ORIGINAL ARTICLES

Blood Pressure and its Correlates in Tobagonian Adolescents

S Nichols[1], F Cadogan[2]

ABSTRACT

Objective: *To determine age-specific patterns and correlates of blood pressure (BP) in Tobagonian adolescents.*

Methods: *Blood pressure, weight and heights were measured using standardized procedures. Age-height and gender-specific BP levels were established and compared with those established for adolescents in the United States of America, the United Kingdom and Jamaica.*

Results*: Of the available population, 3749 or 84.9% participated in the study. Among Tobagonian adolescents, the mean one-year age increment in systolic blood pressure (SBP) was 3.6 (95% CI: 3.2, 3.9) mmHg in males and 1.5 (95% CI: 1.2, 1.8) mmHg in females. Likewise, the mean one-year increment in diastolic blood pressure (DBP) was 2.1 (95% CI: 1.7, 2.4) mmHg in males and 1.2 (95% CI: 0.9, 1.4) mmHg in females. There was an inversion of mean BP with age. Females 12–13 years having significantly higher mean SBP while those 15–18 years had lower SBP than their male counterparts. Similarly, females 12–14 years had significantly higher mean DBP while those 16–18 years had lower DBP than their male counterparts. Approximately, 6.1% (95% CI: 5.4, 7.0) and 8.2% (95% CI: 7.4, 9.1) of participants had elevated SBP and DBP based on the US reference standards. Adolescents from the UK had average SBP and DBP that were 10 mmHg higher and lower respectively than their Tobagonian counterparts while Jamaican adolescents had diastolic BP consistently lower than Tobagonian adolescents of similar age. Elevated BP was associated with overweight and family history of hypertension.*

Conclusion: *Growth and maturational factors are important determinants of blood pressure levels in this population. Furthermore, the wide variation in these key variables among possible BP referent populations necessitates the development of local blood pressure reference standards for Tobagonian adolescent populations.*

La Presión Sanguínea y sus Correlatos en los Adolescentes de Tobago

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RESUMEN

Objetivo: *Determinar los patrones de edad específicos así como los correlatos de presión sanguínea (PS) en los adolescentes tobaguenses.*

Métodos: *Usando procedimientos estandarizados, se midieron la presión sanguínea, el peso y la altura. Se establecieron los niveles de presión sanguínea específicos del género en relación, y relativos a la edad-altura, comparándoseles entonces con los establecidos para adolescentes en los Estados Unidos de América, el Reino Unido, y Jamaica.*

Resultados: *De la población disponible, 3749 (el 84.9%) participaron en el estudio. Entre los adolescentes tobaguenses, el incremento medio de la presión sanguínea sistólica (PSS) en relación con la edad en un año, fue 3.6 (95% CI: 3.2, 3.9) mmHg en los varones y 1.5 (95% CI: 1.2, 1.8) mmHg en*

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las hembras. Asimismo, el incremento medio de la presión sanguínea diastólica (PSD) en un año fue 2.1 (95% CI: 1.7, 2.4) mmHg en los varones y 1.2 (95% CI: 0.9, 1.4) mmHg en las hembras. Hubo una inversión de la PS media con la edad. Las hembras de 12–13 años presentaron una PSS significativamente más alta en tanto que las de 15-18 años tuvieron una PSS más baja que sus contrapartidas masculinas. De modo similar, las hembras de 12–14 años tuvieron una PSD significativamente más alta, mientras que las de 16-18 años tuvieron una PSD más baja que sus contrapartidas masculinas. Aproximadamente, 6.1% (95% CI: 5.4, 7.0) y el 8.2% (95% CI: 7.4, 9.1) de los participantes tuvieron PSS y PSD elevadas tomando por base las normas de referencia de los Estados Unidos. Los adolescentes del Reino Unido tuvieron como promedio PSS y PSD que fueron 10 mmHg más alta y más baja respectivamente que las de sus contrapartidas tobaguenses, mientras que los adolescentes jamaicanos tuvieron PS diastólica sistemáticamente más baja que la de los adolescentes tobaguenses de edad similar. La PS elevada estuvo asociada con el sobrepeso y una historia familiar de hipertensión.

