

Original Article

Heat-Related Health Problems Among School Children in Rural Maharashtra - A Cross-sectional Study

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A B S T R A C T

Background: In comparison to adults, children are more susceptible to climatic and environmental shocks due to a variety of factors, including physical and physiological vulnerability. It is common for children to get health problems during summer as their immune system is still developing. In view of this, the study was planned among school students to assess the impact of heat on their health.

Methodology: The present cross-sectional study was conducted in a rural area among school children. All the students studying in the first standard to the tenth standard were included in the study by using purposive sampling technique. The relevant data and clinical examination findings were recorded in predesigned and pretested proforma. The data was analysed with the help of suitable statistical methods.

Results: 420 students were included in the study of which 242 (57.62%) were boys and 178 (42.38%) were girls. 161 (38.33%) subjects were in the age group of 9–12 years. 45.71% of the students spend more than an hour in the sun daily. 95.54% of the students do not use any sun protective measures while going out. 47.60% of students had skin problems related to sun exposure. 70.00% of students were consuming water less than or equal to 2 litres in a day. 20.00% had experienced health problems related to summer including urinary tract infections, conjunctivitis, and skin rashes.

Conclusion: The harmful impacts of hot climate during the summer season include everything from minor illnesses to fatalities. However, fortunately, most of these can be prevented by taking basic precautions like using sun protection measures and staying well hydrated.

Keywords: School Students, Heat-Related Illness, Summer Season

Introduction

Climate change will cause global temperatures to rise in the twenty-first century, as well as an increase in the frequency and severity of heat waves. Long-term exposure to high daytime and nocturnal temperatures puts the body under cumulative physiological stress, exacerbating the top global causes of death, such as diabetes mellitus, kidney illness, and respiratory and cardiovascular disorders. Heatwaves can have a severe short-term effect on huge populations, frequently result in public health emergencies, increase mortality, and have cascading socioeconomic effects.¹ Summer season is not only attributed to extreme heat and temperature but also to increased risk of various illnesses. It is common for children to have health problems during summer as their immune system is not fully developed. Children are the most vulnerable group and might suffer even life-threatening effects from a broad spectrum of summer-related illnesses. Rising average air temperatures will result in more cases of heat-related illnesses, with nearly half of those cases being children, according to specialists. There are two main causes for this. The first one is that children depend on adults to protect them from overheating and the second one is that their bodies have more difficulty in regulating their body temperature than adults.²

Heat-related illnesses include a wide spectrum ranging from mild prickly heat to fatal heat stroke. Less severe types of heat illness improve with rest, fluids, and departure from hot surroundings. Early detection is crucial for the treatment of heat exhaustion and heatstroke, requiring immediate cooling and fluid resuscitation.³ In addition to heat-related illnesses, children are also prone to diseases like urinary tract infection, conjunctivitis and diarrheal diseases. These diseases are related to inadequate or unhygienic water intake too. Children who are very keen to play out in the sun usually fail to meet the water requirement of the body, which is more in the summer season than other climatic conditions. Limited access to clean water and the lack of awareness regarding proper hydration practices contribute to the prevalence of dehydration. The summer months also coincide with a surge in vector activity, leading to a heightened risk of diseases such as malaria, dengue, and Chikungunya fever. Children, with their often unpredictable outdoor activities, become susceptible to mosquito bites, exposing them to these potentially severe illnesses. The health impacts extend beyond the physical realm, affecting a child's education. Sick children are more likely to miss school, leading to academic setbacks and hindering their overall development.

Heat illness is a spectrum of illnesses from heat cramps to heat stroke. Mortality for heat stroke ranges from 17% to 70%, depending on the severity and age of the

patient. Children are more susceptible to heat illness than adults for many reasons.⁴ In view of this, the study was planned among private primary and secondary school students in rural areas in Maharashtra to assess their age and gender distribution, duration of exposure to the sun, morbidity pattern among them, daily water consumption, and use of sun protective measures. At the same time, the association between said variables and morbidity among them was also tested. Parents should know about how to prevent and control heat-related illness among their children who are attending school. Health education and communication have a great role in this issue. A few recommendations are also suggested to promote, maintain and protect the health of the students during the summer season. Primary school children, in particular, are the most vulnerable to extreme weather conditions, such as heat waves intensifying due to climate change. This will adversely impair their development, well-being and learning outcomes. Significant research gaps exist in understanding and mitigating children's vulnerabilities to heat waves. This study will definitely address some gaps and will help to understand the impact of heat waves on children's health and well-being.

