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The Relationship Between Height Components and Bi-iliac/Bi-acromial Index with Blood Pressure Among Chakma Tribal Children of Tripura Aged 6-16 Years

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Abstract: Blood pressure in pre-pubertal and pubertal age group is now an alarming situation to health professionals worldwide. Little knowledge is still with us about how different body composition parameters correlate with blood pressure. Blood pressure (BP) correlates with various factors like weight, height, sitting height (SH) among children and adolescents in developed countries with upper-middle socio-economic society. Intention of present research work is to contrast sitting height, relative sitting height ratio (Cormic Index), biiliocristal to biacromial ratio and BMI of rural Chakma boys and girls between the age 6-16 years of Tripura, North-eastern State, with the National Health and Nutrition Examination Survey III (NHANESIII) reference data to conclude the correlation among sitting height, relative sitting height ratio, biiliocristal-biacromial ratio and BMI with BP among Chakma children of lower socio-economic group of Tripura. A total of 1350 children (676 boys and 674 girls) of 12 government schools from Chakma community aged 6-16 years were selected by stratified cluster random sampling method of North and Dhalai district of Tripura, undergo blood pressure and anthropometric measurements using standard techniques. Multiple regression is applied for establishing the relationship between height, sitting height, relative sitting height ratio, biiliocristal-biacromial ratio and BMI with Systolic blood pressure (SBP) and Diastolic blood presure (DBP) among these children. In comparison with NHANES III reference data, Chakma children aged 6 to 16 years showed lower mean sitting height value. In the multiple regression analysis, sitting height is positively associated with systolic BP (β=0.893; 95% Ci=0.964-0.966) and diastolic BP (β=0.505; 95% Ci=0.935-0.938) in both the sexes. The results of present research work is statistically significant for both sitting height and cormic index with systolic BP (β=0.650; 95% Ci=0.963-0.970 and β=0.103; 95% Ci=0.963-0.970 respectively), whereas only sitting height remains significant with diastolic BP (β=3.519; 95% Ci=0.934-0.946) after being adjusted for age, gender and BMI among Chakma children. The present findings recommended a must large population based research work after being adjusted for factors like dietary habits, athletic performance, salt intake, socio-economic status etc. for accurate estimation of predominance of hypertension among North-eastern children and adolescents. Significant positive association was found between systolic and diastolic blood pressure together with the height, sitting height, relative sitting height ratio among studied population.

Keywords: Chakma Tribes, Sitting Height, Cormic Index, Biiliocristal, Biacromial, Blood Pressure, Tripura

1. Background

The commencement of physiological growth and progression throughout pubescence is signifying by the inception of pubescence, that is routinely outlined because the physiological alteration of a toddler into adult one. Human physical growth may be spirited fixing progression and is being prejudiced by heredity and environment. Genetic factors so play within the earmarked growth patterns in numerous races, tribes and ethnic groups [1]. A mess of biological changes occur throughout pubescence together with sexual satiety, which will increases in height, Cormic Index (CI), bone length, weight, muscle density associated by noticeable enhancement in body shape and composition. The pursuance of those events throughout pubescence is coherent among adolescent, however, there is also an excellent degree of deviation within the longevity of inception, confinement and rhythm of those events among the individuals. Therefore, adolescents with the same sequential age will vary significantly in physical appearance, which leads undeviating importance in nutrition requirements for children and adolescents. At 13 years of age boys were completed their linear growth spurt related to pubescence and practiced important development in musculature can have remarkably totally different in nutrition and energy requirements than those 13 years old boys who nonetheless practiced pubescence [2, 3].

The present study thus designed to estimate and understand the racial differences between the Chakma boys and girls of the North and Dhalai district of Tripura with regard to body composition and shape and to evaluate how Standing Height (Ht), Sitting Height (SH), Cormic Index (CI: Sitting height to Height Ratio), Biiliocristal breadth, Biacromial breadth etc. inter relate with blood pressure (Systolic and Diastolic). The Cormic Index that is Sitting height to Stature quantitative relation is that the most typical bi-variate exponent of body shape and composition, which is measured by relative length of trunk and lower limb that alters between team, class, individuals and groups [4]. Racial, tribe or ethnic variation within the mean Cormic index is found in different population, which has been applied as a potent means to discuss body shape in various populations populations, viz. Australian aborigines, Nilotic Africans [5]; for the Indo-Mediterranean, European population, it's regarding 52% (0.52). Africans have proportionately longer legs generally with Cormic Index worth around 51% (0.51). Eastern populations with Asians have proportionately short legs with cormic index of 53-54% [6]. Aborigines of Australians who have relatively long leg exhibit low value in Cormic Index of 40-55%) [7]. In Indian context, Chhattisgarh tribal males aged 5 to 14 years and West Bengal Bengali boys aged 6 to 12 years the mean CI was found 49.75 and 38.73 respectively [8, 9].

