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Original Research Article

Prevalence and Risk Factors Associated with Headache in School Going Children Aged 10-16 Years - A Cross-Sectional Study

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ABSTRACT

Background: Headache is one of the most common neurological complaints among school-going children and adolescents and poses a significant public health concern. Recurrent headaches can adversely affect academic performance, school attendance, cognitive functioning, and overall quality of life. Despite its high occurrence, data on prevalence and contributory risk factors among Indian school children remain limited.
Aim: To determine the prevalence of headache among school going children aged 10-16 years.
Materials and method: A school-based cross-sectional study was conducted among 1,025 students aged 10–16 years in selected schools of Puducherry. Participants were selected using convenience sampling after obtaining parental consent and child assent. Data were collected using a pretested structured questionnaire covering demographic characteristics, headache profile, associated symptoms, and lifestyle factors. Headache severity was assessed using the Wong–Baker FACES Pain Rating Scale. Statistical analysis was performed using SPSS version 26. Associations were evaluated using the Chi-square test, and independent predictors were identified using multivariate logistic regression. A p-value <0.05 was considered statistically significant.
Results: The overall prevalence of headache was 55.9%. Although age and gender alone were not significantly associated with headache, a significant age–gender interaction was observed ($p <0.001$). Most headaches began between 6 and 9 years of age and were predominantly mild to moderate in intensity. Difficulty in reading the blackboard, reduced outdoor play, short sleep duration, and prolonged mobile phone use were significantly associated with headache. Multivariate analysis identified visual difficulty, reduced physical activity, short sleep duration, and moderate to high mobile phone usage as independent risk factors, while certain parental working patterns showed a protective effect.
Conclusion: Headache is highly prevalent among school-going children and is strongly influenced by modifiable lifestyle and environmental factors. Early screening and preventive

strategies focusing on sleep hygiene, visual health, regulated screen time, and physical activity are essential to reduce the burden of headache in this population.

Keywords: Headache, School-going children, Prevalence, Risk factors, Lifestyle factors

INTRODUCTION

Headache is among the most prevalent health complaints and most frequently reported neurological complaints among children and adolescents and represents an important public health concern during the school-going children. It can substantially affect cognitive performance, school attendance, and overall quality of life. Although often considered a benign symptom, recurrent headache in children can significantly interfere with academic performance, concentration, school attendance, and participation in daily activities. Studies suggest that approximately 65–75% of school-aged children experience at least one headache episode. Despite pediatricians and parents recognizing that headaches represent a significant health concern in this population, the exact prevalence and factors contributing to their occurrence remain incompletely understood. Primary headaches, such as migraine (2–17%) and tension-type headache (0.9–24%), are commonly reported, while secondary headaches may arise from various other risk factors (1). The female-to-male ratio was 1.5:1 for all types of headaches and 1.7:1 specifically for migraines. Secondary headaches, which are linked to underlying medical conditions, were found to be uncommon among children with recurrent headaches (2). In India, migraine is considered the leading cause of primary headache in school children, with prevalence estimates ranging from 10% to 20% (3). The impact of headache extends beyond the affected child, contributing to parental anxiety, increased healthcare utilization, and reduced quality of life.

The prevalence of headache tends to increase with age during childhood and adolescence, with a noticeable rise during the early teenage years. Both primary headache disorders, such as tension-type headache and migraine, and secondary headaches related to infections, visual strain, or psychosocial stressors are commonly encountered in this age group (4,5). School-aged children are particularly vulnerable due to multiple biological, psychological, and environmental influences that coincide with periods of rapid physical growth and cognitive development. Additionally, children with a family history of migraine are at a higher risk of developing similar headaches themselves (4). Psychosocial aspects, such as insecure attachment, may also manifest as somatic complaints, including headache, potentially as a means to elicit parental attention and care (6). Lifestyle factors, including excessive screen time, have emerged as notable contributors, with approximately 18% of school-going children being affected (7,8). Sleep disturbances, including insufficient or poor-quality sleep, are both risk factors for and consequences of headaches, with children suffering from migraines often demonstrating greater sleepiness and reduced sleep quality (9).

When primary headaches are not adequately recognized or diagnosed, children may rely more frequently on analgesics, which can increase the likelihood of habitual use into adulthood (10,11). Early and comprehensive evaluation is therefore critical to achieve accurate diagnosis, guide appropriate management, and reduce the impact of headaches on the child's daily functioning and quality of life. This study aims to assess the prevalence of headache and identify associated risk factors among school children aged 10–16 years.

MATERIALS & METHODS

A cross-sectional study was conducted among school-going children aged 10–16 years in selected schools of Puducherry over a period of 18 months, from August 2023 to February 2025. The objective of this study was to determine the risk factors associated with headache in school going children aged 10 -16 years. Ethical permission was obtained with ethical approval number IHEC No: AV/IHEC/2024/084 from the institutional Human Ethics Committee of Aarupadai Veedu Medical College and Hospital in Kirumampakam, Puducherry and along with necessary permissions from the Puducherry education department and school authorities. A total of 1025 students, including both boys and girls, were enrolled using convenience sampling. The sample size of 1025 was calculated based on a previous study by Sinha R et al. in 2023, assuming an expected headache prevalence of 60%, with an absolute precision of 3% and a 5% level of significance, using the formula for estimation of a single proportion (3). Children aged 10–16 years studying in the selected schools whose parents or guardians provided written informed consent and who gave assent were included. Children with known intracranial tumors, dental disorders, febrile illness at the time of study, or other systemic illnesses causing secondary headache were excluded. Data were collected using a pretested, self-designed structured questionnaire administered to students with parental assistance. The questionnaire captured demographic details, headache characteristics, associated symptoms, functional impact, and potential risk factors. Headache severity was assessed using the Wong–Baker FACES Pain Rating Scale. Completed questionnaires were verified for completeness and consistency, and the collected data were compiled and analyzed.