Materials and Methods

The present descriptive cross-sectional study was conducted among private school students in a rural area in Maharashtra in the month of March 2023. Necessary permissions were obtained before conducting the study. All the students from the first standard to the tenth standard were included in the study using purposive sampling method. Inclusion and exclusion criteria were defined. A total of 420 students were there in the school at the time of the study. Consent was obtained from students as well as from their parents. The subjects were examined clinically. The students and their parents both were interviewed regarding the history of any illnesses in the past one month, their water drinking habits and exposure to the sun. The socio-demographic characteristics of the subjects were recorded. Data was entered in a predesigned and pretested proforma. The data obtained was entered in a Microsoft Excel sheet and statistical analysis was done using the chi-square test. The statistical level of significance is fixed at $p < 0.05$. The data is represented in tables. The results of this study were compared with other similar studies. The study subjects and parents were educated about the consumption of adequate drinking water, avoiding outdoor activities during excessive heat, using sun protective measures while going out and availing timely medical advice.

Results

420 students were included in the study, of which 242 (57.62%) were boys and 178 (42.38%) were girls. The majority i.e., 161 (38.33%), were in the age group of 9–12

years. The age and genderwise distribution of the subjects is shown in Table 1.

All the students were exposed to the sun, of which 192 (45.71%) were exposed to the sun for more than one hour daily while 228 (54.29%) were exposed for less than or equal to one hour. Of the 192 subjects exposed to the sun for more than one hour daily, 115 (59.90%) were boys and 77 (40.10%) were girls ($p = 0.38$) (Table 2).

Among 420 subjects exposed to the sun daily, 84 (20.00%) suffered from one or more health problems during the last one month. Of the 192 subjects exposed to sun for more than one hour daily, 40 (20.83%) were morbid while of the

228 subjects exposed to sun for less than or equal to one hour daily, 44 (19.30%) were morbid. The distribution of morbid subjects based on the duration of exposure to the sun is shown in Table 3.

The most common summer-related morbidity observed was skin rashes (47.60%), followed by urinary tract infections (21.42%) and gastrointestinal problems (21.42%). The distribution is shown in Table 4.

Of the 420 subjects, 294 (70.00%) were consuming water less than or equal to 2 litres every day and 126 (30.00%) were consuming more than 2 litres daily ($p = 0.005$). The distribution is shown in Table 5.

Table 1. Age and Genderwise Distribution of the Subjects

(N = 420)

Age Groups (Years)	Boys	Girls	Total
5–8	75 (30.99)	57 (32.02)	132 (31.43)
9–12	91 (37.60)	70 (39.32)	161 (38.33)
13–16	76 (31.41)	51 (28.66)	127 (30.24)
Total	242 (57.62)	178 (42.38)	420 (100.00)

Table 2. Distribution of the Subjects According to Gender and Duration of Exposure to Sun

(N = 420)

Variables	Duration of Exposure to Sun	
	> 1 Hour n (%)	< 1 Hour n (%)
Boys	115 (59.90)	127 (55.70)
Girls	77 (40.10)	101 (44.30)
Total	192 (45.71)	228 (54.29)

Chi-square value = 0.75, p value = 0.38

Table 3. Distribution of the Subjects According to Daily Exposure to Sun and Morbidity Status

(N = 420)

Duration of Exposure to Sun	Morbid Subjects n (%)	Non-morbid Subjects n (%)
> 1 Hour (n = 192)	40 (20.83)	152 (79.17)
< 1 Hour (n = 228)	44 (19.30)	184 (80.70)
Total	84 (20.00)	336 (80.00)

Chi-square value = 0.153, p value = 0.70

Table 4. Pattern of Heat-related Illnesses Among the Subjects in the Last One Month

(N = 84)

Heat-related Illness	Frequency	Percentage
Skin diseases	40	47.60
Gastrointestinal diseases	18	21.42
Urinary tract infections	18	21.42
Conjunctivitis	3	3.57
Fatigue	14	16.66

Table 5. Distribution of the Subjects According to Gender and Daily Water Consumption

(N = 420)

Quantity (Liter)	Boys	%	Girls	%	Total	%
1	50	11.90	43	10.23	93	22.14
2	103	24.52	98	23.33	201	47.86
3	64	15.23	28	6.67	92	21.90
> 3	25	5.95	9	2.14	34	8.09
Total	242	57.62	178	42.38	420	100.0

Chi-square value = 12.813, p value = 0.005

Table 6. Association of Morbidity with Daily Water Consumption

(N = 420)

Morbidity	Water (< 2 Litres)	%	Water (> 2 Litres)	%	Total
Present	48	57.14	36	42.86	84
Absent	246	73.21	90	26.79	336
Total	294	70.00	126	30.00	420

