet's' index, however, has not been shown by other workers to have much association with blood pressure. While Voors et al[3] showed a good correlation, Antia-Obong[4] and Okonofua[5] observed every poor association. This study however, shows a fairly good correlation between Quetelet's index and systolic blood pressure in girls, a weak but statistically significant ($p<0.05$) correlation with diastolic blood pressure in both sexes and a non-statistically significant ($p>0.05$) correlation with systolic blood pressure in boys.

Obviously then, blood pressures changed with changes in weight, height and Quetelet's index depending on the sex of the child. This is seen from the correlation coefficient values, which are highest for weight than height and Quetelet's index in that order. This may explain why Hahn[20] made the observation that the association between blood pressure and growth was higher than between age and blood pressure, and Levine et al[26] also observed that body size had a positive confounding effect on tracking correlation of childhood blood pressure. This relationship may be a direct cause and effect process or due to some factors, for example genetic and diet, which affect both body build and blood pressures independent of one another.

Conclusion

In conclusion, this study has shown that the blood pressure of Nigerian children is affected by their anthropometric indices. This was found to be more with weight and least with the Quetelet's index. Additionally, the systolic blood pressure was affected more by all the anthropometric indices than the diastolic pressure.

This effect of anthropometry on blood pressure in children should be borne in mind while interpreting childhood blood pressures.

ACKNOWLEDGEMENT

I wish to thank Professor Bede Ibe of the Department of Paediatrics for making out time to go through my manuscript.

REFERENCES

1. Voors A.W., Foster T.A., Frerichs R.R., Webber L.S., Berenson G.S. Studies of blood pressures in children ages 5 – 14, in a total biracial community; The Bogalusa Heart Study. Circulation 1976; 54 (2); 319 - 326.
2. Bertrand ED., Coly M., Ravinet L. Normal Blood Pressure and arterial hypertension in black school children (11 to 18 years aged) in Ivory Coast. Comparison with white school children of same age. Tropical Cardiology 1979; 5 (19): 131-138
3. Sever P.S., Gordon. D., Peart W.S., Beighton P. Blood pressure and its correlates in urban and tribal Africa. Lancet 1980: 60 – 64.
4. Antia-Obong E. O. A study of arterial blood pressure in urban and rural school children: F.N.M.C. Part II Dissertation, National Postgraduate Medical College of Nigeria, Lagos, (1985).
5. Okonfuna J.A. A study of blood pressure in urban and rural Nigerian children and adolescents: F.N.M.C. Part II Dissertation, National Postgraduate Medical College of Nigeria, Lagos, (1988).
6. Champman J.M., Clark V. A., Coulson A. N., Browning G.G. Problems of measurement in blood pressure surveys; inter observer differences in blood pressure determinations. Amer. J. Epidemiol. 1966; 84 (3): 483 – 494.
7. Burch G.E., Shewey L. Sphygmomanometric cuff size and blood pressure recordings. J.A.M.A. 1973; 225 (10): 1215 – 1216.
8. Editorial: Heritability of blood pressures Brit. Med. J. 1978: 127 – 128.
9. Freis E. D. Salt. Volume and prevention of hypertension. Circulation 1976; 53 (4): 589 – 594.
10. Sharper A.C., Leonard P.J., Jones K.W., Jones M. Environmental effects on the body build, blood pressure and blood chemistry of nomadic warriors 1969; 46 (5); 282 – 289.
11. Robinow M., Hamiltom W.F., Woodbury R.A., Volpitto P.P. Accuracy of clinical determinations of blood pressure in children. Am. J. Dis. Child. 1939; 58 102 – 118.
12. Littler W.A., West M.J., Honour A.J., Sleight P. The variability of arterial pressure. Am. Heart J. 1978; 95 (2): 180 – 186.
13. Richardson D.W., Honour A.J., Fenton G.W., Stott F.H., Pickering G.W. Variation in arterial pressure throughout the day and night. Clin. Sci. 1964; 26: 445-460.
14. Etta K. M., Watson R.S. Casual blood pressures and their possible relation to age, body weight, Quetelet's index, serum cholesterol, percentage of body fat and mid-arm muscle circumference in three groups of northern Nigerian residents. Afr. J. Med. Sci. 1976; 5: 255 – 262.
15. Bertrand Ed., Bertrand C., Ravinet L., et al. Determination of normal blood pressure in 1893 young Ivorian of between 10 and 25 years; correlation with weight. Tropical Cardiology 1982; 8 (31): 93 – 103.
16. Antia A.U., Maxwell R., Gough A., Ayeni O. Arterial blood pressures in Jamaican children of negro decent. W.I. Med. J. (1980); 29: 110 – 116.
17. Londe S., Gollub S., Gollub S.W., Goldring D. Blood pressure in black and in white children. J. Paediatr. 1977; 90 (1): 93 – 94.
18. Akinnkugbe O. O. ed. High blood pressure in the African. Edinburgh and London: Churchill Livingstone 1972; 51 – 80.
19. Master A.M., Dublin L.I., Marks H.H. The normal blood pressure range and its clinical implications J.A.M.A. 1950; 143 (17): 1464 – 1470.
20. Hahn L. The relation of blood pressures to weight, height and body surface area in school boys aged 11 – 15 years. Arch. Dis. Child. 1951; 41 – 53.

21. Londe S. Blood pressure standards for normal children as determined under office conditions. Clinical paediatrics 1968; 7 (7): 400 – 403.

22. Londe S., Goldring D. High blood pressure in children: problems and guidelines for evaluation and treatment. Amer. J. Cardiol, 1976; 37: 650 – 657.

23. Heyden S., Bartal A.G., Hames C.G., McDonough J.R. Elevated blood pressure levels in adolescents, Evans County, Georgia. J.A.M.A. 1969; 209 (11): 1683-1689

24. Johnson A.L., Cornoni J.C., Cassel J. C., Tyroler H.A., Heyden S., Hames C.G. Influence of race, sex, and weight on blood pressure behaviour in young adults. Amer. J. Cardiol 1975; 35: 523 – 530.

25. Ayoola E. A. Prevalence of adolescent hypertension in Nigeria, Nig. J. Paed: 1979; 6 (1): 18 – 26.

26. Levine R.S., Hennekens C.H., Klein B. et al. A longitudinal evaluation of blood pressure in children. A. J. P. M. 1979; 69 (11): 1175 – 1177.