Original Article

Derivation of Simplified Blood Pressure Percentile Chart for Children Aged 1-13 Years in Southern India: A Cross-sectional Study

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ABSTRACT

Introduction: Systemic arterial hypertension is an important cause of adverse cardiovascular events with high morbidity and mortality in adults. Blood Pressure (BP) percentile chart from outside India varies significantly in comparison with Indian charts. Percentile distribution charts have already been developed for adults in various studies but its use is limited in paediatric age group.

Aim: To measure blood pressure values of children aged between 1-13 years and derive percentile charts for each age group.

Materials and Methods: A cross-sectional study was conducted at SRM Medical College and Research Centre in Kattankalathur, Tamil Nadu, India. Duration of the study was six months from July to December 2021. After Registration of an Institutional Review Board (IRB) approval, 1230 children were recruited and BP was measured using oscillometric method. Blood pressure values were represented as mean with standard deviations. Univariate analyses between blood pressure, age, height, and weight were done with Pearson's correlation method, and gender differences were tested with Student's t-test.

Results: Study group included 1,230 children with a mean (SD) age of 6.1 (3.4) years. Simplified percentile charts were created using age and gender. Height and weight was not used as it was seen to explain very little variability of BP. 95th percentile values suggested levels indicating hypertension to be 110/71.5, 125/79, 131/83.5 at ages of 1,5 and 10 years, respectively for female while the same for male was 105/70, 124/79, 129/82.

Conclusion: Simplified reference tables and charts, and simple convenient thresholds may be useful for rapid screening of hypertension using oscillometric method.

INTRODUCTION

Blood pressure is defined as the pressure exerted by blood along the lateral wall of vessels. Hypertension in children is defined as Systolic Blood Pressure (SBP) and/or Diastolic Blood Pressure (DBP) above the 95th percentile. BP between the 90th and 95th percentile is defined as "high normal" or "prehypertensive" [1-2]. Systemic arterial hypertension is an important cause of adverse cardiovascular events with high morbidity and mortality in adults. Studies suggest that hypertension in adults has its origin in childhood [3-4]. Indeed, blood pressure in childhood is the best predictor of hypertension in adults. Recently, its incidence has been increasing due to changes in lifestyle and increasing obesity rates in these age groups [5]. This fact necessitates the need to include blood pressure in regular paediatric healthcare set-up.

American Academy of Paediatrics (AAP) in its guideline suggests that, measuring BP annually in children and adolescents greater than three years of age. Also, paediatricians should make a diagnosis of hypertension if BP readings are greater than the 95th percentile on three different occasions [6]. But, there are practical problems in implementing the above recommendation in office practice. The traditional auscultatory method using a sphygmomanometer is cumbersome for a busy practitioner. Also, for interpretation of measured values, one has to refer to a complex normative blood pressure table which has different values for age, height and gender [7]. The oscillometric method of blood pressure measurement is promising as it is easy, reliable, accurate, and avoids observer bias. AAP also recommends the usage of validated oscillometric devices for screening BP in children. But if elevated, such BP measurements need to be confirmed by the auscultatory method also [6].

A number of studies on BP reference values in children using mercury sphygmomanometer have been done already [8-12], BP reference tables in normal children using the oscillometric method are limited [2,8,9]. Percentile distribution charts have already been developed for adults in various studies [9-10] but its use is limited in paediatric age group. The aim of the study was to derive similar simplified BP percentile tables and charts for children aged between 1-13 years living in a South Indian state using Oscillometric method.

MATERIALS AND METHODS

This cross-sectional study was conducted at SRM Medical College and Research Centre in Kattankalathur, Tamil Nadu, India. Duration of the study was six months from July to December 2021. Approval from the IRB of SRM Medical College and Research Centre, Kattankalathur (Approval number-2881/IEC/2021) was obtained before the start of the above-mentioned study.

Inclusion criteria: Healthy children were included in the study.

Exclusion criteria: Children with known medical co-morbidities like hypertension, renal failure, Diabetes mellitus, and respiratory diseases were excluded from the study.

Sample size calculation: Sample size was calculated using the formula from the World Health Organisation (WHO) step-wise approach to chronic disease surveillance ($N=Z^2 \times P [1-P]/e^2$), [13]

where N=sample size, Z=level of confidence, P=baseline level of the selected indicator, and e=margin of error [13].