Statistical Analysis

To analyse the data SPSS (IBM SPSS Statistics for Windows, Version 26.0, Armonk, NY: IBM Corp. Released 2019) is used. The Normality tests, Kolmogorov-Smirnov and Shapiro-Wilks tests results revealed that the data follows normal distribution. Therefore, to analyse the data, parametric test was applied. Descriptive statistics determined the frequency, percentage, mean and standard deviation for the variables. The association between categorical variables, including headache status with sociodemographic characteristics, clinical features, and lifestyle factors, was evaluated using the Chi-square test. To identify independent predictors of headache, variables found to be significant on bivariate analysis were entered into a multivariate logistic regression model, and results were expressed as adjusted odds ratios with 95% confidence intervals. Significance level is fixed as 5% ($\alpha = 0.05$). P-value <0.05 was considered statistically significance.

RESULT

A total of 1,025 school-going children aged 10–16 years participated in the study, with a mean age of 12.97 ± 2.02 years and equal gender representation. Overall, headache was reported by 55.9% of participants. The prevalence of headache did not differ significantly across age groups or between genders; however, a significant interaction between age group and gender was observed, with females reporting a higher prevalence in the 10–12 and 12–14-year age groups, while males predominated in the 14–16-year group ($p < 0.001$). Most headaches had an onset between 6 and 9 years of age and were characterized by variable frequency, commonly occurring 1–6 times per week. Occipital, bilateral, and frontal headache locations were almost equally reported, with dull pain being the most frequent nature. Headache episodes often lasted more than one hour and were predominantly of mild to moderate intensity, though severe headaches were also reported. Family type and family history of headache were not significantly associated with headache prevalence. Living arrangement showed a borderline association, while parental working status demonstrated a significant association, with children having only the mother working or both parents working showing lower odds of headache compared to those with only the father working ($p < 0.003$). Lifestyle factors showed strong associations with headache:

difficulty in reading the blackboard, reduced outdoor play, prolonged mobile phone use, and short sleep duration were significantly linked to higher headache prevalence. Children sleeping less than 7 hours and those using mobile phones for more than 4 hours daily had markedly higher odds of headache ($p < 0.001$). Multivariate logistic regression identified difficulty in reading the blackboard, reduced outdoor play, short sleep duration, and moderate to high mobile phone use as independent predictors of headache, while certain parental working patterns showed a protective effect.

PART A: Sociodemographic Profile, Prevalence, and Clinical Characteristics of Headache among Study Participants (n = 1025)

Table 1: Frequency and Percentage Distribution of Sociodemographic Characteristics among Study Participants

	Frequency	**Percentage**
Age in years	12.97 years (mean)	2.017 (SD)
Age group (years)		
10–12 years	448	43.7
12–14 years	298	29.1
14–16 years	279	27.2
Gender		
Male	513	50.0
Female	512	50.0
Types of family		
Joint	490	47.8
Nuclear	535	52.2
Types of Living		
Both parents	367	35.8
Grandparents	325	31.7
Single parent	333	32.5
Working parent		
Father	348	34.0
Mother	346	33.8
Both	331	32.3
Family history of headache		
Yes	397	38.7
No	628	61.3

Table 1 presents the frequency and percentage distribution of the sociodemographic characteristics of the study participants. The mean age of the participants was 12.97 ± 2.02 years, reflecting a predominance of early to mid-adolescence. The highest proportion of participants belonged to the 10–12-year age group (43.7%), followed by those aged 12–14 years (29.1%) and 14–16 years (27.2%). Gender distribution was equal, with males and females each accounting for 50% of the study population. Slightly more participants were from nuclear families (52.2%) compared to joint families (47.8%). Regarding living arrangements, 35.8% resided with both parents, while comparable proportions lived with grandparents (31.7%) or with a single parent (32.5%). The working status of parents was evenly represented, with fathers, mothers, and both parents working in 34.0%, 33.8%, and 32.3% of cases, respectively. A family history of headache was reported by 38.7% of participants, whereas 61.3% reported no such history.