Studies reflected that rapid increase in growth of the lower limbs is the sign of the early stage of adolescent growth spurt in height, whereas physical growth within the sitting height is another component of standing height happens later.

Subsequently, growth in leg length terminates before growth in sitting height that continues up to late adolescence [10, 11]. Cormic Index increased in late adolescence period due to disproportionate growth of the trunk occurs in adolescent growth spurt [12-14].

High blood pressure (BP) may be chief community strength, any complication cause mortality and morbidity in each advanced and developing states [15, 16]. Obtainable literature showed that constant increase in BP in children is related to the high risk of heart diseases in desert African adults [17, 18]. Moreover, a close relation was found between growth proportions in children with occurrence of risk factors in Cardio Vascular Disease (CVD). Studies on children of Brazil showed an association on sitting height and relative sitting height ratio with blood pressure. Work of Dong and his co-workers (2016) on Chinese population also exhibited that sitting height is related to blood pressure [19]. Some recent studies reported a significant relevance between sitting height with both systolic and diastolic blood pressure in rural children and children from upper-middle socioeconomic group of South Africa [20-22] and America [23]. The main objective of this study is to compare sitting height and relative sitting height ratio of Chakma tribal children aged 6-16 years of different Govt. Schools with reference population of NHANES III survey [24]. Some growth related study was reported in tribe and non-tribe population of Tripura [25, 26], however there's lack of data concerning relation of BP with body shape and composition in different Indian population [27-31]. Our present research was configuring to see the relationship between sitting height, relative sitting height ratio and biiliocristal-biacromial ratio with blood pressure among Chakma children studying in different Govt. schools of North and Dhalai district of Tripura.

2. Methods

2.1. Study Population and Ethical Approval

A total of 1350 Chakma tribal children (676 boys and 674 girls) aged 6-16 years were selected from 12 Govt. Schools by stratified cluster sampling method of North and Dhalai district of Tripura. Generally, children attending different Govt. Schools of Tripura from afore mentioned district, fall inside the lower socio-economic groups of the population. Children who were present at the schools throughout the times of the survey participated in the study. Written consent was obtained from parents or guardians, School authorities.

2.2. Anthropometric Measurements

Using standard procedures stature (standing heights) was measured to the nearest 0.1cm through an anthropometer (GPM Swiss made). Students were asked standing barefoot, erect and head controlled in Frankfurt horizontal plane. Sitting height was measured once sitting with their head at eye–ear plane on a regular laboratory stool of an identified height placed against the anthropometer. Simply before

taking the measurement, subjects were asked to require a deep breath and hold it. The head portion was lowered to the uppermost point of the head, ensuring that the hair is totally compressed. In measuring sitting height (SH); subjects were asked to sit down on a bench of a identified height. The intra-observer and inter-observer variations were calculated for testing the co-efficient of dependableness (R) of the collected anthropometric measurements using the technical error measurement {TEM=$\sqrt{(\Sigma D^2/2N)}$, D=difference between the measurements, N=number of individuals measured} [32]. Body weight was taken to the nearest 0.1kg using the convenient weighing machine (Libra), students were taught to wear minimum artifact before taking all activity. Body mass index (BMI) was calculated as – weight (kg) / height (m)^2. Cormic index has been outlined as the ratio of the sitting height to the full body length and as a measure of body shape; that is calculated as Sitting height / Stature x 100.

As the stature and body weight show diurnal variation [33, 34], which suggests the variation of a measurement throughout the course of the day, all of the measurements were taken between 9.00 a.m. and 04.00 p.m.

2.3. Blood Pressure

Using an Digital Sphygmomanometer (OMRON, Model-HEM-7111), a minimum of 3 BP readings of systolic and diastolic BP were taken at 5 min intervals once participants had been sitting quietly for at least 10 min or longer. The bladder device contains an electronic unhearable electrical device that monitors the BP and pulse, displaying those concurrently on the screen. In this pilot study, conducted before the survey, a high correlation (r=0.86) was found between the readings enamored with the automated device and those taken with a conventional Sphygmomanometer.