P was estimated at 0.50 (recommended by the STEPS survey guidelines [13]. When the estimated baseline is unknown), Z=1.96 (at 95% confidence interval), and e=0.05; thus, the estimated sample size was n=1.962×0.5 (1-0.5)/0.052=384. This basic sample size

was adjusted for design effect, and the required sample size was, therefore, n=384×2×1.5=1153.

Study Procedure

After obtaining consent from parents, 1230 children between the age of 1-13 years who visit the tertiary care hospital, were recruited. BP was recorded by sphygmomanometer after 5 minutes of rest in Outpatient Department (OPD) using different cuff sizes depending upon the age of the child. Sizes varied from 4×8 cm for younger children to 9×18 cm for older children. Two readings were recorded and the average of the readings was tabulated in the case report form. The height of the child was calculated by a stadiometer. The child stood with bare foot on a flat floor against a wall parallel and with heels, buttocks, shoulders, and occiput touching the wall and the height was expressed in centimetres (cm). Weight was measured using standard weighing scale and was expressed as kilograms (kg). The results were also compared with two other studies by Narang et al., [2] and Kaelber DC and Pickett F, [14].

Narang R et al., [2] found only small improvement in SBP and DBP variance after addition of height to gender and age in multivariate regression analysis. Also, there was a linear correlation between age and height for both boys and girls. Hence, like Narang R et al., [2] to simplify the tables, percentiles were prepared for age and gender only, without incorporating height adjustment. Univariate and multivariate analysis showed little significant correlation between age and weight; hence weight was not incorporated [2].

STATISTICAL ANALYSIS

Univariate analyses between blood pressure and age, was performed with Pearson's correlation method, and gender differences were tested with Student's t-test. p-values less than 0.05 were regarded as significant. Age and gender-specific percentile curves for SBP and DBP were generated.

RESULTS

The study group included 1,230 children with a mean (SD) age of 6.1 (3.4) years. Total number of male was 632 while that of female was 598. Mean (SD) age for male was 5.8 (3.4) and the same for female was 6.3 (3.6). [Table/Fig-1,2] show the anthropometric and blood pressure parameters of children grouped by age and gender. Majority children (68 female and 88 male) belonged to 4 years of age in both sexes. Corresponding mean blood pressure was 106.76/65.01 mmHg for female and 107.09/67.09 mmHg for male for this age group. 95th percentile values suggested the levels indicating hypertension to be 110/71.5, 125/79, 131/83.5 at ages of 1,5 and 10 years, respectively for female while the same for male was 105/70, 124/79, 129/82.

[Table/Fig-1,2] shows the anthropometric and haemodynamic parameters of both male and female recorded from the patients. [Table/Fig-3,4] represents the percentile values of systolic and diastolic blood pressure of female while [Table/Fig-5,6] is a graphical presentation of the percentile chart of systolic blood pressure

Age (years)	N	Weight (kg)	Height (cm)	SBP (mmHg)	DBP (mmHg)
1	48	10.88 (2.11)	83.8 (8)	95.64 (8.02)	59.56 (6.73)
2	78	11.52 (2.41)	87.79 (6)	102 (10.43)	61.62 (8.29)
3	70	14.53 (2.24)	96.91 (5)	106.07 (11.18)	68.78 (10.46)
4	88	16.2 (3.24)	102.5 (6)	107.09 (9.84)	67.09 (6.20)
5	68	19.05 (4.26)	108 (11)	110.25 (12.07)	68.57 (9.03)
6	46	20.54 (3.12)	115.26 (5)	107.76 (10.43)	67.3 (6.82)
7	50	22.03 (4.99)	120.64 (7)	113.6 (12.76)	68.54 (8.70)
8	34	27.91 (7.59)	129.05 (7)	110.94 (8.48)	67.82 (5.55)
9	26	28.83 (8.06)	131.61 (6)	112.03 (11.90)	68.38 (6.65)
10	38	32.44 (7.98)	136.68 (7)	115.21 (8.30)	68 (7.88)
11	36	36.57 (6.81)	144.88 (6)	115.08 (9.45)	69.91 (7.92)
12	30	38.53 (10.31)	144.93 (7)	115.03 (6.82)	70.73 (4.85)
13	20	37.18 (6.39)	147.55 (11)	115.11 (10.34)	73.22 (5.79)
Total	632	-	-	-	-

[Table/Fig-1]: Anthropometric and haemodynamic parameters-male.
Values in mean (standard deviation), N- Total number;
SBP: Systolic blood pressure; DBP: Diastolic blood pressure