Chi-square = 8.26, p value < 0.05

Table 7. Association of Morbidity with Usage of Sun Protective Measures

(N = 420)

Morbidity	Using Sun Protective Measures	%	Not Using Sun Protective Measures	%	Total
Present	9	10.71	75	89.29	84
Absent	15	4.46	321	95.54	336
Total	24	5.71	396	94.29	420

Chi-square value = 4.8, p value = 0.02

Of the 84 morbid subjects, 48 (57.14%) were drinking water \leq 2 litres while 36 (42.86%) were drinking water > 2 litres per day ($p < 0.05$). The distribution is shown in Table 6.

Of the 420 students, 24 (5.71%) were using sun protective measures while 396 (94.29%) were not using sun protective measures. Of the 84 subjects with morbidity, 9 (10.71%) were using sun protective measures, while 75 (89.29%) were not using them. Of the 336 subjects with no morbidity, 15 (4.46%) were using sun protective measures and 321 (95.54%) were not using them. The difference is statistically significant ($p < 0.05$) (Table 7).

Discussion

In the present study in rural Maharashtra, it is observed that all the students were getting exposed to the sun, of which 45.71% were exposed to the sun for more than one

hour daily while 54.29% were exposed for less than or equal to one hour. Of the subjects exposed to the sun for more than one hour daily, 59.90% were boys and 40.10% were girls. It is also observed that 20.00% of subjects suffered from one or more health problems during the last one month. Of the subjects exposed to the sun for more than one hour daily, 20.83% were morbid while of the subjects exposed to the sun for less than or equal to one hour, 19.30% were morbid.

The most common heat-related morbidity observed in this study was skin rashes (47.60%), followed by Urinary tract infections (21.42%) and gastrointestinal problems (21.42%). Kad and Kumbhar⁵ in their study in Pune city, observed that 32.7% of subjects were suffering from skin rashes, whereas in our study the same health problem was there among 47.60% of subjects. In the present study, it

is observed that 20% of subjects reported one or more health problems while the above study mentioned that only 25.50% of subjects were healthy during the summer season.

In a study conducted in South Korea,⁶ it was found that extreme heat was associated with a 22% increase in emergency department visits among children. Magnus and Canares⁷ in their study, observed that, being generally deconditioned, being dehydrated, or recovering from a recent illness are all risk factors for exertional heat illness. In our study too, inadequate daily consumption of water is significantly associated with summer-related illnesses. Hypohydration is one of the causes of heat illnesses among school children. Similarly, reduced water intake is found to be significantly associated with summer illness, in our study. Lala and Hagishima⁸ in their survey among primary school teachers in India observed, 84% of the teachers said they reminded students to regularly drink water and stay hydrated.

In our study, it is observed that of the 84 subjects with morbidity, 9 (10.71%) were using sun protective measures while 75 (89.29%) were not using them. Of the 336 subjects with no morbidity, 15 (4.46%) were using sun protective measures and 321 (95.54%) were not using them ($p < 0.05$). Ahmed et al.⁹ observed quite a high burden of diarrhoeal disease in Kashmir and mentioned that the seasonal pattern of diarrheal disease resembles that found in studies across India. Heat-related illnesses occur due to exposure to high environmental temperatures in conditions in which an organism is unable to maintain adequate homeostasis. Heat-related illness is largely preventable.¹⁰

Global climate change is inevitable. The world is already witnessing extreme weather events. Among them, heat waves are projected to increase in number, intensity and duration in the near future. In India, a significant number of deaths take place every year due to heat-related illnesses. All these deaths are largely preventable. Informing the people on the preventive actions to be taken, reporting early to health care facility, timely diagnosis and complete treatment, would reduce the morbidity and mortality attributable to heat waves.¹¹

Conclusion

In the present study, it was observed that 20.00% of the students had suffered from heat-related illness. The most common ailment was skin problems. Daily drinking water consumption of students was less than or equal to 2 litres in the case of 70.00% of the students. There was a significant association between the prevalence of heat-related illnesses and not usage of sun protective measures as well as reduced daily consumption of drinking water. School children routinely get exposed to the sun during

the summer season, due to which they are vulnerable to various diseases. Basic precautions like using sun protection measures and staying well hydrated can help to overcome these health issues. Health education to parents to restrict sun exposure as well as to ensure adequate water and fluid intake in children during summer is essential. Compulsory water breaks in school should be practised. Reducing outdoor school activities in the hot sun will help to protect the health of the school children.

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