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Original Research Article

Prevalence and Associated Factors of Nocturnal Enuresis among 6–12-Year-Old School Children in Rural Mathura: A School-Based Cross-Sectional Study

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Conflict of interest: Nil

Abstract

Background: Nocturnal enuresis is a common paediatric condition that may persist beyond early childhood and affect emotional wellbeing, sleep, family functioning, and school participation. Rural school data are important for estimating community burden and identifying modifiable associated factors.

Methods: A school-based cross-sectional study was conducted among 416 children aged 6–12 years attending five rural primary schools in Mathura district from March 2024 to September 2025. Data were collected using a pre-tested structured parent questionnaire. Nocturnal enuresis was defined as bedwetting during sleep occurring at least twice per week for at least three months. Variables included demographic characteristics, wet-night frequency, daytime urinary symptoms, bedtime, and evening fluid intake, ease of arousal, snoring, family history, and recent stress. Data were analysed using frequency distributions, percentages, mean ± standard deviation, median with interquartile range, and appropriate statistical tests.

Results: The overall prevalence of nocturnal enuresis was 18.8% (78/416). Wet-night frequency among enuretic children ranged from 2 to 7 nights/week, with a mean of 3.56 ± 1.46 and median of 3.0 (IQR: 2–4). Primary enuresis was present in 64 children (82.1%), while secondary enuresis was present in 14 children (17.9%). Monosymptomatic nocturnal enuresis accounted for 48 cases (61.5%), and non-monosymptomatic nocturnal enuresis accounted for 30 cases (38.5%). Nocturnal enuresis was significantly associated with maternal education, daytime urgency, daytime frequency, daytime wetting, later bedtime, evening fluid intake after 6 pm, type of evening drink, and difficulty in arousal from sleep. Parental night waking was common among affected children and reflected a family management practice. Age group, sex, number of siblings, birth order, snoring, family history of bedwetting, and recent stress were not statistically significant.

Conclusion: Nocturnal enuresis affected nearly one-fifth of rural school children aged 6–12 years. The condition was mainly primary and monosymptomatic, although a substantial subgroup had daytime urinary symptoms. Later bedtime, evening fluid intake, difficulty in arousal, and daytime urinary symptoms were important associated factors, supporting the need for early identification and structured, non-stigmatizing counselling.

Keywords: Nocturnal Enuresis; Bedwetting; School Children; Rural Health; Lower Urinary Tract Symptoms; Sleep Arousal.

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Introduction

Nocturnal enuresis is defined as intermittent urinary incontinence during sleep in children aged at least five years, with standardised terminology distinguishing monosymptomatic from non-monosymptomatic presentations. [1] The condition is common in school-aged children, but estimates vary widely because of differences in case definition, age groups, data collection methods, and whether daytime lower urinary tract symptoms are assessed. [2] Persistent bedwetting may have psychosocial consequences, including embarrassment, avoidance of social activities, reduced self-esteem, and family stress. Recent school-based evidence has also highlighted the

relationship between nocturnal enuresis and social anxiety among primary school children. [3] In the Indian setting, delayed help-seeking may occur because bedwetting is often perceived as a developmental issue, misbehaviour, or a condition that will resolve without support. [4]

Several potentially modifiable factors have been associated with nocturnal enuresis, including sleep-arousal difficulty, late evening fluid intake, bedtime routines, daytime urinary symptoms, constipation, family history, and symptoms suggestive of sleep-disordered breathing. [5-7] Indian school-based studies have shown that community-level assessment is useful for estimating the true burden of the condition and identifying children who may benefit from counselling or further evaluation. [8,9]

This study aimed to determine the prevalence of nocturnal enuresis and associated factors among 6–12-year-old children attending selected rural schools in Mathura district.

Materials and Methods

Study design and setting: This was a school-based cross-sectional study conducted in five rural primary schools in Mathura district, Uttar Pradesh, India: Baba Yadaram Vidhya Mandir, Symbiosis School of Excellence, KSPM Kids World School, Ramanlal Shorwala School, and Baba Patiram Vidhya Mandir.