2.4. Statistical Analysis

Descriptive statistics were performed for height, SH, CI and BP with the Chakma boys and girls of the North and Dhalai Tripura aged 6–16years. Student's t-test was applied

to check the significant difference between the genders. SH and SH/H% of Chakma children were compared with NHANES III reference population [35]. The multiple regression models were accustomed analyze the relationship between BP (Systolic Blood Pressure and Diastolic Blood Pressure) and components of height (height, SH and CI) and were unadjusted and adjusted regarding to age, gender and BMI. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 18. The statistical significance was set at P<0.05. The technical error of measurement (TEM) was calculated and the results were found to be within the reference value as cited by Lohman et al. (1988) [36]. Therefore, TEM wasn't incorporated within the statistical analysis.

3. Results

Table 1 represents descriptive statistics for weight, standing height, sitting height (SH), Cormic Index (SH/H%) and BI/BA% between Chakma tribal children aged 6–16 years from different Govt. Schools of North and Dhalai Tripura. At age 13-16 years, there is a significant difference was found among boys and girls in their weight, similarly significant differences were noticed in their mean height at ages 12-16 years. Though mean SH in girls is higher than the boys at age 11 years, but boys were significantly (P<0.05) higher than girls at ages 14-16 years. Overall boy's mean weight (35.09), mean height (141.5), mean SH (75.9) was found significantly higher than girl's mean weight (34.22), mean height (138.9) and mean SH (75.2). The mean BI/BA% was found significantly (P<0.05) higher in Chakma girls (74.8-76.5) than Chakma boys (70.3-72.8) at ages 8-16 years. Mean BI/BA% of Chakma girls (74.56) were found significantly higher than boys (71.9). SH of both Chakma boys and girls increased proportionally with the advancement of age (Figure 1). Figure 1 also showed comparative physical growth pattern of Chakma boys and girls with the NHANES-III boys and girls [24] in respect of SH.

Table 1. Statistical constant of Standing height, Sitting height, CI, BI/BA% of Chakma tribal children of Tripura aged 6-16 years.

Age (in years)	Nos of Students		Weight (Kg)		Height (cm)	
	Boys	Girls	Boys Mean (SD)	Girls Mean (SD)	Boys Mean (SD)	Girls Mean (SD)
6	59	59	20.2	19.8	118.1	117.6
7	58	58	22.6	22.6	123.0	123.0
8	62	62	24.7	24.4	127.6	127.5
9	56	55	26.7	26.4	132.2	131.7
10	61	58	29.6	29.3	134.2	133.4
11	66	63	32.4*	33.6*	139.0	138.0
12	61	59	36.7	36.3	145.4*	142.9*
13	62	67	41.1*	39.5	151.2*	147.8*
14	62	65	46.4*	44.8	158.1*	153.2*
15	63	61	51.6*	49.1*	162.4*	156.6*
16	66	67	54.0	50.6*	165.3*	157.1*

Table 1. *Continued.*

Age (in years)	Sitting Height (cm)		Cormic Index (CI)		BI/BA%	
	Boys Mean (SD)	Girls Mean (SD)	Boys Mean (SD)	Girls Mean (SD)	Boys Mean (SD)	Girls Mean (SD)
6	63.8	63.7	54.0	54.2	74.3	74.5
7	66.7	66.6	54.2	54.2	75.4	75.5
8	68.6	68.2	53.8	53.5	72.8*	74.8*
9	70.5	70.2	53.3	53.3	71.5*	74.4*
10	71.6	71.8	53.4	53.8	70.9*	73.2*
11	73.8*	74.6*	53.1	54.1	70.5*	73.6*
12	78.2*	77.3*	53.8	54.1	70.3*	73.9*
13	81.1*	80.8*	53.6*	54.7*	71.6*	74.3*
14	85.3*	83.1*	54.0*	54.2*	71.9*	74.0*
15	87.3*	85.3*	53.7*	54.5*	70.5*	75.5*
16	87.8*	85.5*	53.1*	54.4*	71.2*	76.5*

* Significant at P<0.05; SD–Standard Deviation, CI–Cormic Index, BI/BA% - Biiliocristal to Biacromial ratio.