Age (years)	N	Weight (kg)	Height (cm)	SBP (mmHg)	DBP (mmHg)
1	60	9.24 (2.78)	79.8 (7)	94.9 (7.49)	61 (6.27)
2	38	11.37 (1.71)	84.57 (5)	98.78 (8.29)	62.28 (5.95)
3	66	13.63 (2.36)	94.36 (4)	99.89 (7.54)	62.75 (7.06)
4	68	16.32 (2.02)	101.79 (6)	106.76 (12.35)	65.01 (8.29)
5	56	18.48 (3.64)	108.78 (6)	106.89 (10.47)	67.21 (8.53)
6	48	19.19 (4.51)	115.25 (7)	107.35 (11.63)	66.31 (9.13)
7	26	21.17 (4.28)	120.3 (8)	108.73 (7.06)	65.8 (6.83)
8	44	26.54 (6.21)	126.09 (8)	115.2 (7.87)	71.75 (8.11)
9	48	30.02 (6.22)	132.75 (7)	115.91 (8.45)	69.54 (7.03)
10	50	33.71 (7.47)	137.68 (5)	116.7 (9.93)	70.36 (6.68)
11	36	33.48 (6.36)	137.55 (6)	114.91 (10.07)	71 (6.13)
12	24	38.07 (8.69)	144 (6)	117.77 (9.91)	71.77 (8.18)
13	34	37.39 (6.65)	149.66 (8)	117 (10.26)	70.63 (7.61)
Total	598	-	-	-	-

[Table/Fig-2]: Anthropometric and haemodynamic parameters-female.
Values in mean (standard deviation), n-total number
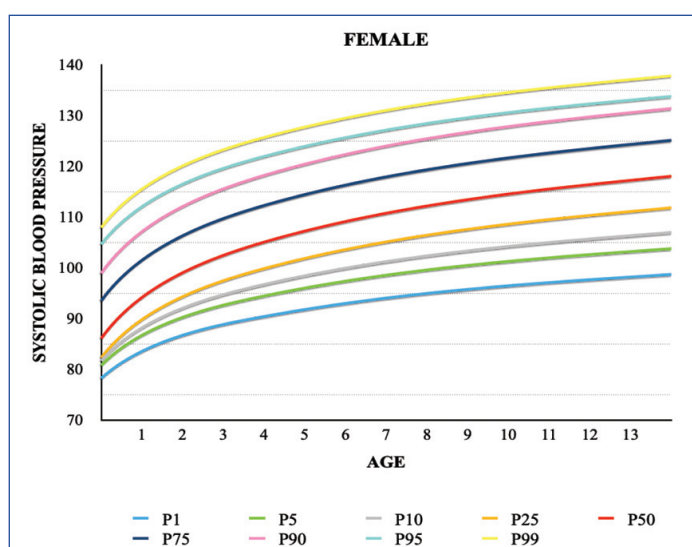SBP: Systolic blood pressure; DBP: Diastolic blood pressure

Age (years)	SBP (mmHg)								
	P1	P5	P10	P25	P50	P75	P90	P95	P99
1	83.5	84	86.95	88	93.5	100	104.3	110	111
2	84	89.85	90.35	93.25	98	101	109	111.25	120.5
3	85.5	92	92	95.5	99.5	102.5	109.85	117.25	121.5
4	86.5	93.175	94	98	102.5	113.5	119	120.125	126
5	89	96.75	95.5	100.875	105	113.5	119.5	125	130
6	92	98.375	97	98.875	102.25	115	125	126.5	130
7	94.5	98.5	99.5	101	109	120	125	128	131
8	95	99.5	103	109.5	114.5	122	125.6	129	133
9	96	100	103	111	116	122.5	128	130.25	133
10	98	100.875	103.25	110	117.5	123	129	131.325	134
11	98	102	107.5	106	113.5	123	129	131.5	134
12	100	103.8	108	116.25	120.5	124	129.5	132.5	135
13	100.5	105	109.5	111	119	123.375	130.2	133.65	139.5

[Table/Fig-3]: Percentile value of SBP with age-female.
P1 to p99 indicates 1st to 99th percentile; SBP: Systolic blood pressure