Study duration: The study was conducted from March 2024 to September 2025.

Participants: The study population included school-going children aged 6–12 years enrolled in the selected rural primary schools. Children were included after written informed consent was obtained from parents or guardians.

Inclusion criteria: Children aged 6–12 years, children selected during the sampling procedure, and children whose parents or guardians consented and cooperated in completing the questionnaire were included.

Exclusion criteria: Children with profound mental retardation, children receiving diuretic drugs, children with known diabetes, and subsequent siblings of an already sampled participant were excluded.

Sample size: The sample size was calculated using Fisher's formula for prevalence studies, using Z = 1.96 for 95% confidence interval, expected prevalence = 12%, and absolute precision = 3.2%. The minimum required sample size was 396. After allowing for a 5% non-response or incomplete questionnaire rate, the final sample size was increased to 416 children.

Sampling Method: Participants were selected from the included schools using simple random sampling by paper-picking technique.

Data collection and variables: Data were collected using a structured parent questionnaire. A pilot study was conducted among 30 children aged 6–12 years in one rural primary school that was not included in the final sample. Minor modifications were made to improve clarity of questions related to bedwetting frequency, daytime symptoms, and evening fluid intake. Data from the pilot study were not included in the final analysis.

The questionnaire collected information on age, sex, class, number of siblings, birth order, maternal education, nocturnal enuresis history, wet-night frequency, prior dryness, age of attaining night-time dryness, daytime urgency, daytime frequency, daytime wetting, usual bedtime, parental waking practice, number of times the child was woken at night, ease of arousal from sleep, snoring, evening fluid intake, type of evening drink, family history of bedwetting, and recent stressful events.

Outcome Measures: The primary outcome was prevalence of nocturnal enuresis, defined as repeated urination into bed or clothes during sleep occurring at least twice per week for at least three consecutive months in a child aged at least five years, and not attributable to drug effects or a medical condition. Secondary outcomes included associated demographic, urinary, sleep-related, fluid-intake, familial, and stress-related factors.

Monosymptomatic nocturnal enuresis was defined as nocturnal enuresis without daytime urinary symptoms. Non-monosymptomatic nocturnal enuresis was defined as nocturnal enuresis associated with daytime urinary symptoms such as urgency, frequency, daytime wetting, or voiding dysfunction.

Statistical analysis: Data were entered in MS Access. Categorical variables were summarised using frequencies and percentages. Continuous variables were expressed as mean ± standard deviation or median with range or interquartile range, as appropriate.

Chi-square test and Fisher's exact test were used for categorical variables. Mann–Whitney U test was used for skewed variables, and t-test was used for comparison of means where applicable.

Ethical considerations: Institutional Ethics Committee approval and school administration approval were obtained before commencement of the study. Written informed consent was obtained from parents or guardians, and participation was voluntary.

Results

Study population and prevalence of nocturnal enuresis: A total of 416 children aged 6–12 years were included. The overall prevalence of nocturnal enuresis was 18.8% (78/416), while 338 children (81.2%) did not meet the case definition. Among the total sample, wet-night frequency ranged from 0 to 7 nights/week, with a mean of 0.77 ± 1.51 and median of 0 (IQR: 0–1). Among children with nocturnal enuresis, wet-night frequency ranged from 2 to 7 nights/week, with a mean of 3.56 ± 1.46 and median of 3 (IQR: 2–4). Among non-enuretic children, wet-night frequency ranged from 0 to 1 night/week, with a mean of 0.13 ± 0.34 and median of 0 (IQR: 0–0). The difference was statistically significant ($p < 0.001$, Mann–Whitney U test).