Table 2 reflects that, at ages 10-14 years Chakma girl's mean systolic blood pressure (103.58-113.91) were higher (P<0.05) than Chakma boy's mean systolic blood pressure (102.94-112.41), but at age 8, 9 and 18 years systolic BP of Chakma boys were found significantly higher than systolic blood pressure (SBP) of Chakma girls. Similarly, diastolic blood pressure (DBP) of girls (71.12-72.99) was also found significantly higher than the Chakma boys (69.59-71.89) at ages 12-14 years. Table 2 also reflects BP percentile and comparison between boys and girls of age 6-16 years. SBP and DBP both were observed to be gradually increasing with age advancement (Figure 2). The prevalence of hypertension was found 9.02% in Chakma boys and 8.3% in Chakma girls, whereas 2.8% Chakma boys and 2.5% Chakma girls were found hypertensive (Table 2). Post-pubertal aged children were found maximum percentage of pre-hypertensive and hypertensive. Among 80 Chakma boys combining pre-hypertension and hypertension 21 (26.25%) and among 73 Chakma girls 18 (24.66%) had a family history of hypertension. Figure 2 also showed comparative aspects of SBP and DBP of Chakma boys and girls with the NIH reference data.

Table 2. *Descriptive statistics for BMI, SBP and DBP of Chakma boys and girls of Tripura aged 6-16 years and prevalence of hypertension among them.*

Age (in years)	Body Mass Index (BMI)		Systolic BP		Diastolic BP	
	Boys Mean (SD)	Girls Mean (SD)	Boys Mean (SD)	Girls Mean (SD)	Boys Mean (SD)	Girls Mean (SD)
6	14.43	14.27	95.39 (3.69)	95.24 (2.35)	63.17* (3.07)	61.31* (2.47)
7	14.91	14.87	97.62 (5.98)	97.21 (2.44)	63.69 (4.69)	63.01 (2.17)
8	15.10	14.98	99.91* (6.36)	98.42* (4.31)	64.85* (4.43)	63.24* (3.05)
9	15.23	15.14	102.12* (6.18)	101.00* (4.48)	66.92 (4.63)	66.22 (3.2)
10	16.37	16.41	102.94* (4.69)	103.58 (4.93)	67.95 (3.60)	67.94 (4.25)
11	16.71*	17.53*	104.52* (5.26)	107.05* (8.13)	68.81 (3.69)	69.55 (5.14)
12	17.27	17.68	105.46* (5.77)	109.23* (7.7)	69.59* (3.59)	71.12* (5.45)
13	17.96	18.01	108.52* (5.8)	112.19* (9.95)	70.11* (3.39)	72.03* (7.15)
14	18.54*	19.04*	112.41 (7.63)	113.91 (7.21)	71.89* (4.73)	72.99* (4.5)
15	19.53	20.03	115.08 (6.9)	115.28 (10.58)	73.49 (5.02)	73.52 (7.56)
16	19.77*	20.44*	118.13* (8.36)	115.68* (8.2)	74.95 (5.44)	74.14 (6.73)

Table 2. *Continued.*

Age (in years)	BP Percentile (<90th)		BP Percentile (≥90th to <95th)		BP Percentile (≥95th)	
	Normal		Pre-hypertensive		Hypertensive	
	Boys No.(%)	Girls No.(%)	Boys No.(%)	Girls No.(%)	Boys No.(%)	Girls No.(%)
6	59 (100)	59 (100)¥	0	0	0	0
7	52 (89.65)	58 (100)	4 (6.9)	0	2 (3.45)	0
8	55 (88.7)	58 (93.55)	5 (8.07)	4 (6.45)	2 (3.23)	0
9	49 (87.5)	52 (94.5)	4 (7.14)	3 (5.45)	3 (5.36)	0
10	58 (95)	56 (96.56)	2 (3.3)	2 (3.44)	1 (1.6)	0
11	59 (89.4)	56 (88.9)	6 (9.1)	6 (9.5)	1 (1.5)	1 (1.6)
12	55 (90.2)	52 (88.1)	5 (8.2)	5 (8.5)	1 (1.6)	2 (3.4)
13	57 (91.9)	55 (82.1)	4 (6.5)	8 (11.93)	1 (1.6)	4 (5.97)
14	50 (80.65)	56 (86.16)	10 (16.12)	6 (9.24)	2 (3.23)	3 (4.6)
15	52 (82.53)	47 (77.05)	9 (14.3)	10 (16.4)	2 (3.17)	4 (5.55)
16	50 (75.8)	52 (77.6)	12 (18.2)	12 (17.9)	4 (6)	3 (4.5)

