International Journal of Physiology, Sports and Physical Education

ISSN Print: 2664-7710
ISSN Online: 2664-7729
Impact Factor: RJIF 8.28
IJPSPE 2026; 8(1): 08-10
www.physicaleducationjournal.net
Received: 02-11-2025
Accepted: 05-12-2025

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Physiological Variables among Tribal and Non-Tribal Children of Tripura, India

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DOI: https://www.doi.org/10.33545/26647710.2026.v8.i1a.198

Abstract
Childhood is a vital stage of life characterized by rapid growth and maturation, during which the cardiovascular and respiratory systems undergo notable developmental changes. Resting heart rate (RHR), blood pressure (BP), and peak expiratory flow rate (PEFR) are widely used indicators of cardiovascular and pulmonary health and are known to vary with age, sex, ethnicity, nutritional status, and level of physical activity. The present cross-sectional study was designed to examine age- and sex-related differences in selected physiological parameters among tribal (Tripuri and Reang) and non-tribal (Bengali) school-going children of Tripura, India. A total of children aged 8-15 years were assessed for RHR, systolic blood pressure (SBP), diastolic blood pressure (DBP), and PEFR using standardized techniques. The findings revealed a gradual and significant increase in SBP, DBP, and PEFR with advancing age, while RHR showed a significant decline ($P<0.001$). In general, boys demonstrated higher blood pressure and PEFR values, whereas girls exhibited comparatively higher resting heart rates. These observations emphasize the need for regular monitoring of physiological parameters during childhood for early detection of cardiovascular risk and for their relevance in public health planning and sports science.

Keywords: Resting heart rate, Blood pressure, Peak expiratory flow rate, Tribal children, Adolescents, India

Introduction
Childhood and adolescence are marked by rapid physical growth, hormonal changes, and progressive maturation of the cardiovascular and respiratory systems. Physiological parameters such as resting heart rate, blood pressure, and pulmonary function serve as sensitive indicators of growth, physical fitness, and overall cardiovascular health. Evidence suggests that elevated resting heart rate and blood pressure during childhood may predispose individuals to cardiovascular disorders later in life [2, 8-11]

India is known for its remarkable ethnic diversity, including a large number of tribal communities with distinct cultural practices, lifestyles, and socioeconomic backgrounds. Children belonging to tribal populations often differ from their non-tribal counterparts in terms of nutritional intake, physical activity patterns, and environmental exposure, all of which may influence physiological development. Despite this, comparative studies focusing on physiological variables among tribal and non-tribal children, particularly from northeastern India, remain limited [1, 3, 7].

Tripura, a northeastern state of India, is home to several indigenous tribal groups such as Tripuri and Reang, along with a sizeable non-tribal Bengali population. Assessing age- and sex-related physiological variations among these groups is important for child health evaluation, preventive cardiology, and sports science. Therefore, the present study aimed to assess resting heart rate, systolic and diastolic blood pressure, and peak expiratory flow rate among Tripuri, Reang, and Bengali children aged 8-15 years [2, 9].

Materials and Methods
This cross-sectional study was conducted among apparently healthy school-going children aged 8-15 years from Tripuri, Reang, and Bengali communities of Tripura. Children with known cardiovascular or respiratory diseases were excluded from the study. All procedures were carried out in accordance with the principles of the Helsinki Declaration [4, 5].

Prior permission was obtained from the school authorities before commencement of the study. The purpose and procedures of the study were explained to the participants in the presence of their teachers, and all children voluntarily consented to participate [4]. Resting heart rate was recorded after adequate rest using standard clinical methods. Blood pressure was measured in the sitting position with a mercury sphygmomanometer using an appropriately sized cuff. Peak expiratory flow rate was assessed with a peak flow meter, and the highest value obtained from three attempts was recorded [4, 5]. Data were expressed as mean ± standard deviation. Age- and sex-wise comparisons were performed using analysis of variance (ANOVA). Statistical significance was considered at $P<0.05$, $P<0.01$, and $P<0.001$.

Results

Age-wise analysis demonstrated a significant increase in systolic blood pressure, diastolic blood pressure, and peak expiratory flow rate with advancing age across all three communities ($P<0.001$). In contrast, resting heart rate showed a significant decreasing trend with age.