Table 2: Prevalence of age group and gender distribution among headache according to study participants

Variables	Headache				Odds ratio	95% Confidence interval	Chi square value	P value
	Yes		No					
Age group (years)								
10–12 years	259	45.2	189	41.8	1.00 (Reference)	–	1.667	0.434
12–14 years	158	27.6	140	31.0	0.82	0.64 – 1.05		
14–16 years	156	27.2	123	27.2	0.92	0.71 – 1.19		
Gender								
Male	298	52.0	215	47.6	0.925	0.829-1.031	1.993	0.158
Female	275	48.0	237	52.4	1.104	0.962-1.268		

Table 2 presents the age group and gender distribution of headache among the study participants. The highest proportion of headache was observed in the 10–12 years age group (45.2%), followed by the 12–14 years (27.6%) and 14–16 years (27.2%) age groups; however, the association between age group and headache was not statistically significant ($\chi^2 = 1.667$, $p = 0.434$). Taking the 10–12 years age group as the reference, participants aged 12–14 years showed lower odds of headache (OR = 0.82; 95% CI: 0.64–1.05), and those aged 14–16 years also demonstrated no significant difference (OR = 0.92; 95% CI: 0.71–1.19). With regard to gender, headache was reported by 52.0% of males and 48.0% of females. The difference in headache prevalence between males and females was not statistically significant ($\chi^2 = 1.993$, $p = 0.158$), and the odds of headache were comparable between males (OR = 0.93; 95% CI: 0.83–1.03) and females (OR = 1.10; 95% CI: 0.96–1.27), indicating that neither age nor gender had a significant influence on headache occurrence in the study population.

Table 3: Frequency and percentage Distribution of Age at Onset and Clinical Characteristics of Headache among Study Participants

	Frequency	Percentage
Age at onset		
6-9 years	323	31.5
10-12 years	198	19.3
13–16 years	52	5.1
Frequency/Week		
1–2 episodes	185	18.0
3–4 episodes	194	18.9
5–6 episodes	194	18.9
Site of headache		
Bilateral	194	18.9
Frontal	183	17.9
Occipital	196	19.1
Nature of headache		
Dull	208	20.3
Pulsating	183	17.9
Tight band	182	17.8
Duration of headache		
<30 min	168	16.4
>1 hr	215	21.0
30-60 min	190	18.5
Intensity of headache		
Mild	212	20.7
Moderate	176	17.2
Severe	185	18.0

Table 3 summarizes the age at onset and key clinical characteristics of headache among the study participants. Headache onset was most commonly reported between 6 and 9 years of age (31.5%), while fewer participants reported onset during early adolescence (10–12 years: 19.3%) and late adolescence (13–16 years: 5.1%). In terms of frequency, headaches were experienced almost equally as 1–2 episodes per week (18.0%), 3–4 episodes per week (18.9%), and 5–6 episodes per week (18.9%). The site of headache varied, with occipital (19.1%), bilateral (18.9%), and frontal (17.9%) locations being nearly equally represented. Regarding the nature of pain, dull headache was the most frequently reported type (20.3%), followed by pulsating (17.9%) and tight band–like pain (17.8%). The duration of headache episodes showed variability, with a higher proportion lasting more than one hour (21.0%), while others lasted 30–60 minutes (18.5%) or less than 30 minutes (16.4%). Concerning intensity, mild headache was most common (20.7%), though moderate (17.2%) and severe (18.0%) intensities were also frequently reported, indicating a broad spectrum of headache severity among the participants.

Table 4: Association between Age group and gender of Headache among Study Participants

Age group (years)	Gender				Chi square value	P value
	Male		Female			
10–12 years	207	40.4	241	47.1	16.989	<0.001*
12–14 years	137	26.7	161	31.4		
14–16 years	169	32.9	110	21.5		

Table 4 shows the association between age group and gender among study participants with headache. In the 10–12-year age group, headache was more frequently reported among females (47.1%) than males (40.4%). Similarly, in the 12–14-year group, females (31.4%) reported a higher proportion of headaches compared to males (26.7%). In contrast, in the 14–16-year age group, males (32.9%) had a higher prevalence of headache than females (21.5%). The association between age group and gender was statistically significant (p < 0.001), indicating that headache distribution varies meaningfully by gender across different age groups in the study population.

Table 5: Association of Family and Living Factors with Headache Prevalence among Participants

Variables	Headache		Odds ratio	95% Confidence interval	Chi square value	P value
	Yes	No				
Types of family						
Joint	274 (47.8%)	216 (47.8%)	0.999	0.871-1.147	0.000	1.000
Nuclear	299 (52.2%)	236 (52.2%)	1.001	0.897-1.116		
Types of Living						
Both parents	223 (38.9%)	144 (31.9%)	1.00 (Reference)	–	5.510	0.06
Grandparents	174 (30.4%)	151 (33.4%)	0.74	0.56 – 0.97		
Single parent	176 (30.7%)	157 (34.7%)	0.72	0.55 – 0.95		
Working parent						
Father	219 (38.2%)	129 (28.5%)	1.00 (Reference)	–	11.760	0.003*
Mother	188 (32.8%)	158 (35.0%)	0.70	0.53 – 0.92		
Both	166 (29.0%)	165 (36.5%)	0.59	0.45 – 0.78		

Family history of headache						
Yes	225 (39.3%)	172 (38.1%)	0.978	0.875-1.093	0.157	0.699
No	348 (60.7%)	280 (61.9%)	1.029	0.893-1.187		