* Significant at P<0.05;
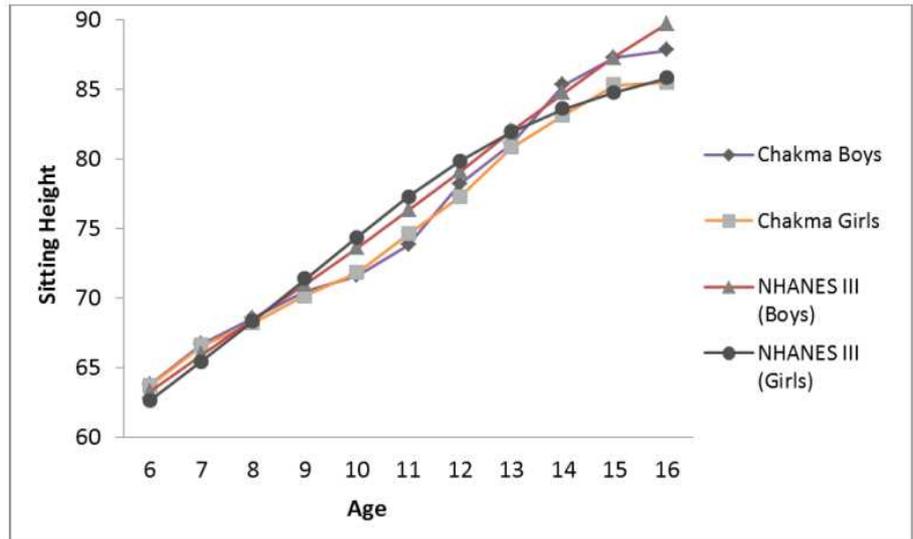¥ Percentage values are mention in parentheses.

Figure 1. *The comparison of Sitting height of Chakma tribal children with NHANES III reference data.*
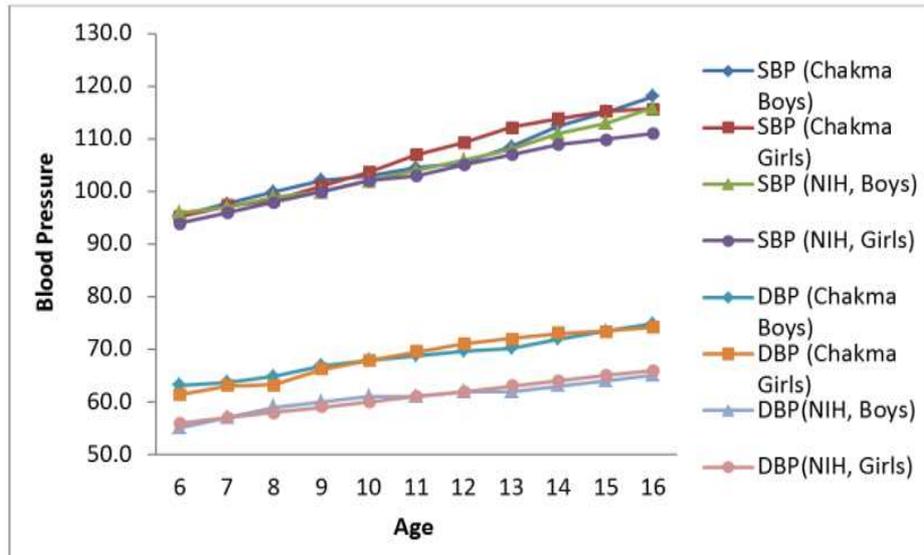