Table 1: Physiological variables of Tripuri children according to age and sex

Age (years)	Tripuri Boys	Tripuri Girls	Resting Heart Rate (bpm) Boys	Resting Heart Rate (bpm) Girls	SBP (mmHg) Boys	SBP (mmHg) Girls	DBP (mmHg) Boys	DBP (mmHg) Girls	PEFR (litres/min) Boys	PEFR (litres/min) Girls
8	33	36	82.0±3.19	83.0±2.52	103.03±3.62	102.94±3.75	71.88±4.54	69.89±5.37	162.73±43.50*	143.33±15.09
9	31	33	82.45±6.03*	79.39±4.12	105.10±4.09	103.64±3.46	72.0±4.52	71.09±3.0	205.16±48.18	205.76±26.75
10	30	34	82.40±5.87	84.58±3.34	106.67±3.66	106.12±3.53	73.33±4.66	72.53±4.32	228.33±66.54	220.59±66.82
11	31	30	81.61±7.67	85.13±11.4	107.81±4.35	107.20±4.81	74.77±6.30	73.80±3.74	266.13±57.57	264.33±33.34
12	31	37	79.61±8.94	85.19±4.96**	108.90±5.10	108.22±4.78	75.42±4.31	73.89±3.60	311.94±75.02	306.22±50.74
13	34	33	84.18±9.34	86.48±5.51	109.18±5.09	108.61±3.17	76.12±5.20	74.48±2.92	350.29±73.26	356.67±42.76
14	35	32	85.66±6.33**	81.88±5.31	110.40±6.01	110.13±4.18	77.94±5.80	75.44±4.10	409.14±37.29	393.13±40.78
15	31	30	75.74±8.11	79.63±3.23*	111.81±5.99	111.27±3.52	78.0±3.45*	76.07±3.60	446.76±43.22	431.67±47.68
F ratio			5.45###	7.15###	10.92###	17.64###	7.47###	9.41###	96.16###	170.12###

w. r. t. sex: ***$P<0.001$; **$P<0.01$; *$P<0.05$; w. r. t. age: ### $P< 0.001$

Table 2: Physiological variables of Reang children according to age and sex

Age (years)	Tripuri Boys (n)	Tripuri Girls (n)	Resting Heart Rate (bpm) Boys	Resting Heart Rate (bpm) Girls	SBP (mmHg) Boys	SBP (mmHg) Girls	DBP (mmHg) Boys	DBP (mmHg) Girls	PEFR (litres/min) Boys	PEFR (litres/min) Girls
8	33	36	82.0±3.19	83.0±2.52	103.03±3.62	102.94±3.75	71.88±4.54	69.89±5.37	162.73±43.50*	143.33±15.09
9	31	33	82.45±6.03*	79.39±4.12	105.10±4.09	103.64±3.46	72.0±4.52	71.09±3.0	205.16±48.18	205.76±26.75
10	30	34	82.40±5.87	84.58±3.34	106.67±3.66	106.12±3.53	73.33±4.66	72.53±4.32	228.33±66.54	220.59±66.82
11	31	30	81.61±7.67	85.13±11.4	107.81±4.35	107.20±4.81	74.77±6.30	73.80±3.74	266.13±57.57	264.33±33.34
12	31	37	79.61±8.94	85.19±4.96**	108.90±5.10	108.22±4.78	75.42±4.31	73.89±3.60	311.94±75.02	306.22±50.74
13	34	33	84.18±9.34	86.48±5.51	109.18±5.09	108.61±3.17	76.12±5.20	74.48±2.92	350.29±73.26	356.67±42.76
14	35	32	85.66±6.33**	81.88±5.31	110.40±6.01	110.13±4.18	77.94±5.80	75.44±4.10	409.14±37.29	393.13±40.78
15	31	30	75.74±8.11	79.63±3.23*	111.81±5.99	111.27±3.52	78.0±3.45*	76.07±3.60	446.76±43.22	431.67±47.68
F ratio			5.45###	7.15###	10.92###	17.64###	7.47###	9.41###	96.16###	170.12###