Age (years)	DBP (mmHg)								
	P1	P5	P10	P25	P50	P75	P90	P95	P99
1	40.5	51.5	52.45	57	60.5	65	69	71.5	77
2	49.5	52.25	56	57.5	60	65	70	73.45	76
3	50.5	53.05	56.5	58.5	62	66.25	72.3	79	77.5
4	51	56	58	61	63	69	74.5	79.6	79
5	54	55	57.05	60.75	65.5	69.625	74	79	81
6	55	54.5	56.5	59	65.25	72	78.5	80	83
7	56	55.25	57.5	60	65	74.5	78.75	80	84.5
8	56	59	61	64.5	69.5	75	79	80.75	85
9	57	57.5	62.5	63.75	66.25	76.375	79	82	86.5
10	58.5	61.875	63	66.5	70	77	81	83.5	89
11	60	61.75	63	66	69	78	82	85	89
12	61	62	64.65	69.375	72.25	78.625	83	87.35	90
13	61	62	66	69	71	78	84.55	88.8	91

[Table/Fig-4]: Percentile value of DBP with age-female.
P1 to p99 indicates 1st to 99th percentile; DBP: Diastolic blood pressure

[Table/Fig-5]: Percentile chart of systolic blood pressure and age-female.
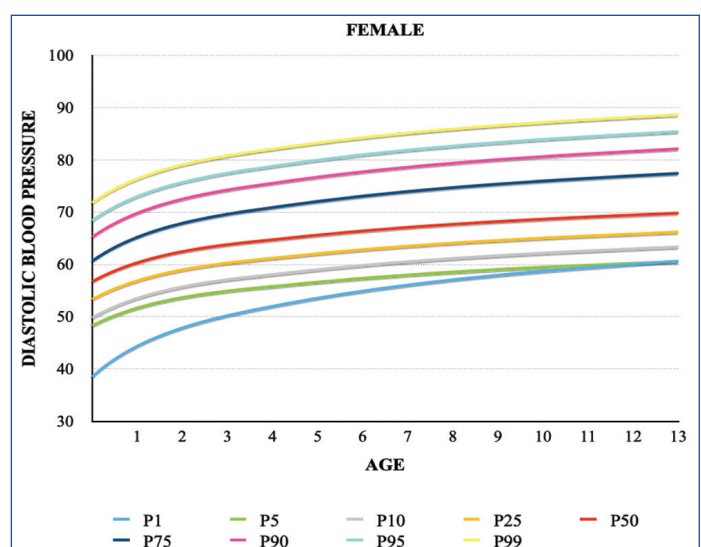
[Table/Fig-6]: Percentile chart of diastolic blood pressure and age-female.

and age-female [Table/Fig-7,8]. [Table/Fig-9,10] is a graphical presentation of the percentile chart of systolic blood pressure and age-male.

DISCUSSION

The study findings showed that blood pressure steadily increases with age in both males and females reaching adult levels by 13 years.

On comparing the values between girls and boys, girls tend to have higher blood pressure than boys. Raj M et al., in their study from Kochi also had similar findings and attributed the difference to be due to the early onset of sexual maturation in girls [15]. Narang R et al., [2] is the only study in India to publish simplified oscillometric reference tables based on North Indian children. In their study, they found that the contribution of height to blood pressure is small.

| Age (years)	SBP (mmHg)								
	P1	P5	P10	P25	P50	P75	P90	P95	P99
1	78.5	83	88	90.625	93.25	98.5	105	105	118
2	80	84.2	89.4	97	100	107.875	116.5	120.3	125
3	84	88.5	92.5	98	104	112.75	120.55	123	126
4	85	90.725	96	100	104.5	113.125	120.55	123	129
5	88	91.35	96	100.5	109	114.625	122	124.15	129
6	89.5	94	97	101.75	113	116	123	125.825	129
7	90.5	96.625	97	101	113	118.75	124	126.1	130
8	96.5	99	99.7	102.5	112	119	125	129	130
9	96.5	99	101	104.5	114	120.75	125.5	129.225	130.5
10	97	99.425	101.3	106	114.75	122	128.65	129	131.5
11	99	101.25	104.25	108	115	123	129	130.975	132
12	99.5	102.425	106	109.25	115.5	124	129.5	131	132
13	102	103.125	106.2	111	117.5	127	133	133	135

[Table/Fig-7]: Percentile value of SBP with age-male.
P1 to p99 indicates 1st to 99th percentile; SBP: Systolic blood pressure