Figure 2. *The comparison of Systolic BP and Diastolic BP of Chakma tribal children with NIH reference data.*
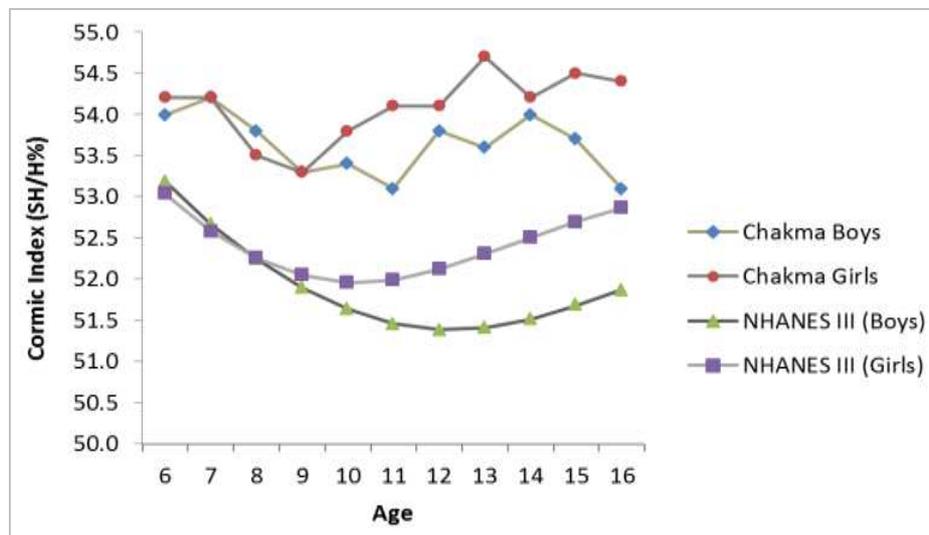

Figure 3. *A comparison between Relative sitting height ratio (CI) of Chakma tribal children with NHANES III reference data.*

Figure 3 represents the comparison among mean values of Cormic Index (CI) of Chakma boys and girls in different Govt. Schools of North and Dhalai Tripura with the NHANES III children aged 6–16 years. Chakma boy's exhibit higher mean values in comparison to NHANES III boys of ages 7-9, 14 and 16 years, whereas Chakma girls showed higher mean values compared to NHANES III girls of ages 6, 7 and 15 years. Figure 3 showed decreasing trends in Cormic Index with age, except 12-14 years for Chakma boys and 12-16 years for Chakma girls and also showed the comparison with NHANES III reference data. Mean Cormic Index values of Chakma boys and girls were higher than in compared with NHANES III children for both sex.

Table 3 and 4 represents multiple regressions co-efficient for the association between standing height, sitting height, cormic index, biiliocristal-biacromial ratio (BI/BA%) with systolic and diastolic blood pressure in Chakma boys and girls of North and Dhalai district of Tripura, attending in different Govt. Schools, adjusted and unadjusted value for age, sex and BMI. A significant association (P<0.001) was found between height with systolic BP (β=0.481; 95% Ci=0.951-0.954) and with diastolic BP (β=0.275; 95% Ci=0.940-0.943), sitting height with systolic BP (β=0.893; 95% Ci=0.964-0.966) and with diastolic BP (β=0.505; 95% Ci=0.935-0.938) for unadjusted. Relative sitting height ratio (Cormic Index) and BI/BA% for Chakma boys and girls separately showed significant association with systolic BP (table 3) in unadjusted. After adjustment for age, sex and BMI, significant association was found with systolic BP for SH (β=0.650; 95% Ci=0.963-0.970) and for CI (SH/H%) (β=0.103; 95% Ci=0.963-0.970), whereas only SH showed significant association with DBP after being adjusted (β=3.519; 95% Ci=0.934-0.946). Chakma boys and girls separately showed significant association with DBP after adjusted (table 4).

Table 3. Multiple Regression Co-efficient (β), P-value and 95% confidence intervals for the association between Standing height, Sitting height, Cormic Index, BI/BA% and SBP of Chakma boys and girls of Tripura.

Variable	Group	Nos. of Students	Unadjusted							Adjusted for age, gender and BMI						
			β	SE	R	R²	Adj. R²	t	p-value	β	SE	R	R²	Adj. R²	t	p-value
Height (cm)	All	1350	0.481	0.024	0.977	0.954	0.951	20.307	*	0.143	2.378	0.985	0.970	0.963	0.060	0.953
	Boys	676	0.709	0.033	0.990	0.979	0.977	21.733	*	1.479	0.280	1.000	1.000	0.999	5.278	*
	Girls	674	0.744	0.021	0.996	0.992	0.991	35.376	*	0.351	0.186	1.000	1.000	1.000	1.883	0.102
Sitting Height (cm)	All	1350	0.893	0.038	0.983	0.966	0.964	23.778	*	0.650	4.400	0.985	0.970	0.963	0.148	*
	Boys	676	1.324	0.060	0.990	0.980	0.978	22.044	*	-1.892	0.526	1.000	1.000	0.999	-3.600	*
	Girls	674	1.368	0.044	0.995	0.990	0.989	31.365	*	0.328	0.330	1.000	1.000	1.000	0.995	0.353
CI (SH/H%)	All	1350	2.224	0.558	0.138	0.019	0.030	0.625	0.539	0.103	6.148	0.985	0.970	0.963	0.000	*
	Boys	676	1.965	0.147	0.973	0.947	0.942	13.376	*	-0.070	0.384	1.000	1.000	0.999	-0.181	0.861
	Girls	674	1.970	0.137	0.977	0.954	0.949	14.334	*	1.592	0.226	1.000	1.000	1.000	7.030	*
BI/BA%	All	1350	-0.702	0.839	0.184	0.034	-0.015	-0.836	0.413	0.318	0.249	0.985	0.970	0.963	1.278	0.218
	Boys	676	1.445	0.129	0.962	0.926	0.918	11.173	*	0.608	0.259	1.000	1.000	0.999	2.351	0.051
	Girls	674	1.425	0.104	0.974	0.949	0.944	13.672	*	-0.715	0.165	1.000	1.000	1.000	-4.331	*