Table 5 depicts the association between family- and living-related factors and headache prevalence among the study participants. Type of family did not show any association with headache, as equal proportions of participants from joint and nuclear families reported headache, with nearly identical odds between the two groups (OR = 0.99; 95% CI: 0.87–1.15; χ^2 = 0.000, p = 1.000). With respect to living arrangements, participants living with both parents were taken as the reference group. Although a higher proportion of headache was observed among those living with both parents (38.9%), the overall association between type of living and headache did not reach statistical significance (χ^2 = 5.510, p = 0.06). However, participants living with grandparents (OR = 0.74; 95% CI: 0.56–0.97) and those living with a single parent (OR = 0.72; 95% CI: 0.55–0.95) showed lower odds of headache compared to those living with both parents. A statistically significant association was observed between working parent status and headache prevalence (χ^2 = 11.760, p = 0.003). Compared to participants whose father alone was working, those whose mother alone was working (OR = 0.70; 95% CI: 0.53–0.92) and those with both parents working (OR = 0.59; 95% CI: 0.45–0.78) had significantly lower odds of headache. Family history of headache was not significantly associated with headache prevalence (χ^2 = 0.157, p = 0.699), indicating no meaningful influence of this factor on headache occurrence in the study population.

PART B: Clinical Profile, Lifestyle Factors, and Determinants of Headache Among Study Participants

Table 6: History of headache among study participants

	Frequency	Percentage
Headache		
Yes	573	55.9
No	452	44.1
Any Injury		
Yes	75	7.3
No	498	48.6
Headache after injury		
Yes	36	3.5
No	537	52.4
When it is more		
School days	171	20.6
Holidays	191	18.6
Both	211	20.6
Time of the headache day		
Day	199	19.4
Morning	193	18.8
Night	181	17.7
Leave due to headache		
Yes	315	30.7
No	258	25.2

Table 6 presents the history of headache among the study participants. Overall, more than half of the participants (55.9%) reported experiencing headaches, while 44.1% did not. A small proportion reported having any injury (7.3%), and only 3.5% experienced headache following an injury, indicating that most headaches were unrelated to trauma. Headaches occurred slightly more frequently during school days (20.6%) and both school days and holidays (20.6%) compared to holidays alone (18.6%). Regarding the timing of headache episodes, occurrences were distributed throughout the day, with 19.4% during the day, 18.8% in the morning, and 17.7% at night. Additionally, 30.7% of participants reported taking leave from school due to headache, highlighting the impact of headaches on daily activities and school attendance.

Table 7: Symptoms and relieving factors of headache among study participants

	Frequency	Percentage
Symptoms before Headache		
None	210	20.5
Numbness	179	17.5
Visual	184	18.0
Symptoms during Headache		
None	202	19.7
Photophobia	174	17.0
Vomiting	197	19.2
Reason for headache		
Eye problem	140	13.7
Screen	121	11.8
Sleep	186	18.1
Stress	126	12.3
Relieving factors		
Medicine	174	17.0
Rest	177	17.3
Sleep	222	21.7
Headache awakens sleep		
Yes	268	26.1
No	305	29.8

Table 7 describes the symptoms and relieving factors associated with headache among the study participants. Before the onset of headache, 20.5% of participants reported no symptoms, while numbness and visual disturbances were reported by 17.5% and 18.0%, respectively. During headache episodes, 19.7% experienced no additional symptoms, whereas vomiting (19.2%) and photophobia (17.0%) were commonly reported. Participants identified several possible triggers or reasons for their headaches, with inadequate sleep being the most frequent (18.1%), followed by eye problems (13.7%), stress (12.3%), and prolonged screen use (11.8%). Sleep was the most commonly reported factor that relieved headache (21.7%), followed by rest (17.3%) and medication (17.0%). Additionally, 26.1% of participants reported that headaches disrupted their sleep, while 29.8% did not experience sleep disturbance. These findings suggest that headaches among the participants are associated with a range of prodromal and concurrent symptoms and are influenced by lifestyle and visual factors.

Table 8: Visual-related factors associated with headache among study participants

	Headache		Odds ratio	95% Confidence interval	Chi square value	P value
	Yes	No				
Spectacles use						
Yes	283 (49.4%)	227 (50.2%)	1.015	0.910-1.131	0.070	0.802
No	290 (50.6%)	225 (49.8%)	0.982	0.855-1.127		
Years of Spectacles use						

No	290 (50.6%)	225 (49.8%)	1.00 (Reference)	–	3.434	0.488
1 year	55 (9.6%)	49 (10.8%)	0.87	0.57 – 1.34		
2 years	126 (22.0%)	108 (23.9%)	0.91	0.67 – 1.23		
3 years	53 (9.2%)	29 (6.4%)	1.42	0.87 – 2.31		
4 years	49 (8.6%)	41 (9.1%)	0.93	0.60 – 1.46		
Difficulty in reading blackboard						
Yes	305 (53.2%)	187 (41.4%)	0.811	0.727-0.905	14.232	0.001*
No	268 (46.8%)	265 (58.6%)	1.308	1.136-1.507		

Table 8 presents the association between visual-related factors and headache among the study participants. Spectacle use was not significantly associated with headache, as nearly equal proportions of participants with and without headache were spectacle users, with comparable odds between users and non-users (OR = 1.02; 95% CI: 0.91–1.13; χ^2 = 0.070, p = 0.802). Similarly, the duration of spectacle use did not show a statistically significant association with headache prevalence (χ^2 = 3.434, p = 0.488), and the odds of headache remained similar across different years of spectacle use when compared with those not using spectacles, indicating the absence of a duration-dependent effect. In contrast, difficulty in reading the blackboard demonstrated a statistically significant association with headache (χ^2 = 14.232, p = 0.001). Participants reporting difficulty in reading the blackboard had a higher prevalence of headache (53.2%) and significantly greater likelihood of headache compared to those without such difficulty, suggesting that visual strain due to uncorrected or inadequately corrected distance vision is an important factor associated with headache among the study population.