Age (years)	DBP (mmHg)								
	P1	P5	P10	P25	P50	P75	P90	P95	P99
1	40	46.25	47.5	55.875	58.25	63.875	69	70	72.5
2	47	47	51	57.5	62.5	68	70.9	73.725	76
3	47.5	52.5	58	61	65.5	69	75	77	79
4	50	57.5	58	61.625	65.5	70.125	75	78.5	80
5	52.5	57.5	59	62	66	71.75	76	79.025	80
6	53	57.875	59	62.25	66.5	72	77	79.125	82
7	54	58.5	59	62.5	67	73	77.75	80.75	82.5
8	55	59	60	62.875	67.25	73.125	78.5	81.125	82.5
9	57	59	60.5	63	67.5	74.375	79	82	83
10	59	59.25	60.7	65	69	75	79.3	82.25	87
11	60	60	60.6	65	69	75	80	83	87.5
12	61	62.35	64	66.125	71.67	76.75	81	88.25	90.5
13	65	65	66.4	68	72	77.5	82.5	89.55	95

[Table/Fig-8]: Percentile value of DBP with age-male.
P1 to p99 indicates 1st to 99th percentile; DBP: Diastolic blood pressure
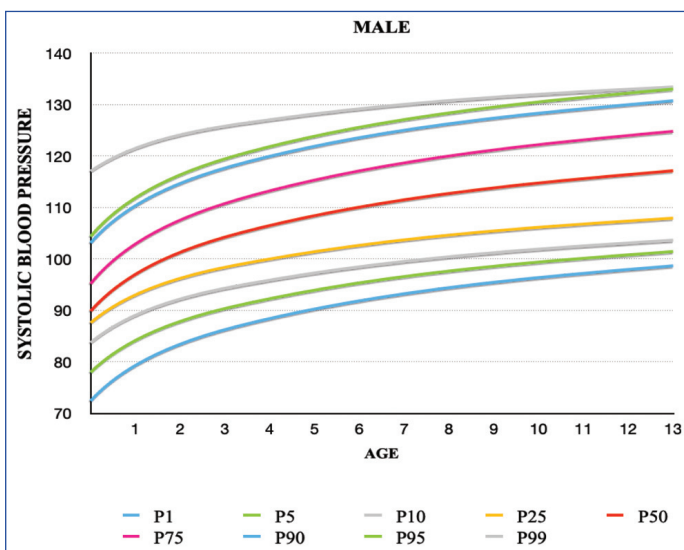
[Table/Fig-9]: Percentile chart of systolic blood pressure and age-male.
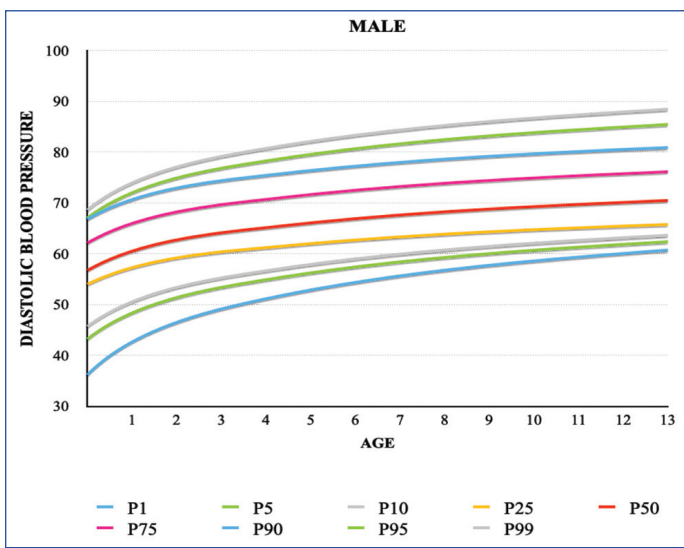
[Table/Fig-10]: Percentile chart of diastolic blood pressure and age- male.

Hence, they presented simple blood pressure tables based on age and gender only.