w.r.t. Sex: ***$P<0.001$; **$P<0.01$; *$P<0.05$; w. r. t. age: ### $P< 0.001$

Table 3: Physiological variables of Bengali children according to age and sex

Age (years)	Bengali Boys (n)	Bengali Girls (n)	Resting Heart Rate (bpm) Boys	Resting Heart Rate (bpm) Girls	SBP (mmHg) Boys	SBP (mmHg) Girls	DBP (mmHg) Boys	DBP (mmHg) Girls	PEFR (litres/min) Boys	PEFR (litres/min) Girls
8	30	31	88.90±6.67	86.90±4.84	100.96±3.59	100.84±4.59	70.13±5.15	70.0±7.29	158.23±35.98	149.19±32.33
9	33	30	89.64±9.22	86.0±9.35	102.91±3.04	102.87±4.38	72.67±4.40	70.67±9.69	202.58±41.05	203.67±33.41
10	36	32	89.94±7.74***	82.75±6.17	104.94±3.64	103.94±5.21	73.33±6.02	72.75±7.19	240.0±48.71	235.63±48.92
11	32	34	87.5±6.56***	81.18±5.19	107.75±3.53	107.06±5.64	73.56±3.19	72.82±10.15	266.25±55.16	264.33±52.25
12	31	30	84.58±3.74**	81.13±5.98	108.07±4.83	108.20±5.30	74.0±3.52	73.80±4.14	322.26±59.17	334.66±69.41
13	30	34	84.17±9.40	80.88±4.75	109.6±5.52	108.94±4.93	74.07±4.83	74.0±3.14	374.0±53.70	356.67±43.42
14	34	36	79.71±7.93	78.50±5.96	110.82±5.88	110.56±6.23	74.71±7.03	74.22±4.47	392.06±67.51	393.13±41.38
15	30	31	79.0±13.21	75.16±8.42	112.93±9.12	112.58±5.91	76.13±7.08	76.06±4.96	429.83±80.69	420.32±39.88
F ratio			8.32###	10.69###	18.76###	17.5###	3.14##	2.42#	89.49###	124.88###

w.r.t. Sex: ***$P<0.001$; **$P<0.01$; *$P<0.05$; w. r. t. age: ### $P< 0.001$;##$P<0.01$; #$P<0.05$.

Sex-wise comparisons revealed that Tripuri boys generally had higher systolic and diastolic blood pressure and PEFR values than girls in most age groups, while girls tended to show higher resting heart rates. Among Reang children, boys exhibited significantly higher resting heart rate at 11 and 15 years of age, whereas no significant sex-related differences were observed for blood pressure and PEFR. In the Bengali group, boys showed higher resting heart rate between 10 and 12 years, though differences in blood pressure and PEFR were not statistically significant.

Discussion

The observed decline in resting heart rate with increasing age reflects the maturation of the cardiovascular system and improved autonomic regulation during growth. Differences in resting heart rate between boys and girls may be influenced by hormonal variations, body composition, and differences in physical activity levels [2, 6, 8]. The progressive increase in blood pressure with age is consistent with previous findings and may be attributed to increases in body size, vascular resistance, and physiological demands during growth. Higher blood pressure values observed among boys

could be related to greater physical activity levels and sympathetic nervous system activity [9, 11]

The significant age-related increase in peak expiratory flow rate reflects the growth and development of the respiratory muscles and airways. Higher PEFR values in boys may be due to greater lung volumes, respiratory muscle strength, and androgenic influences. These findings agree with earlier studies conducted among Indian children [1, 3, 7]

Conclusion

The present study highlights significant age- and sex-related variations in resting heart rate, blood pressure, and peak expiratory flow rate among tribal and non-tribal children of Tripura. These physiological parameters are valuable indicators of growth, cardiovascular health, and physical fitness, and their assessment has important implications for early health screening, preventive strategies, and sports science applications [2, 9]

Acknowledgements

The author sincerely acknowledges the cooperation and support of the Headmasters and teachers of the participating schools. Gratitude is also extended to all the students who willingly participated in the study.

Conflict of Interest: None declared.

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