Table 1: Prevalence and wet-night frequency among the study population

Variable	Total (n = 416)	Enuresis (n = 78)	Non-enuretic (n = 338)
Nocturnal enuresis, n (%)	78 (18.8)	78 (100.0)	0 (0.0)
No nocturnal enuresis, n (%)	338 (81.2)	0 (0.0)	338 (100.0)
Wet nights/week, mean ± SD	0.77 ± 1.51	3.56 ± 1.46	0.13 ± 0.34
Wet nights/week, median (IQR)	0 (0–1)	3 (2–4)	0 (0–0)
Wet nights/week, range	0–7	2–7	0–1
0 wet nights/week, n (%)	294 (70.7)	0 (0.0)	294 (87.0)
1 wet night/week, n (%)	44 (10.6)	0 (0.0)	44 (13.0)
2 wet nights/week, n (%)	23 (5.5)	23 (29.5)	0 (0.0)
3 wet nights/week, n (%)	19 (4.6)	19 (24.4)	0 (0.0)
4 wet nights/week, n (%)	19 (4.6)	19 (24.4)	0 (0.0)
5 wet nights/week, n (%)	8 (1.9)	8 (10.3)	0 (0.0)
6 wet nights/week, n (%)	4 (1.0)	4 (5.1)	0 (0.0)
7 wet nights/week, n (%)	5 (1.2)	5 (6.4)	0 (0.0)

Abbreviations: IQR, interquartile range; SD, standard deviation.
Statistical test: Mann–Whitney U test for wet-night frequency comparison.

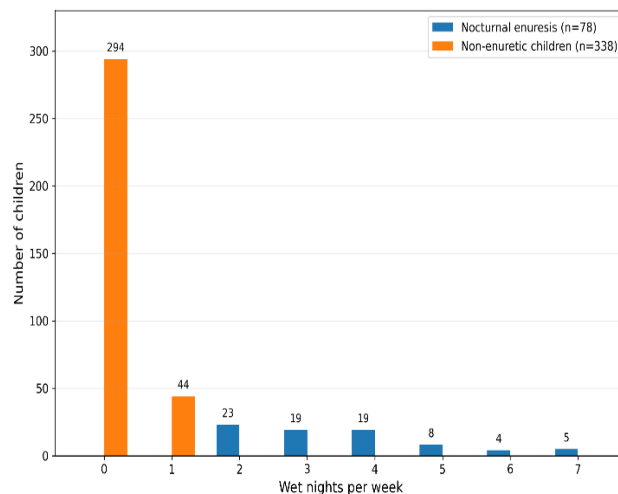

Figure 1: Wet-night frequency per week by nocturnal enuresis status

Baseline demographic and clinical characteristics: The mean age of the study population was 8.72 ± 1.57 years. The age distribution was 179 children (43.0%) in the 6–8-year group, 177 (42.5%) in the 9–10-year group, and 60 (14.4%) in the 11–12-year group. The prevalence of nocturnal enuresis was 23.5% in children aged 6–8 years, 15.3% in children aged 9–10 years, and 15.0% in children aged 11–12 years; this difference was not statistically significant ($p = 0.101$).

The mean age was 8.47 ± 1.63 years in the enuresis group and 8.78 ± 1.55 years in the non-enuretic group ($p = 0.133$). There were 214 boys (51.4%) and 202 girls (48.6%). The prevalence of nocturnal enuresis was 18.7% among boys and 18.8% among girls, with no statistically significant difference ($p = 1.000$). Class-wise prevalence ranged from 7.1% in Class 7 to 27.5% in Class 2; the overall class-wise association was not statistically significant ($p = 0.344$). Maternal education showed a statistically significant association with nocturnal enuresis ($p < 0.001$). Number of siblings and birth order were not significantly associated with nocturnal enuresis.