Table 9: Physical Activity, and Sports Participation in Relation to Headache Among Study Participants

	Frequency	Percentage
Physical activity increases headache		
Yes	273	26.6
No	300	29.3
Hours of outside play		
<2 hours	513	50.0
>2 hours	512	50.0
Is Sports affected		
Yes	278	27.1
No	295	28.8

Table 9 presents the relationship between physical activity, and sports participation with headache among the study participants. About 26.6% of participants reported that physical activity worsened their headache, while 29.3% did not experience any increase in headache with activity. Regarding sports participation, 27.1% reported that their involvement in sports was affected by headache, whereas 28.8% did not experience any impact. These findings indicate that while a proportion of children experience headache exacerbation related to physical activity or sports, many maintain regular participation, suggesting variability in the influence of physical exertion on headache occurrence.

Table 10: Pattern of Gadget Duration of Outdoor Play Duration, Mobile Phone Usage Among Study Participants

	Headache		Odds ratio	95% Confidence interval	Chi square value	P value
	Yes	No				
Hours of outside play						
<2 hours	262 (45.7%)	251 (55.5%)	0.841	0.753-0.938	9.720	0.002*
>2 hours	311 (54.3%)	201 (44.5%)	1.246	1.084-1.433		
Most Gadget use						
Laptop	206 (36.0%)	173 (38.3%)	1.00 (Reference)	–	1.559	0.459
Mobile	192 (33.5%)	135 (29.9%)	1.19	0.90 – 1.58		
TV	175 (30.5%)	144 (31.9%)	1.02	0.77 – 1.36		
Mobile phone use						
<4 hours	45 (7.9%)	221 (48.9%)	1.00 (Reference)	–	221.526	0.001*
>6 hours	253 (44.2%)	113 (25.0%)	11.00	7.62 – 15.88		
4-6 hours	275 (48.0%)	118 (26.1%)	11.42	7.92 – 16.45		

Table 10 shows the association between duration of outdoor play, pattern of gadget use, and mobile phone usage with headache among the study participants. A statistically significant association was observed between hours of outdoor play and headache prevalence ($\chi^2 = 9.720$, $p = 0.002$). Participants who spent less than 2 hours in outdoor play had a higher prevalence of headache, while those engaging in outdoor play for more than 2 hours showed significantly higher odds of not having headache (OR = 1.25; 95% CI: 1.08–1.43), suggesting a protective effect of longer outdoor activity. The type of gadget most frequently used did not demonstrate a significant association with headache ($\chi^2 = 1.559$, $p = 0.459$), as participants predominantly using mobile phones or television had odds of headache comparable to those using laptops. In contrast, duration of mobile phone use showed a strong and statistically significant association with headache ($\chi^2 = 221.526$, $p = 0.001$). Compared with participants using mobile phones for less than 4 hours, those using phones for 4–6 hours (OR = 11.42; 95% CI: 7.92–16.45) and more than 6 hours (OR = 11.00; 95% CI: 7.62–15.88) had markedly higher odds of headache, highlighting prolonged mobile phone use as a major factor associated with headache in the study population.

Table 11: Sleep Pattern, and Sleep Disturbances Associated with Headache Among Study Participants

	Headache		Odds ratio	95% Confidence interval	Chi square value	P value
	Yes	No				
Sleep time						
<7 hours	200 (34.9%)	92 (20.4%)	1.00 (Reference)	–	26.295	0.001*
>8 hours	158 (27.6%)	155 (34.3%)	0.47	0.34 – 0.65		
7-8 hours	215 (37.5%)	205 (45.4%)	0.48	0.35 – 0.66		
Wake up time						
5-6 AM	185 (32.3%)	152 (33.6%)	1.00 (Reference)	–	1.014	0.602

6-7 AM	188 (32.8%)	135 (29.9%)	1.14	0.85 – 1.54		
After 7 AM	200 (34.9%)	165 (36.5%)	0.99	0.74 – 1.33		

Table 11 presents the association between sleep pattern and headache among the study participants. A statistically significant association was observed between sleep duration and headache prevalence (χ^2 = 26.295, p = 0.001). Participants sleeping for less than 7 hours had a higher prevalence of headache and were taken as the reference group. Those who slept for 7–8 hours and more than 8 hours had significantly lower odds of headache (7–8 hours: OR = 0.48; 95% CI: 0.35–0.66; >8 hours: OR = 0.47; 95% CI: 0.34–0.65), indicating a protective effect of adequate sleep duration against headache. In contrast, wake-up time did not show a statistically significant association with headache occurrence (χ^2 = 1.014, p = 0.602). Compared to participants waking between 5–6 AM, those waking between 6–7 AM (OR = 1.14; 95% CI: 0.85–1.54) and after 7 AM (OR = 0.99; 95% CI: 0.74–1.33) showed no significant difference in headache prevalence. Overall, shorter sleep duration emerged as an important factor associated with headache, while wake-up time did not appear to influence headache occurrence in the study population.

