Trends in Clinical and Medical Sciences

PSR Press

Article

Study of medical diseases among peripubertal school children (12-14 years) attending rural school

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Received: 15 December 2022; Accepted: 28 March 2023; Published: 13 April 2023.

Abstract: Background: Peri-puberty is a critical period between 10-16 years of age, during which various environmental factors, such as family, peer group, school, and community characteristics, contribute to adolescent health and risk behaviors. The present study aimed to determine the prevalence of hypertension, anemia, and malnutrition in school children of the peri-pubertal age group, along with associated social factors.

Material and Methods: This single-center, cross-sectional study was conducted in school children from standard 7th to 9th who were present during the survey. They underwent history taking, anthropometric measurements, and clinical examination.

Results: The study included 300 school children aged 12-14 years. Most of the children were 14 years old (39.33%), boys (83%), and from socioeconomic class IV (50.67%). Of the total, 185 (61.67%) children were underweight, 85 (28.33%) were normal, 21 (7%) were overweight, and 9 (3%) were obese. Among the children, 32 (10.67%) had hypertension, with diastolic hypertension being more prevalent (19, 6.33%) than systolic hypertension (13, 4.33%). The prevalence of hypertension in girls (13.72%) was higher than in boys (10%). HTN was found more in obese children (5, 55.6%), followed by overweight children (7, 33.33%), normal children (14, 16.5%), and lastly underweight children (6, 3.2%). A total of 123 (41%) children were anemic, and the prevalence of anemia was insignificantly higher in girls (43.13%) than in boys (40.56%) (p-value=0.36, not significant). Out of 133 (44.33%) malnourished children, boys (46.18%) were more prevalent than girls (35.29%). Among 215 malnourished children, 104 (34.67%) children were anemic, and out of 85 well-nourished children, 19 (6.33%) were anemic.

Conclusion: The prevalence of hypertension was higher in children from higher socioeconomic status, obese and overweight children. Anaemia was more common in undernourished children.

Keywords: Hypertension; Children; Obesity; Overweight children; Anaemia; Undernutrition.

1. Introduction

Adolescence is a defined period of life, according to the World Health Organization, spanning from 10 to 19 years [1]. Peri-puberty, which includes 10-16 years of age, is a biologic process in which a child becomes an adult [2]. Adolescents constitute approximately twenty percent of the global population, and around 84 percent of them are found in developing countries [3]. As of March 1, 2011, adolescents constituted approximately 22 percent of the Indian population, of which twelve percent were aged 10-14 years [4].

Adolescence is a period of transition from childhood to adulthood, during which young people undergo rapid changes in body structure, physiologic, psychologic, and social functioning. It represents a vulnerable and dependent period of human life, during which children are more prone to acquire abnormal behavior, abnormal eating habits, increased intake of fast foods, decreased physical exercise, and constitutional growth spurts. In addition, menarche also occurs in this period, making adolescents more prone to malnutrition, obesity, anemia, and hypertension [5,6]. Environmental factors, such as family, peer group, school, and community characteristics, also contribute to adolescent health and risk behaviors, and should be taken into

consideration when assessing peripubertal health. The present study aimed to investigate the prevalence of hypertension, anemia, and malnutrition, along with social factors associated with these conditions, in school children of the peri-pubertal age group.

2. Material and methods

The present study was a single-center, cross-sectional study conducted at the Department of Pediatrics and the Department of Community Medicine, Navodaya Medical College and Research Centre, Raichur, India. The study duration was two years, from January 2011 to December 2013. Ethical clearance was obtained from the institutional ethics committee prior to the commencement of the study.

2.1. Inclusion criteria

The study included all children from standard 7th to 9th who were present at the time of the survey and willing to participate in the study.

2.2. Exclusion criteria

Children studying in 7th to 9th standard with age group of <12years and >14 years were excluded in the study

Written consent was obtained from the participants and their guardians after explaining the study in the local language. The study was conducted in a government school located in the field area of the Department of Paediatrics, and necessary approval was obtained from the school authorities before the commencement of the study. Demographic parameters such as name, age, sex, occupation and education of parents, type of diet, economic status of the family, fuel type for cooking, frequency of eating outside the home, and any vehicle used in the household were collected.

Anthropometric parameters were measured, including height (measured in centimeters marked on the wall with the help of a measuring tape), weight (measured in kilograms using a portable weighing machine), and body mass index (BMI) calculated by dividing the weight (kg) by the square of the height (meter). Nutritional status was assessed based on anthropometric parameters such as weight for age, height for age, and weight for height. Undernutrition (low weight for age), stunting (low height for age), and wasting (low weight for height) were identified as per the Indian Academy of Pediatrics (IAP) classification.