Table 2: Baseline demographic and clinical characteristics by nocturnal enuresis status

Characteristic	Total (n = 416) n (%)	Enuresis (n = 78) n (%)	Non-enuretic (n = 338) n (%)
Age, years, mean ± SD	8.72 ± 1.57	8.47 ± 1.63	8.78 ± 1.55
Age group			
6–8 years	179 (43.0)	42 (53.8)	137 (40.5)
9–10 years	177 (42.5)	27 (34.6)	150 (44.4)
11–12 years	60 (14.4)	9 (11.5)	51 (15.1)
Sex			
Male	214 (51.4)	40 (51.3)	174 (51.5)
Female	202 (48.6)	38 (48.7)	164 (48.5)
Class			
Class 1	51 (12.3)	11 (14.1)	40 (11.8)
Class 2	51 (12.3)	14 (17.9)	37 (10.9)
Class 3	83 (20.0)	18 (23.1)	65 (19.2)
Class 4	87 (20.9)	11 (14.1)	76 (22.5)
Class 5	81 (19.5)	14 (17.9)	67 (19.8)
Class 6	49 (11.8)	9 (11.5)	40 (11.8)
Class 7	14 (3.4)	1 (1.3)	13 (3.8)
Number of siblings, mean ± SD	0.95 ± 0.90	0.94 ± 1.00	0.96 ± 0.88
Number of siblings			
0	150 (36.1)	32 (41.0)	118 (34.9)
1	165 (39.7)	28 (35.9)	137 (40.5)
2	72 (17.3)	9 (11.5)	63 (18.6)
3	29 (7.0)	9 (11.5)	20 (5.9)
Mother's education			
Primary (Class 1–5)	138 (33.2)	38 (48.7)	100 (29.6)
Secondary (Class 9–10)	106 (25.5)	1 (1.3)	105 (31.1)
Higher secondary (Class 11–12)	109 (26.2)	24 (30.8)	85 (25.1)
Graduate	63 (15.1)	15 (19.2)	48 (14.2)
Birth order			
First	254 (61.1)	46 (59.0)	208 (61.5)
Second	115 (27.6)	21 (26.9)	94 (27.8)
Third	40 (9.6)	10 (12.8)	30 (8.9)
Fourth	7 (1.7)	1 (1.3)	6 (1.8)
Abbreviation: SD, standard deviation.			

Clinical pattern of nocturnal enuresis and daytime urinary symptoms: Among the 78 children with nocturnal enuresis, 48 (61.5%) had monosymptomatic nocturnal enuresis and 30 (38.5%) had non-monosymptomatic nocturnal enuresis. Primary enuresis was present in 64 children (82.1%), while secondary enuresis was present in 14 children (17.9%). Among children with secondary enuresis, the age at which night-time dryness had previously been attained ranged from 4 to 6 years, with a mean of 4.71 ± 0.73 years.

Daytime urinary symptoms were observed only among children with nocturnal enuresis. Daytime urgency was present in 19 children (24.4%) with nocturnal enuresis and none of the non-enuretic children ($p < 0.001$).

Daytime frequency was present in 18 children (23.1%) with nocturnal enuresis and none of the non-enuretic children ($p < 0.001$). Daytime wetting was present in 20 children (25.6%) with nocturnal enuresis and none of the non-enuretic children ($p < 0.001$).

Table 3: Clinical pattern of nocturnal enuresis and daytime urinary symptoms

Variable	Enuresis (n = 78) n (%)	Non-enuretic (n = 338) n (%)
Type of nocturnal enuresis		
Monosymptomatic nocturnal enuresis	48 (61.5)	
Non-monosymptomatic nocturnal enuresis	30 (38.5)	
Onset pattern		
Primary enuresis	64 (82.1)	

Secondary enuresis	14 (17.9)	
Age at prior dryness among secondary enuresis cases		
4 years	6 (42.9)	
5 years	6 (42.9)	
6 years	2 (14.3)	
Daytime urgency		
Yes	19 (24.4)	0 (0.0)
No	59 (75.6)	338 (100.0)
Daytime frequency		
Yes	18 (23.1)	0 (0.0)
No	60 (76.9)	338 (100.0)
Daytime wetting		
Yes	20 (25.6)	0 (0.0)
No	58 (74.4)	338 (100.0)
Statistical test: Fisher's exact test for daytime urinary symptom comparisons.		