Table 12: Association Between Selected Sociodemographic and Lifestyle Variables and Headache Status Among Study Participants

Variables	Headache				Odds ratio	95% Confidence interval	Chi square value	P value
	Yes		No					
Working Parent								
Father	219	38.2	129	28.5	1.00 (Reference)	–	11.760	<0.003*
Mother	188	32.8	158	35.0	0.70	0.53 – 0.92		
Both	166	29.0	165	36.5	0.59	0.45 – 0.78		
Sleep Time								
<7 hours	200	34.9	92	20.4	1.00 (Reference)	–	26.295	<0.001*
>8 hours	158	27.6	155	34.3	0.47	0.34 – 0.65		
7-8 hours	215	37.5	205	45.4	0.48	0.35 – 0.66		
Mobile phone usage								
<4 hours	45	7.9	221	48.9	1.00 (Reference)	–	221.526	<0.001*
>6 hours	253	44.2	113	25.0	11.00	7.62 – 15.88		
4-6 hours	275	48.0	118	26.1	11.42	7.92 – 16.45		

Table 12 summarizes the association between selected sociodemographic and lifestyle variables and headache status among the study participants. A statistically significant association was observed between working parent status and headache prevalence (χ^2 = 11.760, p < 0.003). Using participants with only the father working as the reference group, those with only the mother working (OR = 0.70; 95% CI: 0.53–0.92) and those with both parents working (OR = 0.59; 95% CI: 0.45–0.78) had significantly lower odds of headache. Sleep duration also showed a strong and significant association with headache (χ^2 = 26.295, p < 0.001), with participants sleeping less than 7 hours having higher headache prevalence. Compared to this group, those sleeping for 7–8 hours (OR = 0.48; 95% CI: 0.35–0.66) and more than 8 hours (OR = 0.47; 95% CI: 0.34–0.65) had significantly reduced odds of headache, indicating a protective effect of adequate sleep. Furthermore, mobile phone usage demonstrated a highly significant association with headache (χ^2 = 221.526, p < 0.001). Participants using mobile phones for

4–6 hours (OR = 11.42; 95% CI: 7.92–16.45) and more than 6 hours (OR = 11.00; 95% CI: 7.62–15.88) had markedly higher odds of headache compared to those using mobile phones for less than 4 hours. Overall, parental working status, insufficient sleep, and prolonged mobile phone use emerged as significant factors associated with headache among the study participants.

Table 13: Multivariate Logistic Regression Analysis Showing Risk Factors Associated with Headache among Study Participants

Variable	Adjusted Odds ratio (AOR)	95% Confidence interval	P value
Difficulty in reading blackboard	1.42	1.06-1.90	<0.01*
Hours of outside play (reduced)	1.61	1.20-2.15	<0.001*
Working parent			
Father only	0.62	0.44-0.88	<0.008*
Mother only	0.52	0.36-0.75	<0.001*
Sleep time			
Short sleep duration	2.96	1.99-4.42	<0.001*
Mobile phone usage			
Moderate usage	13.65	9.01-20.97	<0.001*
High usage	13.51	8.87-20.57	<0.001*

Table 13 presents the multivariate logistic regression analysis identifying independent risk factors associated with headache among the study participants after adjusting for potential confounders. Difficulty in reading the blackboard emerged as a significant predictor of headache, with participants experiencing this difficulty having 1.42 times higher odds of headache (AOR = 1.42; 95% CI: 1.06–1.90; $p < 0.01$). Reduced hours of outdoor play were also independently associated with headache, increasing the odds by 1.61 times (AOR = 1.61; 95% CI: 1.20–2.15; $p < 0.001$). With regard to parental working status, having only the father working (AOR = 0.62; 95% CI: 0.44–0.88; $p < 0.008$) or only the mother working (AOR = 0.52; 95% CI: 0.36–0.75; $p < 0.001$) was associated with significantly lower odds of headache, indicating a protective effect compared to the reference category. Short sleep duration showed a strong independent association with headache, with nearly threefold higher odds observed among participants with inadequate sleep (AOR = 2.96; 95% CI: 1.99–4.42; $p < 0.001$). Additionally, mobile phone use showed the strongest association, with both moderate (AOR = 13.65; 95% CI: 9.01–20.97; $p < 0.001$) and high use (AOR = 13.51; 95% CI: 8.87–20.57; $p < 0.001$) markedly increasing the risk of headache. Overall, visual strain, reduced outdoor activity, insufficient sleep, and prolonged mobile phone use were identified as key independent risk factors for headache in this study.

DISCUSSION

Sociodemographic Profile of the Study Participants

In the present study, the mean age of participants was 12.97 ± 2.02 years, with the majority belonging to the 10–12-year age group (43.7%), followed by the 12–14-year (29.1%) and 14–16-year (27.2%) groups (Table 1). Although headache prevalence was highest in this younger age group, the association between age group and headache was not statistically significant ($p = 0.434$) (Table 2). Similar observations were reported by Abu-Arafeh et al., in 2010 who found that headache prevalence increases with age but does not differ significantly across close adolescent age brackets (10). In contrast, a study by Wöber-Bingöl et al. in 2013 demonstrated a progressive increase in headache prevalence with advancing age, highlighting possible variations related to environmental exposure and academic stress (12).