Conclusión. *Los factores de crecimiento y madurez son importantes determinantes de los niveles de presión sanguínea en esta población. Además, la amplia variación de estas variables claves entre las posibles poblaciones referentes de PS requiere el desarrollo de normas locales de referencia de la presión sanguínea para las poblaciones de adolescentes tobaguenses.*

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INTRODUCTION

In Tobago, an island with a population of about 50 000 persons of whom over 90% are of African descent, hypertension and its co-morbidities account for over 35% of all annual visits made by adults to public healthcare facilities. It is the single major contributor to illness and death among adults 30 years and over (1, 2). This is in contrast to the situation a mere three decades ago when infectious diseases were the major causes of illness and death in this population (3, 4). Essential hypertension and its co-morbidities inevitably place a major burden on scarce resources and reduce overall productivity of those affected (5). It is becoming increasingly apparent that essential hypertension may have its origin in early life. In fact, prospective studies have demonstrated increased left ventricular mass and peripheral resistance with elevated blood pressure in childhood (6–8). These, as well as the recognition that blood pressure in childhood is the most powerful predictor of hypertension in adults, have renewed interest in investigating blood pressure and its correlates in childhood and adolescence (9–11). Currently, the diagnosis and treatment of elevated blood pressure among children and adolescents are based primarily on data and recommendations emanating from the Task Force on Blood Pressure Control (12, 13). This approach implies that blood pressure is similar in children from different populations (14). Notwithstanding, several recent studies have shown that the level and trend in blood pressure vary from population to population (15, 16). In fact, among children and adolescents, blood pressure levels are strongly influenced by growth patterns, age and gender (16). This study aims to describe the blood pressure profile and correlates for a Tobagonian adolescent population and compare these with those established for adolescents in the United States of America (USA), the United Kingdom (UK) and Jamaica (17–19).

SUBJECTS AND METHODS

All adolescent students aged 12 to 16 years old attending secondary schools on the island during the period September 5, 1999 to January 31, 2000, were invited to participate in the survey. Parental consent, as well as the consent of each participant, was obtained prior to commencement of the study. A total of 3749 adolescents (2139 females and 1610 males) was enrolled in the study. All participants were examined in school uniform. Blood pressures were measured on the right arm with a Baumanometer mercury sphygmomanometer (WABaum, New York) after each participant had rested in a sitting position for 5 to 10 minutes with the right arm resting on a table at the heart level (20). Prior to blood pressure measurement, the upper mid-arm circumference was taken. For each individual, a cuff with bladder width 40–50% of this value and whose length encircled the arm was used during all pressure measurements (21–23). In addition, pulse rate was measured one minute prior to the measurement of blood pressure. During blood pressure measurements, the cuff was rapidly inflated to a pressure 20 mmHg above the point where the radial pulse disappeared (22). The pressure within the cuff was then released at a rate of about 2 to 3 mmHg per second while auscultation was performed over the brachial artery (13). Systolic blood pressure was recorded at the beginning of the first Korotkoff phase and diastolic blood pressure at the ending of the fifth Korotkoff phase. The mean of two such measurements three minutes apart was used in determining the systolic and diastolic blood pressure for each participant. Elevated blood pressure was defined as systolic and/or diastolic pressure $ the 95th percentile of the age-height-gender specific percentile reference level for the US population (12). All blood pressure readings were taken between 9:00 am and 12:00 noon in a designated quiet area at school with ambient temperatures ranging from 26–29^{o}C (23,

24). Weight was measured to the nearest 0.1 kg with an electronic weighing scale (SECA) while height was measured to the nearest millimetre with a portable stadiometer using standard anthropometric methodology (25). Percentage body fat (%BF) was measured to the nearest 0.5% using a body fat analyser (Tanita, Model 351). All measurements were taken by nursing personnel who underwent a two-week training programme specifically for this survey. Body mass index (BMI) was calculated by dividing the participant's weight in kilograms by their height squared in metres. Participants with BMI $ 25 kg/m^2 were considered overweight.