Sleep, arousal, parental waking, and evening fluid practices: Usual bedtime was significantly associated with nocturnal enuresis (p < 0.001). No child sleeping between 8–9 pm had nocturnal enuresis. The prevalence of nocturnal enuresis was 16.4% among children sleeping between 9–10 pm and 42.5% among children sleeping between 10–11 pm. Mean bedtime was later in the enuresis group than in the non-enuretic group (21.74 ± 0.67 hours vs 20.84 ± 0.72 hours; p < 0.001). Parental waking at night was reported in 46 children (11.1%); all belonged to the enuresis group. Among children with nocturnal enuresis, 46 (59.0%) were woken at night by parents, while 32 (41.0%) were not. Among those woken at night, 19 (41.3%) were woken once and 27 (58.7%) were woken twice per night. Evening fluid intake after 6 pm was reported in 175 children (42.1%). Nocturnal enuresis was more common among children who drank fluids in the evening than among those who did not (36.0% vs 6.2%; p < 0.001). The type of evening drink was also significantly associated with nocturnal enuresis (p < 0.001). The highest prevalence of nocturnal enuresis was observed among children consuming caffeinated drinks (23/30; 76.7%) and aerated drinks (10/16; 62.5%) in the evening.

Difficulty in arousal from sleep was significantly associated with nocturnal enuresis. Enuresis was present in 24.4% of children who were not easily aroused compared with 14.8% of children who were easily aroused (p = 0.015). Snoring was reported in 39 children (9.4%); enuresis was present in 23.1% of snorers and 18.3% of non-snorers, with no statistically significant association (p = 0.517).

Table 4: Sleep, arousal, parental waking, and evening fluid factors by nocturnal enuresis status

Variable	Enuresis (n = 78) n (%)	Non-enuretic (n = 338) n (%)
Usual bedtime		
8–9 pm	0 (0.0)	120 (35.5)
9–10 pm	30 (38.5)	153 (45.3)
10–11 pm	48 (61.5)	65 (19.2)
Bedtime, hours, mean ± SD	21.74 ± 0.67	20.84 ± 0.72
Parents wake child at night		
Yes	46 (59.0)	0 (0.0)
No	32 (41.0)	338 (100.0)
Number of times child is woken per night		
0	32 (41.0)	338 (100.0)
1	19 (24.4)	0 (0.0)
2	27 (34.6)	0 (0.0)
Evening fluid intake after 6 pm		
Yes	63 (80.8)	112 (33.1)
No	15 (19.2)	226 (66.9)
Evening drink category		
No evening drinks	15 (19.2)	226 (66.9)
Dairy	17 (21.8)	39 (11.5)
Water	7 (9.0)	34 (10.1)
Juice	6 (7.7)	26 (7.7)
Caffeinated drinks	23 (29.5)	7 (2.1)

Aerated drinks	10 (12.8)	6 (1.8)
Easily aroused from sleep		
Yes	36 (46.2)	208 (61.5)
No	42 (53.8)	130 (38.5)
Snoring during sleep		
Yes	9 (11.5)	30 (8.9)
No	69 (88.5)	308 (91.1)
Abbreviation: SD, standard deviation.		