Gender Distribution and Age–Gender Association of Headache

Gender distribution in the study population was equal (Table 1). Although a slightly higher proportion of males reported headache compared to females, though this difference was not statistically significant ($p = 0.158$) (Table 2). However, when age-specific gender distribution was analyzed, a significant association was observed ($p < 0.001$) (Table 4). Females reporting more headaches in the younger age groups and males predominating in the 14–16-year group. This shifting gender pattern has also been reported by Laurell et al., in 2004 who suggested that hormonal changes, psychosocial stressors, and pubertal development may contribute to gender differences in headache prevalence during adolescence (13). In contrast, Abu-Arafeh and Russell in 1994 reported a consistently higher prevalence of headache among females across all pediatric age groups, with no male predominance even in late adolescence (14).

Prevalence of Headache among Study Participants

More than half of the participants (55.9%) reported experiencing headaches, indicating a high overall prevalence (Table 6). This finding is comparable with previous epidemiological studies, such as those by Arruda et al. in 2010 and Özge et al., in 2003 which documented headache prevalence ranging from 50% to 70% among school-aged children (15,16). In contrast, Nieswand et al in 2020 reported headache prevalence ranging between 20% and 40% in school-aged children, suggesting that methodological differences, recall periods, and diagnostic criteria may substantially influence reported prevalence rates (17).

Age at Onset and Clinical Characteristics of Headache

Regarding clinical characteristics, headache onset most commonly occurred between 6 and 9 years of age (31.5%), indicating that headache often begins in early childhood and persists into adolescence (Table 3). Similar early onset has been reported by Virtanen et al in 2002, who noted that many primary headache disorders originate before adolescence (18). In contrast Donghyun Shin et al in 2025 who noted that many primary headache disorders originate after adolescence (19).

Family Structure, Living Arrangement, and Parental Working Status

The association between headache occurrence and family- and household-related variables is presented in Table 5. No statistically significant association was observed between headache prevalence and type of family (joint vs. nuclear), with nearly identical proportions in both groups (OR = 0.999). Living arrangement showed a borderline association with headache prevalence ($\chi^2 = 5.510$; $p = 0.06$), wherein children living with grandparents (OR = 0.74) or single parents (OR = 0.72) had lower odds of headache compared to those living with both parents. Parental working status demonstrated a statistically significant association with headache occurrence ($p = 0.003$); children with working mothers (OR = 0.70) or with both parents working (OR = 0.59) exhibited significantly lower odds of headache compared to those with only the father working. Family history of headache was not significantly associated with headache prevalence in the present study (OR = 0.978).

Frequency, Site, Nature, Duration, and Intensity of Headache

The frequency of headache episodes was evenly distributed across 1–2, 3–4, and 5–6 episodes per week, reflecting heterogeneity in headache patterns (Table 3). The most commonly reported headache sites were occipital, bilateral, and frontal regions were almost equally involved, while dull-aching pain was the most frequently reported nature of headache, followed by pulsating and tight band-like sensations. These findings are consistent with earlier studies describing tension-type and migraine-like features as the most frequent headache commonly observed in children. Larsson et al in 2022 reported that school-aged children exhibit considerable variability in headache frequency, with many experiencing 1–6 episodes per week, and noted that dull or pressing pain in frontal, bilateral, or occipital regions is commonly reported, reflecting heterogeneous headache patterns similar to the present study (20). In contrast, Baglioni et al in 2023 found a predominance of frontal and bilateral headaches with tension-type characteristics, with occipital involvement being relatively uncommon, highlighting that headache site and pain type can vary by population and methodology (21).

The duration and intensity of headache varied considerably, with a substantial proportion of children reporting episodes lasting more than one hour and experiencing moderate to severe pain (Table 3). Importantly, nearly one-third of participants reported school absenteeism due to headache, emphasizing its significant impact on academic attendance and daily activities (Table 6). It is consistent with the present findings, Szperka et al. in 2021 reported that a substantial proportion of children experienced headaches lasting more than one hour, often of moderate to severe intensity, and that these headaches frequently led to school absenteeism and impaired daily functioning (22). In contrast, Straube et al. in 2013 observed that most headaches in children were short-lasting (<30 minutes) and mild in intensity, with fewer cases resulting in school absenteeism, suggesting that headache severity and functional impact can vary widely between populations (23).

Visual Factors and Headache

Spectacle use and duration of spectacle wear were not significantly associated with headache occurrence, with comparable odds observed among students with and without spectacles (Table 8). In contrast, difficulty in reading the blackboard showed a statistically significant association with headache prevalence (p = 0.001). Students reporting blackboard reading difficulty had higher odds of headache, indicating visual strain as a significant contributing factor (Table 8).