Statistical analysis

All statistical analyses were performed using SPSS for Windows Release 10. Prior to analyses, all data were checked for errors and deviations from normality For each age and gender group, systolic and diastolic blood pressure measurements were summarized into frequency counts. The 5th, 10th, 25th, 50th, 90th and 95th percentiles for each age group were estimated through linear interpolations between these frequency counts. These percentiles were then smoothed using cubic splines (15). Finally, univariate regression analyses were applied to examine the relations of blood pressure and BMI, weight, height and percentage BF. Simple descriptive analyses were used to summarize data. Unpaired t-tests were used to analyse gender differences among variables as well as compare blood pressure and anthropometric measures from this study with findings in comparable age groups from published studies in the UK, USA and Jamaica. To allow comparisons with the UK data, height tertiles were determined by dividing each age-gender specific height distribution into three equal groups. Partial correlations were carried out between physiological and anthropometric measures controlling for the effect of age. In this study, participants were grouped into seven yearly age groups calculated on the date of measurement. For example, participants who were 12 years on their last birthday but less than 13 years on the day of measurement were grouped into the "12 years" age group.

RESULTS

Analyses done to check the quality of BP readings showed that approximately 24% of blood pressure readings ended with a zero, 21% ended with a two, 18% ended with a four, 20% ended with a six and 17% ended with an eight indicating satisfactory end digit distribution of blood pressure readings.

Overall, males had significantly higher blood pressure readings, and heights, but lower BMI and percentage BF than their female counterparts. Females 12–13 years had significantly higher mean SBP, while those 15–18 years had lower SBP than their male counterparts. Similarly, females 12–14 years had significantly higher mean DBP while those 16–18 years had lower DBP than their male counterparts (Table 1). Regression analyses showed that the mean one-year increment in systolic blood pressure was 3.6 (95% CI: 3.2, 3.9) mmHg (standard error = 0.20) in males and 1.5 (95% CI: 1.2, 1.8) mmHg (standard error = 0.16) in females. Likewise the mean one-year increment in DBP was 2.1(95% CI: 1.7, 2.4) mmHg (standard error = 0.16) in males and 1.2 mmHg (95% CI: 0.9, 1.4) (standard error = 0.13) in females. Among males, the largest increase in blood pressure occurred between 13 and 16 years (mean difference SBP = 4.6, mean difference DPB = 2.8). Among females, the largest increase in blood pressure occurred between 13 and 14 years (mean difference SBP = 2.9, mean difference DPB = 1.5) and 17 and 18 years (mean difference SBP = 2.5, mean difference DPB = 4.1). Blood pressure levels tended to be more variable in males than in females. In particular, ages 14 to 17 years showed the greatest amount of blood pressure variability among males (Figs. 1–4). Analyses of blood pressure by tertile of height suggest an overall increase in mean blood pressure levels with age within as well as across height tertiles. Among males, the largest change in mean blood pressure occurred among the shortest participants while the smallest change in mean blood pressure was among the tallest persons (Tables 2, 4). There was a significant inverse relation between height tertile and mean change in blood

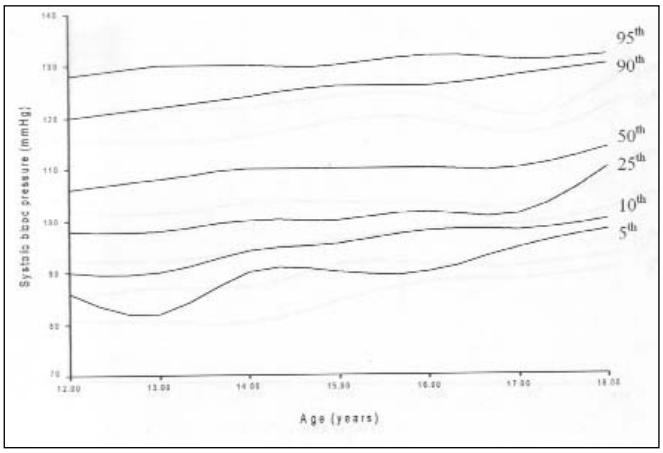

Fig. 1: Smoothed systolic blood pressure percentiles for females by age category.