* Significant at P<0.001

Table 4. Multiple Regression Co-efficient (β), P-value and 95% confidence intervals for the association between Standing height, Sitting height, Cormic Index, BI/BA% and DBP of Chakma boys and girls of Tripura.

Variable	Group	Nos. of Stuents	Unadjusted							Adjusted for age, gender and BMI						
			β	SE	R	R²	Adj. R²	t	p-value	β	SE	R	R²	Adj. R²	t	p-value
Height (cm)	All	1350	0.275	0.015	0.971	0.943	0.940	18.127	*	-1.624	1.826	0.973	0.946	0.934	-0.889	0.386
	Boys	676	0.235	0.013	0.986	0.973	0.970	17.927	*	1.006	0.146	1.000	1.000	1.000	6.890	*
	Girls	674	0.331	0.022	0.980	0.960	0.956	14.710	*	0.682	0.285	1.000	0.999	0.999	2.390	0.048
Sitting Height (cm)	All	1350	0.505	0.029	0.968	0.938	0.935	17.360	*	3.519	3.380	0.973	0.946	0.934	1.041	*
	Boys	676	0.442	0.032	0.977	0.954	0.949	13.668	*	-1.467	0.274	1.000	1.000	1.000	-5.358	*
	Girls	674	0.583	0.041	0.979	0.958	0.953	14.332	*	-0.639	0.505	1.000	0.999	0.999	-1.265	0.246
SH/H%	All	1350	0.235	2.062	0.025	0.001	-0.049	0.114	0.911	-5.040	4.722	0.973	0.946	0.934	-1.067	0.301
	Boys	676	-4.721	3.080	0.455	0.207	0.119	-1.533	0.160	0.873	0.200	1.000	1.000	1.000	4.365	*
	Girls	674	5.877	3.132	0.530	0.281	0.201	1.876	0.093	1.432	0.347	1.000	0.999	0.999	4.133	*
BI/BA%	All	1350	-0.620	0.470	0.283	0.080	0.034	-1.319	0.202	0.018	0.191	0.973	0.946	0.934	0.095	0.925
	Boys	676	-1.697	0.541	0.723	0.522	0.469	-3.135	*	-0.129	0.135	1.000	1.000	1.000	-0.955	0.372
	Girls	674	0.502	1.592	0.104	0.011	-0.099	0.315	0.760	-0.745	0.253	1.000	0.999	0.999	-2.949	0.021

* Significant at P<0.001

4. Discussion

For worldwide public health dilemma, primary hypertension in children was thought of irregularity and has emerged as a sober topic. The pervasiveness of hypertension in children is high in India [37] compared to developed