Kaelber DC and Pickett F, created a similar simplified tool to screen for children with hypertension. They simplified the existing tables in the Fourth report on high blood pressure in children from 476 values to 64 values based on gender and age only. They concluded that such simplified tables can easily identify children with abnormal blood pressure [14]. [Table/Fig-11] [2,14] shows the comparison of present study BP values with the two similar studies by Narang R et al., and Kaelber DC and Pickett F. On comparing 90th percentile values of this study with those of Narang R et al., [2] and Kaelber DC and Pickett F, [14] using t-test, the p-values were less than 0.05. Kaelber DC and Pickett F, values were comparatively on the lower side than both the Indian studies [14]. These variations in values suggest that foreign BP percentile charts cannot be followed as reference. Also multicentric studies representing different parts of the country are needed as significant variations in BP exist between north Indian and south Indian children. Jackson LV et al., [16] used the oscillometric method to measure BP in British children. They also found only 0.03 SD variation in both systolic and diastolic blood pressure with 1 SD variation in height. Hence, they have presented simplified charts based on age and gender only. Present study revealed the data similar to above studies excluding height. These tables will be easy to use and can be used routinely in office practice.

Zuijdwijk C et al., [17] compared such a simple blood pressure table against a standard blood pressure table. They found 100% of sensitivities and specificities of 61.1% and 81.3% in identifying hypertension and abnormal blood pressure values, respectively. These percentile charts are simple to interpret as it is not necessary to measure height percentile. They enable us to easily visualise the BP percentile of the child. Like growth charts, simplified BP charts can be easily printed and longitudinal tracking of BP can be done. The above studies suggest that, simple BP tables like the ones that has been designed in the current study can be valuable screening tools for identifying prehypertension, stage 1 and stage 2 hypertension based on Fourth report [6] among children in office practice settings. Although blood pressure must be recorded in

Place and year of study / Years (Girls)	Present study (SBP) Kattankalathur, TN 2021	Narang R et al., [2] (SBP) Ballabhgarh, Haryana 2015	Kaelber DC and Pickett F, [14] (SBP) Elk Grove Village 2009	Present Study (DBP) Kattankalathur, TN 2021	Narang R et al., [2] (DBP) Ballabhgarh, Haryana 2015	Kaelber DC and Pickett F, [14] (DBP) ElkGrove Village 2009
5	119.5	114	103	74	79	66
6	125	116	104	78.5	80	68
7	125	117	106	78.75	80	69
8	125.6	119	108	79	81	71

9	128	120	110	79	82	72
10	129	122	112	81	83	73
11	129	124	114	82	83	74
12	129.5	126	116	83	84	75
13	130.2	128	117	84.55	85	76
p-value	-	<0.001	<0.001	-	<0.001	<0.001
Years (Boys)						
5	122	116	104	76	79	65
6	123	116	105	77	80	68
7	124	117	106	77.75	80	70
8	125	119	107	78.5	81	71
9	125.5	120	109	79	82	72
10	128.65	121	111	79.3	82	73
11	129	122	113	80	83	74
12	129.5	124	115	81	83	74
13	133	126	117	82.5	84	75
p-value	-	<0.001	<0.001	-	<0.001	<0.001

[Table/Fig-11]: Comparison of 90th percentile BP among studies [2,14].

children as a vital sign, it is seldom practiced clinically [12]. In one review, statistics of measuring blood pressure in paediatric children presenting in emergency department showed that only 5.3% of children had their blood pressure measured in United States, while the same in United Kingdom and Australia was about 9% and 66% respectively [18-21]. For adults presenting in the emergency department, it is very basic to measure blood pressure but the same is not true for children. The reason for this is multifold.

Measuring the blood pressure in children is more difficult than adults because of crying toddlers that is likely to show false measurement, appropriate cuff sizes are not readily available in the triage room and no clear definition exists as to what is hypertension in children and lastly, clear guidance for taking blood pressure in children does not exist [22].

This study tries to address these difficulties in measuring and interpreting blood pressure in children. The Oscillometric method has been utilised using two cuff sizes for measuring blood pressure in children. This study has more practical value as it has captured feasible data rather than ideal data. In adults, the Joint National Committee has given simple cut-off values as 120/80, 140/90, and 160/100 as thresholds for prehypertension, hypertension, and stage 2 hypertension, respectively [23]. As reported, these are simple round values and hence, easy to apply in screening and treating hypertension. Similar simple convenient values need to be developed for children and make the screening process easier and practical.

Limitation(s)

In growth charts construction, serial recordings of blood pressure over a period of time in a cohort of children would have been ideal. But, such a design will need more time and resources. Many cuff sizes based on task force recommendations would have been more appropriate. For practicality purposes, only two cuff sizes were used as they were readily available in the market.