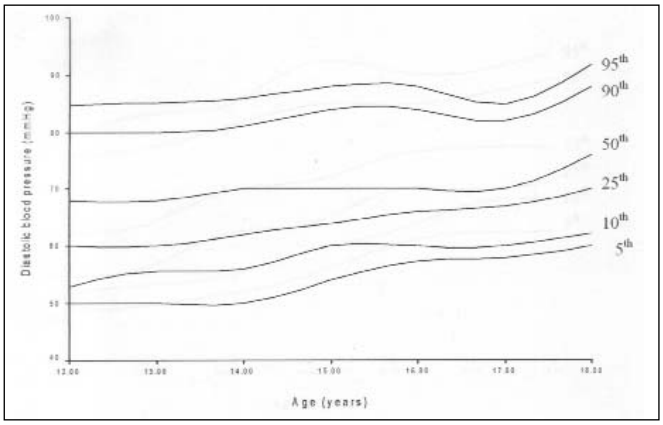

Fig. 2: Smoothed diastolic blood pressure percentiles for females by age category.

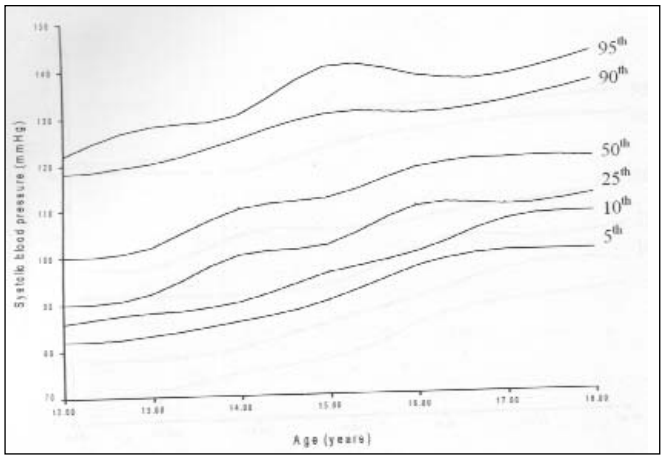

Fig. 3: Smoothed systolic blood pressure percentiles for males by age category.

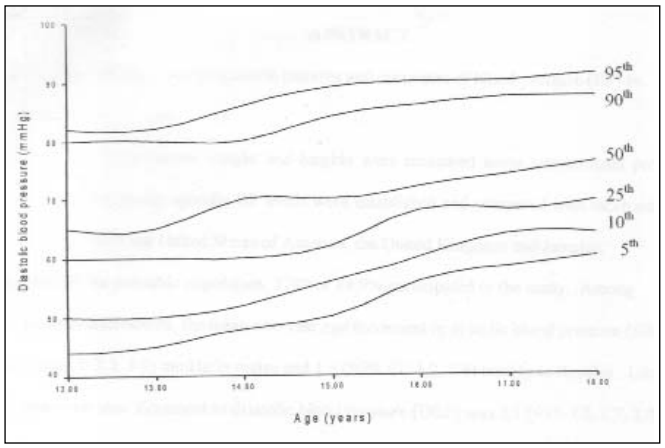

Fig. 4: Smoothed diastolic blood pressure percentiles for males by age category.

Table 1: Characteristics of participants by gender

Characteristics	Females (n = 2139) Mean (SD)	Males (n = 1610) Mean (SD)	*p*-value
Age	14.6 (1.7)	14.4 (1.6)	0.006
Systolic blood pressure (SBP) (mmHg)	109.3 (12.8)	110.2 (14.2)	0.05
Age (yr)			
12	105.4 (13.4)	102.0 (11.8)	0.005
13	106.4 (13.3)	103.7 (13.2)	0.009
14	109.1 (12.8)	108.4 (13.6)	0.510
15	110.5 (12.1)	113.0 (14.1)	0.013
16	111.1 (12.6)	117.4 (12.7)	< 0.001
17	112.3 (11.5)	118.7 (10.7)	< 0.001
18	114.8 (11.3)	120.2 (12.5)	0.004
Diastolic Blood Pressure (DBP) (mmHg)	70.1 (10.2)	68.9 (11.1)	0.002
Age (yr)			
12	67.6 (11.0)	65.6 (10.6)	0.06
13	67.7 (10.5)	64.8 (11.0)	< 0.001
14	69.2 (10.2)	67.4 (11.3)	0.014
15	70.9 (10.0)	70.0 (10.8)	0.250
16	71.8 (9.4)	73.1 (9.4)	0.085
17	71.8 (8.9)	74.2 (9.6)	0.019
18	75.9 (9.0)	76.2 (8.8)	0.780
Pulse (beats/min)	80.1 (11.0)	77.9 (9.8)	< 0.001
Weight (Wt) (kg)	57.6 (13.9)	58.7 (15.2)	0.037
Height (Ht)(cm)	162.4 (7.6)	167.7 (10.5)	< 0.001
Body mass index (BMI) (kg/m^2)	21.8 (5.0)	20.6 (4.2)	< 0.001
Body fat (%)	29.9 (8.7)	16.3 (8.0)	< 0.001