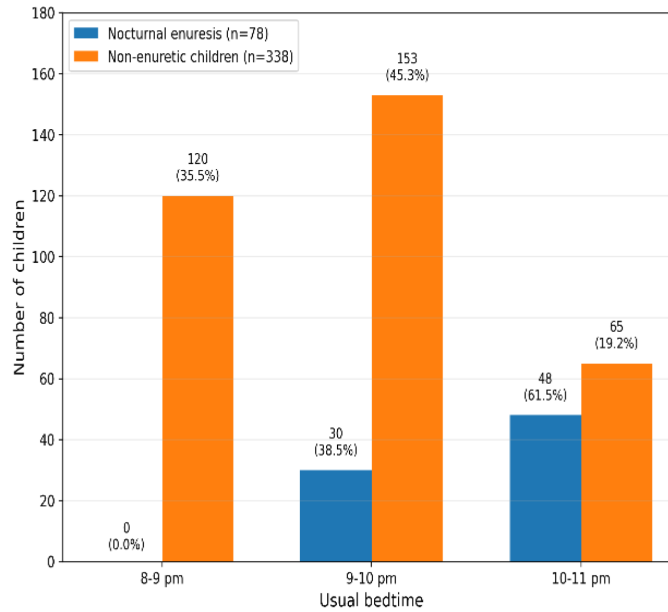

Figure 2. Usual bedtime by nocturnal enuresis status

Family history and stress-related factors: A positive family history of bedwetting was reported in 132 children (31.7%). The prevalence of nocturnal enuresis was similar among children with and without a family history of bedwetting (18.9% vs 18.7%; p = 1.000). Recent stress was reported in 36 children (8.7%). Nocturnal enuresis was present in 30.6% of children with recent stress and 17.6% of children without recent stress; this difference was not statistically significant (p = 0.072).

Among children with recent stress, the commonest reason was exam or academic stress, reported in 16 children (44.4%).

Table 5: Family history and recent stress by nocturnal enuresis status

Variable	**Enuresis (n = 78) n (%)**	**Non-enuretic (n = 338) n (%)**
Family history of bedwetting		
Yes	25 (32.1)	107 (31.7)
No	53 (67.9)	231 (68.3)
Recent stress present		
Yes	11 (14.1)	25 (7.4)
No	67 (85.9)	313 (92.6)
Recent stress reason among children with recent stress	Enuresis (n = 11)	Non-enuretic (n = 25)
Exam/academic stress	8 (72.7)	8 (32.0)
Family conflict at home	2 (18.2)	4 (16.0)
Bullying/peer problems	0 (0.0)	5 (20.0)
Change of school	0 (0.0)	5 (20.0)
Relocation/migration	0 (0.0)	2 (8.0)
Death in family	1 (9.1)	1 (4.0)

Discussion

This school-based cross-sectional study found that nocturnal enuresis affected 18.8% of children aged

6–12 years in rural Mathura. Most cases were primary enuresis and monosymptomatic nocturnal enuresis. However, 38.5% of enuretic children had daytime urinary symptoms, indicating a clinically relevant subgroup requiring more structured assessment.

Important associated factors were maternal education, daytime urinary symptoms, later bedtime, evening fluid intake, type of evening drink, parental waking practice, and difficulty in arousal from sleep. Age group, sex, number of siblings, birth order, snoring, family history, and recent stress were not statistically significant in this cohort.

The prevalence of nocturnal enuresis in the present study was 18.8%, which was lower than the 27.9% reported by Mohammad et al. [3] and the 23.9% reported by Alamri et al.[10] Differences between studies may reflect variations in age groups, definitions, sociocultural settings, questionnaire design, and thresholds used to define clinically relevant wetting.

The mean wet-night frequency among enuretic children was 3.56 ± 1.46 nights/week, indicating a moderate symptom burden. De Sousa et al. reported varying severity patterns among affected primary school children, including children with frequent weekly wetting and children with nightly symptoms. [11]

Monosymptomatic nocturnal enuresis was more common than non-monosymptomatic nocturnal enuresis in this study. This pattern is consistent with standard clinical classification, which emphasises the importance of separating children with isolated nocturnal wetting from those with daytime lower urinary tract symptoms. [1,12,14] The predominance of primary enuresis was also consistent with clinical descriptions of paediatric nocturnal enuresis. [13,14]

The prevalence was highest among children aged 6–8 years and lower in older age groups, although the age-wise association was not statistically significant. Similar age-related decline has been described by Bakhtiar et al., Huang et al., and Indian school-based studies. [5,9,15] The present study did not show male predominance, unlike some earlier studies. [3,11] This suggests that local behavioural, sleep, and household factors may be more prominent than sex-related differences in this population. Maternal education was significantly associated with nocturnal enuresis. Earlier Indian studies have also evaluated parental education as a determinant of bedwetting and care-seeking behaviour. [8,11] The pattern observed in this study was not linear across education categories, indicating that education may interact with awareness, reporting behaviour, household routines, and other social factors.