countries just like the USA, China, European countries where the prevalence of eminent BP was found to be 2.7%–3.7% in various population primarily based surveys [38-40, 41]. Similarly, the prevalence of childhood hypertension has diverse between different populations within India [42-46]. Present cross-sectional study delineated the relevance between Sitting Height (SH), Cormic Index (CI), BI/BA% and blood pressure (systolic and diastolic) among tribal children (age 6 to 16 years) attending different Govt. Schools of North and Dhalai Tripura. Sitting height and Cormic index showed a significant association with systolic and diastolic BP within the unadjusted result. Stature will increase with age, wherever CI decreases and vice versa. However, once being adjusted for age, sex and BMI, only sitting height was significantly associated with both systolic and diastolic BP. With age advancement mean value of sitting height increases but mean value of Cormic Index (Relative sitting height ratio) decreases in the current study. The present study reveals increase value of height with age and is especially because of a rise in lower trunk instead of in upper limb or sitting height [47-50]. However, tribal girls of different Govt. Schools of North and Dhalai Tripura showed higher sitting height value than the boys at age 10 and 11 years, but boys are significantly (P<0.05) higher than the girls at ages 14-16 years of similar schools. This might results rapid growth velocity of Chakma girls compared thereupon of boys among 10 and 13 years of age [51]. Moreover, as age progresses, an increase in mean sitting height and decreases in mean Cormic Index was observed for NHANES III boys and girls. The sitting height and Cormic index values of Chakma children from 12 different Govt. Schools of North and Dhalai Tripura are found lower than NHANES III children (Figures 2 & 3). In Chakma children, at their pre-pubertal ages growth occurred more in lower trunk than their upper trunk, this may due to Govt. School attending children were from lower socio-economic background as compared to NHANES III children, who were from developed countries like USA. Results of our present work showed positive association of sitting height with Systolic and diastolic BP for both adjusted and unadjusted for age, sex and BMI among North and Dhalai district Govt. School attending children. Higher BMI values in Chakma girls than boys from ages 10 years additionally showed higher SBP and DBP. Similar observations were found among Brazilian [52], Chinese [19], rural South African [20] and Indian [45, 46] population. Potential rationalization of this result might be that blood pressure at the level of heart must improve on the hydrostatic pressure elicited by the perpendicular distance between the head and the heart, to make sure an ample perfusion of a children's brain [39]. Supported an outsized sample during this work, the detection of a significant relation of blood pressure with height components was observed in Chakma boys and girls of these two district of Tripura. Height components are simple; they use as a reasonable tools which may be used as a symbol of increased blood pressure in children [20, 39]. Moreover, blood pressure and height components are more valuable, because of their availability

and they are effortlessly implicit by the illiterate and literate population, notably in rural areas of Tripura, North-eastern India. The present study doesn't suppose thoroughgoing info like socio-economic and demographic status, biological process and nutritional condition of their families, food intake, physical exercise and case history of increased blood pressure in their family. Anthropometric variables and blood pressure were measured once correct thought from the authority; hence, recall or biasness on estimation won't triumph in present research work. Moreover, measuring blood pressure at early age, suggested that early observance ought to start from their early days for identification and screening persons that show susceptibility to related risk factors [41].

5. Conclusion

In this pilot work, Chakma children of North and Dhalai Tripura District, Sitting height and Cormic Index (Relative sitting height ratio) were compared low at pre-pubertal ages from the NHANES III reference data. A significant association was observed between sitting height with Systolic and Diastolic blood pressure, when adjusted and unadjusted for age, sex and BMI among the Chakma tribal children of 6-16 years age attending in different Govt. schools. Additionally sitting height and Cormic Index (SH/H%) are often applied as a indicator of high blood pressure (hypertension) among participated children. Additional interrogation with large sample size is recommended for the investigation of interrelationship between various components of standing height and biiliocristal to biacromial ratio (BI/BA%) with blood pressure (BP) in these two district of Tripura overtime, so as to shed a lot of light-weight on unwellness advancement and therefore the conditions thence.

Abbreviations

BP: Blood Pressure; *BMI:* Body Mass Index; *SBP:* Systolic Blood Pressure; *DBP:* Diastolic Blood Pressure; *NHANES III:* National Health and Nutrition Examination Survey III; *SH:* Sitting Height; *CI (SH/H%):* Cormic Index (Relative sitting height ratio); *BI:* Bi-iliocristal; *BA:* Bi-acromial; *BI/BA%:* Bi-iliocristal to Biacromial ratio; *Ci:* Confidence interval.

Availability of Anthropometric Data

Due to privacy limitations allied for ethical endorsement of this research work, participant without identifying information may be unconstrained. As grantee, the authors were permitted to publish only results after data analysis, but not to disclose raw data for their secrecy.

Authors' Contributions

First author was involved in study design, collection of data, statistical analysis and their interpretation, manuscript

drafting and its revision for significant content. Second author helps by interpreting data and drafting manuscripts and correction for valuable intellectual and administrative content. Third author extended her help by data analysis, interpretation and correction for significant content. Revised manuscript approved by all of the three authors.

Ethics Approval and Consent to Participate

The Ethical Committee of Azteca University, Department of Health Science sanctioned ethical approval before data collection and the student's guardians were also provided their written consent.

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