Table 2: Systolic blood pressure by height tertile and age in males

Height group	Age (years)						
	12	13	14	15	16	17	18
Lowest tertile							
Mean (SD) (mmHg)	97.2 (9.2)	98.1 (11.0)	104.2 (13.4)	108.8 (13.8)	115.4 (12.40)	118.1 (10.8)	119.0 (15.0)
90th percentile	110	112	120	125	130	130	143
95th percentile	111	120	129	130	138	138	150
Middle tertile							
Mean (SD) (mmHg)	102.5 (12.4)	103.3 (11.5)	109.4 (12.9)	115.4 (14.2)	118.7 (12.6)	118.8 (11.9)	120.6 (10.1)
90th percentile	118	120	127	131	135	136	138
95th percentile	126	122	131	141	140	140	139
Highest tertile							
Mean (SD) (mmHg)	106.4 (11.9)	109.5 (14.1)	111.6 (13.6)	114.6 (13.3)	117.9 (12.7)	119.2 (9.5)	120.9 (12.5)
90th percentile	120	129	130	134	134	133	132
95th percentile	122	130	135	140	140	136	155
n	214	309	341	307	243	123	73

pressure with age (p-trend < 0.01). Similar analyses among females showed that the largest change in mean blood pressure occurred among female participants in the middle tertile (Tables 3, 5).

A comparison with National Institute of Health (Atlanta, USA) blood pressure data showed that Tobagonian children had significantly higher mean age and gender specific DBP ($p < 0.05$) than their American counterparts. Tobagonian males 12–14 years had significantly lower mean SBP ($p < 0.05$) while those 16 years old had significantly higher mean SBP ($p < 0.05$) than their American counterparts. In addition, Tobagonian females under the age of 14 years had significantly lower mean SBP ($p < 0.05$) while those 15 to 17 years old had significantly higher mean SBP ($p < 0.05$) than their American counterparts. Of participants, 6.1% (95% CI: 5.4, 7.0) and 8.2 % (95% CI: 7.4, 9.1) had SBP and DBP \$95th percentile of the US age-height-gender specific reference standards, respectively. In addition, Tobagonian male and female adolescents had significantly lower SBP and higher DBP blood pressure than their UK counterparts. Overall, Tobagonian adolescent males 12 to16 years were significantly taller (166 cm vs. 160cm; $p < 0.01$) and heavier (mean 57.2 kg *vs* 48.0 kg; $p < 0.01$) than their Jamaican counterparts. In addition, they had

Table 3: Systolic blood pressure by height tertile and age in females

Height group	**Age (years)**						
	12	**13**	**14**	**15**	**16**	**17**	**18**
Lowest tertile							
Mean (SD) (mmHg)	104.1 (14.1)	104.2 (14.0)	107.7 (13.7)	108.4 (12.0)	112.2 (13.5)	111.6 (9.8)	113.2 (12.7)
90th percentile	120	120	121	122	120	126	130
95th percentile	128	128	130	130	130	134	138
Middle tertile							
Mean (SD) (mmHg)	105.1 (13.5)	107.1 (13.2)	109.7 (12.0)	109.9 (11.3)	109.6 (11.0)	116.6 (9.8)	115.5 (9.8)
90th percentile	120	124	122	121	120	127	129
95th percentile	132	130	130	128	130	130	130
Highest tertile							
Mean (SD) (mmHg)	106.9 (13.1)	107.1 (13.5)	109.7 (12.7)	113.4 (12.5)	111.6 (13.2)	113.7 (11.7)	115.8 (11.6)
9th percentile	122	124	128	130	128	129	134
95th percentile	128	130	130	133	130	134	141
n	244	396	431	406	333	229	100