Each child underwent a thorough general and systemic examination, including a detailed clinical history. Anemia was assessed by clinical examination of the palpebral conjunctiva, nail bed, tongue, and palm. Blood pressure was measured in a quiet room after a five-minute rest in a sitting position, with the right arm kept at the same level as the heart during the measurement. The measurements were performed three times repeatedly at an interval of five minutes by the same person, and the average of the last two measurements was recorded.

If any diseases were detected, appropriate advice was given, and medication was prescribed. The parents were informed about their children's health conditions and referred to the medical college hospital if necessary.

Data was collected and compiled using Microsoft Excel and analyzed using SPSS version 23.0. Continuous variables were presented as means and standard deviations (SD), while categorical variables were presented as ratios and proportions. The chi-square test or Fisher exact test was used to test the difference of proportions between qualitative variables. A P-value of less than 0.05 was considered statistically significant.

3. Results

In the current study, the age range of the school children was between 12 to 14 years, with the majority of children falling in the age group of 13 and 14 years, comprising 118 (39.33%) and 106 (35.33%) of the total sample, respectively. The remaining 25.33% of children were in the 12-year age group. Among the participants, boys (83%) outnumbered girls (17%).

Table 1. Age and sex wise distribution of school children

Age (in years)	Boys		Girls		Total	
	No.	%	No.	%	No.	%
12	49	16.33	27	9	76	25.33
13	93	31	13	4.3	106	35.33
14	107	35.67	11	3.67	118	39.34
Total	249	83	51	17	300	100

In the current study, the socioeconomic status of the children was classified according to the B G Prasad classification. Out of the total sample of 300 children, the majority of them belonged to socioeconomic class IV (50.67%), followed by class III (18%). The difference in distribution of socioeconomic status among the study participants was statistically significant with a p value of 0.0007.

Table 2. According to socioeconomic status of school children's family

Socioeconomic status	Boys		Girls		Total	
	No.	%	No.	%	No.	%
Class-I	10	4.01	3	5.88	13	4.33
Class-II	32	12.85	1	1.96	33	11
Class-III	50	20.08	4	7.84	54	18
Class-IV	113	45.38	39	76.47	152	50.67
Class-V	44	17.67	4	7.84	48	16
Total	249	100	51	100	300	100

Out of the total sample of 300 children, a majority of 185 (61.67%) were found to be underweight, while 85 (28.33%) were normal weight, 21 (7%) were overweight, and 9 (3%) were obese. Among the boys (n=249), 155 (62.25%) were underweight, 75 (30.12%) were normal weight, 15 (6.02%) were overweight, and 4 (1.61%) were obese. Among the girls (n=51), 30 (58.82%) were underweight, 10 (19.61%) were normal weight, 6 (11.76%) were overweight, and 5 (9.8%) were obese.

The prevalence of undernutrition was found to be significant among both sexes of school children, with a p value of 0.004.

Table 3. Distribution of school children according to sex and BMI

BMI	Boys (%)	Girls (%)	Total	
			No.	%
Underweight	155(62.25)	30(58.82)	185	61.67
Normal	75(30.12)	10(19.61)	85	28.33
Overweight	15(6.02)	6(11.76)	21	7
Obesity	4(1.61)	5(9.8)	9	3
Total	**249(100)**	**51(100)**	**300**	**100**

In the present study, out of 300 children, 32 (10.67%) were found to have hypertension (HTN). The prevalence of diastolic HTN was higher than systolic HTN, with 19 (6.33%) children having diastolic HTN and 13 (4.33%) children having systolic HTN. Although the incidence of HTN was found to increase with age, there was no significant association between HTN and age (p value = 0.1033, not significant).

Table 4. Distribution of hypertension according to age

Age	Systolic HTN (%)	Diastolic HTN (%)	Total (%)
12 (n=76)	2(2.63%)	2(2.63%)	4(5.3)
13 (n=106)	5(4.72%)	11(10.38%)	16(15.1)
14 (n= 118)	6(5.1%)	6(5.1%)	12(10.2)
Total (n= 300)	**13(4.33%)**	**19(6.33%)**	**32(10.67)**

Out of 300 children, 249 were boys and 51 were girls. The prevalence of HTN in girls (7, 13.72%) was found to be higher compared to boys (25, 10%). However, there was no significant association regarding the distribution of HTN according to sex (p value = 0.2, not significant).