CONCLUSION(S)

In the present study, percentile chart for blood pressure among paediatric population in a hospital setting was derived. Simplified percentile charts were developed using age and gender only. These methods are easier to apply than standard tables in hospital setting and thus, can be used to identify hypertension along with clinical judgment. Also, this study showed that with age, blood pressure increases, though the rise varied at different ages, especially with onset of adolescence. Percentile charts prepared through larger sample size multicentric studies with children representing from different states can be more reliably extrapolated to the

general population and should be the way forward in conducting future research.

REFERENCES

[1] Galescu O, George M, Basetty S, Predescu I, Mongia A, Ten S, et al. Blood pressure over height ratios: Simple and accurate method of detecting elevated blood pressure in children. Int J pediatr. 2012;2012.

[2] Narang R, Saxena A, Ramakrishnan S, Dwivedi SN, Bagga A. Oscillometric blood pressure in Indian school children: Simplified percentile tables and charts. Ind Pediatr. 2015;52(11):939-45.

[3] Bassareo PP, Mercuro G. Paediatric hypertension: An update on a burning problem. World J Cardiol. 2014;6(5):253.

[4] Chiolero A. The quest for blood pressure reference values in children. J Hypertens. 2014;32(3):477-79.

[5] Barba G, Buck C, Bammann K, Hadjigeorgiou C, Hebestreit A, Mårild S, et al. Blood pressure reference values for European non-overweight school children: The IDEFICS study. Int J Obes. 2014;38(2):S48-56.

[6] National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. Pediatrics. 2004;114(2 Suppl 4th Report):555-76. PMID: 15286277.

[7] Falkner B, Daniels SR. Summary of the fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. Hypertension. 2004;44(4):387-98.

[8] Chiolero A, Paradis G, Lambert M. Accuracy of oscillometric devices in children and adults. Blood pressure. 2010;19(4):254-59.

[9] Ostchega Y. Blood pressure randomised methodology study comparing automatic oscillometric and mercury sphygmomanometer devices: National Health and Nutrition Examination Survey, 2009-2010. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. 2012.

[10] Sive PH, Medalie JH, Kahn HA, Neufeld HN, Riss E. Correlation of weight-height index with diastolic and with systolic blood pressure. Br J Prev Soc. Med. 1970;24(4):201.

[11] Balijepalli C, Lösch C, Bramlage P, Erbel R, Humphries KH, Jöckel KH, et al. Percentile distribution of blood pressure readings in 35683 men and women aged 18 to 99 years. J. Human Hypertens. 2014;28(3):193-200.

[12] Bird C, Michie C. Measuring blood pressure in children. BMJ. 2008;336(7657):1321.

[13] World Health Organisation. WHO STEPS Surveillance Manual: The WHO STEPwise approach to chronic disease risk factor surveillance. Geneva, Switzerland: World Health Organisation. 2005.

[14] Kaelber DC, Pickett F. Simple table to identify children and adolescents needing further evaluation of blood pressure. Pediatr. 2009;123(6):e972-74.

[15] Raj M, Sundaram KR, Paul M, Kumar RK. Blood pressure distribution in Indian children. Ind Pediatr. 2010;47(6):477-85.

[16] Jackson LV, Thalange NK, Cole TJ. Blood pressure centiles for Great Britain. Archives of Disease in Childhood. 2007;92(4):298-03.

[17] Zuijdwijk C, Feber J, Murnaghan O, Nakhla M. Detection of hypertension and prehypertension in paediatric patients with type 1 diabetes using a simple blood pressure table. Paediatr. Child Health. 2013;18(9):461-64.

[18] Pazdral PT, Lieberman HM, Pazdral WE, Neumann CG, Lieberman E. Awareness of paediatric hypertension: Measuring blood pressure. JAMA. 1976;235(21):2320-22.

[19] Silverman MA, Walker AR, Nicolaou DD, Bono MJ. The frequency of blood pressure measurements in children in four EDs. Am J Emerg Med. 2000;18(7):784-88.

[20] Gilhotra Y, Willis F. Blood pressure measurements on children in the emergency department. Emergency Med. Australasia. 2006;18(2):148-54.

[21] Sinaiko AR. Hypertension in children. New England J Med. 1996;335(26):1968-73.

[22] Lurbe E, Cifkova R, Cruickshank JK, Dillon MJ, Ferreira I, Invitti C, et al. Management of high blood pressure in children and adolescents: Recommendations of the European Society of Hypertension. J hypertension. 2009;27(9):1719-42.

[23] Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo Jr JL, et al. Seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. Hypertension. 2003;42(6):1206-52.

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