Table 4: Diastolic blood pressure by height tertile and age in males

Height group	**Age (years)**						
	12	**13**	**14**	**15**	**16**	**17**	**18**
Lowest tertile							
Mean (SD) (mmHg)	61.1 (9.0)	61.5 (10.0)	64.4 (11.1)	67.4 (11.0)	71.2 (9.5)	72.8 (11.3)	77.1 (9.6)
90th percentile	72	72	80	80	82	88	92
95th percentile	78	76	84	86	88	90	97
Middle tertile							
Mean (SD) (mmHg)	67.1 (11.1)	64.8 (10.3)	67.3 (11.0)	71.6 (11.5)	73.6 (8.0)	76.0 (9.7)	76.2 (9.2)
90th percentile	80	80	79	86	84	88	89
95th percentile	84	82	86	90	90	95	93
Highest tertile							
Mean (SD) (mmHg)	68.7 (10.2)	67.8 (11.7)	70.3 (11.1)	70.9 (9.6)	74.5 (9.9)	73.8 (7.8)	75.5 (7.6)
90th percentile	81	84	85	82	89	86	84
95th percentile	87	90	90	84	90	90	86
n	214	309	341	307	243	123	73

Table 5: Diastolic blood pressure by height tertile and age in females

Height group	Age (years)						
	12	13	14	15	16	17	18
Lowest tertile							
Mean (SD) (mmHg)	65.8 (11.7)	65.9 (10.1)	68.4 (10.3)	71.5 (10.4)	71.9 (9.9)	71.7 (9.2)	72.8 (8.9)
90th percentile	78	80	80	82	84	82	90
95th percentile	84	88	84	88	90	90	93
Middle tertile							
Mean (SD) (mmHg)	67.4 (9.6)	68.2 (10.5)	69.7 (11.1)	69.3 (9.6)	72.8 (8.6)	71.2 (9.8)	76.9 (8.9)
90th percentile	80	80	82	83	84	81	90
95th percentile	84	84	90	87	90	85	93
Highest tertile							
Mean (SD) (mmHg)	69.3 (11.3)	68.5 (10.4)	69.6 (9.0)	72.4 (9.8)	70.8 (9.7)	72.4 (8.0)	77.8 (9.5)
90th percentile	84	82	80	84	84	82	90
95th percentile	88	87	86	89	86	85	95
n	244	396	431	406	333	229	100

significantly higher mean DBP (69.5 mmHg *vs* 57.4 mmHg; $p < 0.01$) but not mean SBP (109.0 mmHg *vs* 109.9 mmHg). Similarly, Tobagonian adolescent females 12 to16 years were taller (169.9 cm *vs* 162.1 cm; $p < 0.05$) and heavier (56.0 kg *vs* 50.1 kg; $p < 0.01$) than their Jamaican counterparts. In addition, they had significantly higher mean DBP (69.5mmHg *vs* 57.4 mmHg; $p < 0.01$) but not higher mean SBP (108.6 mmHg *vs* 108.4 mmHg). Thirty-seven per cent of participants reported a positive family history of hypertension (*ie* having parents or grandparents who had been diagnosed with hypertension).

In this sample, systolic and diastolic blood pressure readings were significantly positively associated with weight and height; however, the associations were stronger for weight than for height (weight; $r = 0.44$ *vs* height; $r = 0.29$ for SBP: weight; $r = 0.30$ *vs* height; $r = 0.21$ for DBP). In addition, age, BMI, percentage BF and a positive family history of high blood pressure were significantly positively associated with both SBP and DBP. In partial correlation analyses controlling for age and height, weight was significantly positively associated with both systolic and diastolic blood pressure. In similar analyses, controlling for weight and age, height was significantly associated with both systolic and diastolic blood pressure in males. However, no significant associations were found in females. The results of regression analyses suggest that age and BMI explained 14.6% of the variance in SBP in females and 26.7% of the SBP variance in males. Similarly, age and BMI explained 8.0% of the variance in DBP in females and 13.2% of the DBP variance in males. BMI $ 25 was associated with both elevated SBP (odds ratio (OR) = 5.22, 95% confidence intervals (CI): 3.96, 6.88: $p < 0.0001$) and DBP (OR = 2.63, 95% CI: 2.03, 3.41: $p < 0.0001$).