Table 5. Distribution of hypertension according to sex

Sex	Systolic HTN (%)	Diastolic HTN (%)	Total (%)
Boys (n=249)	10(4.01%)	15(6.02%)	25(10)
Girls (n=51)	3(5.88%)	4(7.84%)	7(13.72)
Total (n=300)	13(4.33%)	19(6.33%)	32(10.67)

Present study shows association between BMI and HTN. Out of 300, overall prevalence of hypertension was 10.67%. In association with BMI, HTN was found more in the obese 5(55.6%) followed by overweight children 7(33.33%), normal children 14(16.5%) and lastly underweight children 6(3.2%). There was a significant association between BMI and HTN, predominantly found more in obese and overweight children. (p = 0.000001, significant).

Table 6. Association between BMI and hypertension

BMI	Systolic HTN	Diastolic HTN	Total HTN (%)
Underweight (n=185)	1(0.54)	5(2.7)	6(3.2)
Normal (n=85)	4(4.7)	10(11.76)	14(16.5)
Overweight (n=21)	5(23.8)	2(9.5)	7(33.33)
Obesity (n=9)	3(33.33)	2(22.22)	5(55.6)
Total (n=300)	13(4.33)	19(6.33)	32(10.67)

The present study found a significant association between obesity and socioeconomic status (SES), with a higher prevalence of obesity observed in children belonging to SES class I. However, there was no significant association between overweight and SES.

Table 7. Association between overweight and obesity with socioeconomic status (SES)

SES	Overweight	%	Obesity	%
Class-I (n=13)	-	00	3	23.08
Class-II (n=33)	6	18.18	2	6.06
Class-III (n=54)	3	5.5	-	00
Class-IV (n=152)	7	4.6	3	1.97
Class-V (n=48)	5	10.42	1	2.08
TOTAL (n=300)	21	7	9	3
	(p value = 0.12) not significant (Class I and II are clubbed)		(p value = 0.0006) significant (Class II and III are clubbed)	

Based on the given information, the prevalence of anemia among school children is 41%. The prevalence of anemia in girls is 43.13% while in boys it is 40.56%. The p-value of 0.36 indicates that there is no significant difference in the prevalence of anemia between girls and boys.

Table 8. Sex distribution of anaemia in school children

Anaemia	Boys		Girls		Total	
	No.	%	No.	%	No.	%
Present	101	40.56	22	43.13	123	41
Absent	148	59.43	29	56.86	177	59
Total	249	100	51	100	300	100

The present study investigated the association between nutritional status and anaemia among 300 school children, of which 133 (44.33%) were malnourished and 167 (55.67%) were well-nourished. Prevalence of

malnutrition was higher among boys compared to girls, with 115 (46.18%) boys and 18 (35.29%) girls being malnourished. However, there was no significant difference in malnutrition prevalence between sexes (p = 0.07). Among the malnourished children, 84 (63.16%) were classified as grade I, 37 (27.82%) as grade II, and 12 (9.02%) as grade III malnutrition. There was no significant difference in the distribution of malnutrition grades according to sex.

Table 9. Grades of malnutrition among school children.

Grades of Malnutrition	Boys		Girls		Total	
	No.	%	No.	%	No.	%
Grade I	70	60.86	14	77.77	84	63.16
Grade II*	33	28.69	4	22.22	37	27.82
Grade III	12	10.4	00	00	12	9.02
Grade IV	00	00	00	00	00	00
Total	115	100	18	100	133	100

Further analysis showed that out of the 215 malnourished children, 104 (34.67%) were also anaemic, while only 19 (6.33%) of the well-nourished children were anaemic. A chi-square test revealed a significant association between anaemia and nutritional status ($p < 0.0001$). These findings suggest that malnutrition is strongly associated with an increased risk of anaemia among school children.

Table 10. Relation between anaemia and nutritional status of school children.

Anaemia	Malnourished		Well-nourished		Total	
	No.	%	No.	%	No.	%
Present	104	34.67	19	6.33	123	41
Absent	111	37	66	22	177	59
Total	215	71.67	85	28.33	300	100

4. Discussion

The increasing trends of non-communicable diseases (NCDs) have become a global phenomenon. Risk factors such as high blood pressure, obesity, smoking, alcohol consumption, low physical activity, etc., contribute to the development of NCDs and are more prevalent in developed countries [7]. Furthermore, NCDs such as obesity, diabetes mellitus, hypertension, coronary artery disease, and stroke in adults have been linked to the prevalence of risk factors in childhood [8,9].

This present study aimed to investigate the clinico-social profile of peri-pubertal rural school children. The age of the school children ranged from 12 to 14 years, with the majority being 14 years (39.33%) and 13 years (35.33%), followed by 12 years (25.33%). Similar findings were reported in previous studies by Sudhagandhi et al. [10], Izharul et al. [11], and Joshi et al. [12].