Difficulty in arousal from sleep was significantly associated with nocturnal enuresis. Impaired arousal is a recognised component of the pathophysiology of nocturnal enuresis and has been incorporated into standard clinical frameworks. [1,14] Evening fluid intake and type of evening drink were also strongly associated with nocturnal enuresis. Guidance for childhood bedwetting emphasises regular fluid routines, avoidance of excessive evening intake, and pre-sleep voiding as part of first-line management. [7,14]

Family history was not statistically significant in this cohort, although previous genetic and familial studies have shown strong familial clustering of nocturnal enuresis. [16] This difference may reflect recall variation, under-reporting, or local differences in family awareness. Snoring showed a higher proportion of enuresis but was not statistically significant. Sleep-disordered breathing has been associated with nocturnal enuresis in previous studies and reviews, but the strength of association varies across settings. [6,17]

Recent stress showed a higher proportion of nocturnal enuresis but did not reach statistical significance. Psychosocial stress and family burden remain clinically relevant because bedwetting may affect child confidence, parental stress, and willingness to seek care. [3,4]

The findings suggest that nocturnal enuresis among rural school children is common and frequently linked to modifiable routine-related factors. Later bedtime, evening fluid intake, caffeinated or aerated beverages, and difficulty in arousal are practical counselling targets. Screening for daytime urgency, daytime frequency, and daytime wetting is essential because children with non-monosymptomatic nocturnal enuresis may need evaluation beyond simple reassurance.

Parental waking at night was common among affected children, indicating that families were already attempting to manage the problem. However, repeated night waking may disturb sleep and may not provide durable symptom improvement unless paired with structured behavioural advice, pre-sleep voiding, appropriate fluid timing, positive reinforcement, and follow-up.

Strengths and Limitations

The strengths of this study include its rural school design, adequate sample size, use of a standard operational definition, and assessment of clinically relevant urinary, sleep-related, fluid-intake, familial, and stress-related variables.

The study also has limitations. Its cross-sectional design allows assessment of associations but not

causality. Data were collected using a parent questionnaire, so recall error and under-reporting are possible, particularly for sensitive issues such as bedwetting, stress, family history, and snoring.

Clinical examination and investigations were not performed, so underlying medical contributors could not be objectively assessed. The study was conducted in a single rural area, which may limit generalisability to other rural populations.

Conclusion

Nocturnal enuresis was present in 18.8% of rural school children aged 6–12 years. Most affected children had primary and monosymptomatic nocturnal enuresis, although a substantial subgroup had daytime urinary symptoms. Later bedtime, evening fluid intake, type of evening drink, difficulty in arousal from sleep, and daytime urinary symptoms were important associated factors. These findings support early identification through school and primary care settings, with non-stigmatizing counselling focused on sleep routine, evening fluid practices, pre-sleep voiding, and screening for daytime urinary symptoms.

Declarations

Acknowledgments: The authors acknowledge the cooperation of the school administrations, parents/guardians, and participating children.

Author contributions

- Dr. Aastha contributed to study conception, data collection, data entry, analysis, interpretation of results, and manuscript preparation.
- Dr. Saurabh Singh Talyan contributed to study supervision, methodology, interpretation of results, and critical revision of the manuscript.
- Dr. Manoj Kumar Singh contributed to academic supervision, intellectual content, critical review, and final approval of the manuscript.

All authors read and approved the final manuscript.

Ethics approval and consent to participate: Institutional Ethics Committee approval and school administration approval were obtained before commencement of the study. Written informed consent was obtained from parents or guardians before enrolment. Participation was voluntary, and confidentiality of participant information was maintained throughout the study.

Availability of data and materials: The datasets generated and analysed during the study are available from the corresponding author on reasonable request.

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