DISCUSSION

The purpose of this study was to develop and compare reference standards and correlates of blood pressure in the Tobagonian adolescent school population. The use of the US reference level as the cut-off for elevated systolic and diastolic blood pressure produced estimates that were higher than the expected 5% prevalence of high blood pressure among children of similar ages from the USA. In fact, the prevalence of elevated diastolic blood pressure in the Tobago study population was almost twice that expected using cut-off based on the US reference levels. These findings reflect the higher levels of DBP among Tobagonian adolescents than among their American counterparts. Given the importance of growth and maturational factors on blood pressure during adolescence, the results suggest that the impact of these anthropometric and maturational changes on blood pressure levels might vary for different populations (26, 27). The importance of weight in the determination of blood pressure levels among Tobagonian adolescents (especially females) should not be underestimated. The results suggest that Tobagonian adolescents tend to be heavier that their counterparts from the USA, UK and Jamaica. This might explain the tendency for higher levels of DBP seen in Tobagonian adolescents. This association of weight with blood pressure has been described in Tobagonian adults and might explain the higher prevalence of hypertension in Tobago (1). Alternatively, the findings might be due partially to the various methods of measurement used across the various studies (28).

The findings of differences in blood pressure by age and gender have been described in other populations of African origin and might be attributed to the rapid changes in body composition and other maturational factors that usually

accompany the adolescent growth spurt (29–31). The occurrence of age inversion of blood pressure (especially SBP) between males and females is consistent with that seen in the UK and Jamaican adolescent populations (17, 18). This might be due to the fact that the timing of puberty and its concomitant changes in growth and body composition occur at an earlier age in females than males. In the study sample, the inversion mimics changes in weight with males catching up to females by age 15 years and having significantly higher weight thereafter. The fact that males in all age groups had significantly lower body fat than their female counterparts, coupled with the average lower percentage body fat in males older than 12 years, suggests that the higher blood pressure in males might be linked to maturational effects associated with lean body mass (7, 32, 33). In addition, blood pressure percentile curves suggest that, among males, variables associated with pubertal changes at these ages might have a greater impact on blood pressure variability than among females of a comparable age. This is further supported by the finding that males had higher one-year increment in blood pressure than their female counterparts.

The findings of the present study showed that overweight was the strongest predictor of elevated blood pressure in this population and reiterates the central role of obesity as a major contributor to elevated blood pressure in children (34, 35). It also brings into question whether elevated blood pressure in this population is a disease or a consequence of excess adiposity. A positive association between family history and elevated systolic blood pressure is consistent with other studies and suggest the need to continue interventions that target persons with a positive family history of hypertension (36, 37). The results of this study, suggesting that a third of participants had a family history of high blood pressure (*ie* sibling, parent, grandparent being diagnosed with and/or taking treatment for hypertension) are consistent with the estimated prevalence of the disease among adult Tobagonians (2).

This study has several limitations. The cross-sectional nature of the study prevented the establishment of a temporal cause effect sequence among variables of interest and blood pressure levels (38). Neither did the study take into account other factors that might influence blood pressure levels in this population such as salt intake, urinary sodium excretion, maturation, physical activity and nutrient intakes (7, 39, 40). The small non-response rates might have introduced significant bias in the estimation of age-related blood pressure levels and anthropometry as well as other variables derived from these measures, especially among males who comprised over 80% of the non-responders based on school records. The non-random procedure for recruiting participants might have resulted in bias in the level of physiological and anthropometric estimates as well as the prevalence of elevated BP and overweight. Finally, cut-off values for elevated blood pressure are based on data for the new height percentile and blood pressure data from the National Health and Nutrition Examination Survey (NHANES) 1999 to 2000 as well as data from the 1987 Task Force Report on High Blood Pressure in Children and Adolescents (12, 13). Given the strong effects of growth and maturational effects on blood pressure during adolescence and the increasing prevalence of obesity in the referent population, this use of mixed data spanning some two decades can lead to errors in the estimation of the prevalence of elevated blood pressure based on recommended cut-off values.

To summarize, this report presents estimates of normative blood pressure for Tobagonian adolescents 12–18 years old and compared these with those established for adolescents in the USA, the UK and Jamaica. The differences observed, especially for diastolic blood pressure, has immediate implication for the use of any of these as reference standard. Given the burden hypertension places on the health system in Tobago, it is imperative that researchers develop suitable blood pressure normative reference data that could be used to screen children at high risk of developing hypertension in adulthood.

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