In this study, boys (83%) outnumbered girls (17%). A study by Sudhagandhi et al. [10] reported equal proportions of boys and girls (50%). In another study by Panda et al. [13], out of 116 students in the age group of 10 to 19 years studying in a high school of a peri-urban area in Wardha, 80(68.97%) were boys and 36(31.03%) were girls. Joshi et al. [12] reported that out of 789 children, 387(49%) were boys and 402(51%) were girls.

The present study found that the majority of school children (66.67%) belonged to the lower socioeconomic group, i.e., socioeconomic class IV and V. Similarly, Saluja et al. [14] and Kumari K [15] also reported that the majority of mothers belonged to a lower socioeconomic class. However, Izharul et al. [11] found that out of 500 children, 42 (8.40%) belonged to the upper-middle socioeconomic class (SES II), 238 (47.60%) belonged to the lower-middle socioeconomic class (SES III), and 220 (44.00%) belonged to the upper-lower socioeconomic class (SES IV). The variation in socioeconomic status of children's families between the present study and previous studies could be due to differences in geographical areas.

In the present study, overweight and obesity were more prevalent in girls (11.76% and 9.8%, respectively) compared to boys (6.02% and 1.61%, respectively), which was statistically significant. Meanwhile, undernutrition was statistically significant in boys. The limited mobility of girls outside of their homes due to cultural norms, as well as reduced opportunities for physical work and playtime, could explain the higher

risk of obesity among girls. Studies indicate that in girls, early sexual maturation is associated with a higher prevalence of overweight/obesity, while in boys, the findings are still divergent [16]. There was a significant prevalence of undernutrition among both sexes of school children, which is consistent with the findings of Manohar et al. [17].

In the present study, out of 300 children, 32 (10.67%) were found to have hypertension (HTN). The prevalence of diastolic HTN (19, 6.33%) was higher compared to systolic HTN (13, 4.33%). Sundar et al. [18] reported a prevalence of 21.5% among 400 school children aged 13-17 years, while Ujunwa et al. [19] found a prevalence of 5.4% among 2694 school children aged 10-19 years. Mujumdar et al. [20] reported a prevalence of 2.42% in school children aged 6-15 years, with 2.4% in females and 2.3% in males. The prevalence of hypertension in the present study falls within the range of 2.42% to 21.5%, which may be attributed to different geographical regions and societies in which the studies were conducted.

Of the 300 children, 249 were boys and 51 were girls. The prevalence of HTN in girls (7, 13.72%) was higher than in boys (25, 10%). Similar findings were reported by Ujunwa et al. [19] and Sundar et al. [18].

The present study found a significant association between body mass index (BMI) and HTN, with a higher prevalence observed in obese and overweight children. Sundar et al. [18] reported a prevalence of HTN in 52.17% of 46 overweight students and 56.25% of 15 obese students. This finding is consistent with the present study and suggests that the prevalence of HTN is higher in obese and overweight students compared to normal or underweight children.

The present study also found a significant association between obesity and socioeconomic status (SES), with a higher prevalence of overweight and obesity observed in the higher SES group. This finding is consistent with that reported by Sakeenabi et al. [21].

Hasan et al. [12] studied malnutrition in school children aged 5-14 years and found an overall prevalence of 52% (260 out of 500), with no significant difference in prevalence among boys and girls (53.85% in boys and 49.25% in girls). Similarly, Saluja et al. [14] reported a prevalence of 49.5% (396 out of 800) with no significant difference in prevalence among boys and girls (48.82% in boys and 50.26% in girls). These findings are consistent with those of the present study.

Of the 133 malnourished children in the present study, 84 (63.16%) were classified as having grade I malnutrition, 37 (27.82%) had grade II malnutrition, and 12 (9.02%) had grade III malnutrition. Similar findings were reported by Saluja et al. [14], Shakya et al. [22], and Kumari [15].

Out of 215 malnourished children, 104 (34.67%) children were anaemic and out of 85 well-nourished children 19 (6.33%) were anaemic. Chi square test revealed significant association between anaemia and nutritional status of school children ($p< 0.0001$). It may be due to poor nutritional intake in general and low intake of iron containing food in specific in malnourished children, which may be due to unacceptability, ignorance or unavailability of such food.

5. Conclusion

The study findings suggest that higher socioeconomic status was associated with a higher prevalence of hypertension in children. Furthermore, the prevalence of hypertension was found to be higher in children who were overweight or obese. Additionally, the results indicate that undernourished children were more likely to be anaemic. These findings may be influenced by various factors, including the literacy status of parents and socioeconomic status of the family. Further research is needed to better understand the underlying mechanisms contributing to these associations and to inform interventions to address these health issues in children.

Author Contributions: All authors contributed equally to the writing of this paper. All authors read and approved the final manuscript.

Conflicts of Interest: "Authors declare that they do not have any conflict of interests."

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