Lifestyle and environmental factors showed strong associations with headache. Difficulty in reading the blackboard was significantly associated with headache, and multivariate analysis confirmed it as an independent risk factor (AOR = 1.42) (Table 13). These supports finding by Thorud et al. in 2021 who reported that uncorrected refractive errors and visual strain contribute substantially to headache in school children (24). Similarly, study by Demir et al in 2019 prolonged mobile phone use demonstrated a very strong association with headache, with both moderate and high usage showing markedly increased odds (25). These results align with study by Devi et al in 2023, who highlighted excessive screen time as a major contributor to headache through mechanisms such as eye strain, poor posture, and sleep disturbance (26).

Lifestyle Factors: Outdoor Activity, Gadget Use, and Mobile Phone Exposure

Reduced hours of outdoor play were significantly associated with headache occurrence, with students engaging in less than two hours of outdoor activity per day showing higher odds of headache (p = 0.002) (Table 10). The type of gadget most frequently used was not significantly associated with headache prevalence. However, duration of mobile phone use demonstrated a strong statistically significant association with headache (p = 0.001), with prolonged screen time markedly increasing the odds of headache, identifying excessive mobile phone use as an important modifiable risk factor (Table 10).

Sleep Pattern and Headache

Sleep duration emerged as a critical determinant of headache. Children sleeping less than seven hours had significantly higher odds of headache (AOR = 2.96), whereas moderate sleep duration showed no significant association (Table 13). Sleep deprivation is a well-recognized trigger for headache, as it alters pain modulation, increases fatigue, and affects emotional regulation. While moderate sleep duration showed no significant association, short sleep duration independently increased headache risk, highlighting the importance of healthy sleep hygiene in adolescents (Table 11). These findings are consistent with research by Baldo et al. in 2025 which emphasized inadequate sleep as a key trigger for pediatric headaches (27). In contrast, study by Vgontzas et al. in 2018 have reported a bidirectional relationship, suggesting that headache itself may disrupt sleep, indicating a complex interaction (28).

Association Between Sleep Patterns and Headache

Short sleep duration (<7 hours) was significantly associated with a higher prevalence of headache ($p = 0.001$), identifying inadequate sleep as an important risk factor (Table 11). Students sleeping 7–8 hours or more than 8 hours had significantly lower odds of headache compared to those with insufficient sleep. In contrast, wake-up time showed no significant association with headache prevalence, with comparable odds observed across categories (Table 11), indicating that sleep duration rather than wake-up timing influences headache risk.

Outdoor Play and Physical Activity

Outdoor play activity and physical lifestyle factors also influenced headache prevalence. Reduced outdoor play was independently associated with headache (AOR = 1.61), possibly reflecting increased sedentary behavior and prolonged screen exposure (Table 13). Although physical activity worsened headache in a subset of children, many continued regular sports participation, indicating individual variability in headache triggers. Similar associations have been reported by Kolb et al in 2022, who noted that physical inactivity and reduced outdoor exposure are linked to recurrent headaches in adolescents (29).

Mobile Phone Usage and Headache

One of the most striking findings of the present study was the strong association between mobile phone usage and headache (Table 13). Both moderate and high mobile phone use were associated with markedly increased odds of headache. Excessive screen time may contribute to headache through mechanisms such as visual strain, poor posture, sleep disturbance, and mental fatigue. This finding aligns with study conducted by Çaksen et al. in 2021 growing evidence linking prolonged gadget use to headache and other somatic complaints in children and adolescents (30).

Parental Working Status and Headache

Parental working status also showed a significant association with headache (Table 12). Children with only one working parent had lower odds of headache compared to those with both parents working. This may reflect differences in supervision, emotional support, daily routines, or stress levels within the household. However, this association is complex and may be influenced by multiple unmeasured social and environmental factors. Similar to the present findings, Operto et al. in 2018 reported that children from households with working parents, especially where both parents were employed, experienced higher stress levels and a greater prevalence of headache, suggesting that family routines and supervision may influence headache risk (31).

Association Between Parental Work Status, Sleep Duration, Mobile Phone Usage and Headache

Parental working status was significantly associated with headache occurrence, with students having both parents working or only the mother working showing lower odds of headache compared to those with only the father working ($p < 0.003$) (Table 12). Sleep duration demonstrated a strong association with headache prevalence, as students sleeping less than 7 hours had significantly higher odds of headache, while those sleeping 7–8 hours or more than 8 hours showed a protective effect ($p < 0.001$) (Table 11). Mobile phone usage showed the strongest association with headache occurrence, with students using mobile phones for more than 4 hours daily having markedly higher odds of headache compared to those with shorter usage durations ($p < 0.001$) (Table 13).

CONCLUSION

The present study demonstrates that headache is highly prevalent among school-going children aged 10–16 years, affecting more than half of the participants and significantly impacting academic performance, daily activities, and psychosocial well-being. Headache onset most commonly occurred in early childhood, with variable frequency, site, nature, duration, and intensity, and nearly one-third of children reported school absenteeism due to headache. Multiple factors including visual strain, short sleep duration, reduced outdoor activity, excessive mobile phone use, and parental working status were identified as significant contributors, underscoring the multifactorial etiology of pediatric headache. These findings highlight the urgent need for comprehensive preventive and management strategies, such as vision screening, healthy sleep promotion, moderation of screen time, encouragement of physical activity, and increased awareness among parents, teachers, and healthcare providers, to reduce the burden of headache and improve the quality of life of school-aged children.

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