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Dentistry Section

# Influence of Childhood Sleeping Disorders on Traumatic Dental Injuries and Body Mass Index among School Children: A Cross-sectional Study

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## ABSTRACT

**Introduction:** Sufficient sleep is a crucial factor in child's behaviour and overall well-being. Observable indications of insufficient sleep among youngsters include increased daytime drowsiness and frequently being late or absent from school. Furthermore, potential consequences encompass overeating, weight gain, and increased vulnerability to accidental injuries. Research suggests that reduced sleep duration corresponds with elevated Body Mass Index (BMI) levels and an elevated risk of Traumatic Dental Injuries (TDIs) in obese children. Studies have shown that overweight/obese children have a higher prevalence of TDI compared to lean children, with urban Indian schoolchildren at particular risk, though research on the link between TDI and sleep problems remains limited.

**Aim:** To determine any association between childhood sleeping disorders with TDI and BMI among school children.

**Materials and Methods:** The present cross-sectional study was done from January 2020 to March 2021 including children (6-13 years age) from the Department of Paediatric and Preventive Dentistry, Guru Nanak Institute of Dental Sciences and Research, and local schools of Kolkata suburban region, West Bengal, India using a simple random sampling method. The children's BMI was calculated using the Centers of Disease Control and Prevention (CDC) BMI calculator for child and adolescent, and a visual inspection for signs of TDI was conducted following the International Association of Dental Traumatology (IADT) (2020) guidelines. Parents were provided with Sleep Behaviour Questionnaires (SBQ) and guidance for completion. Subsequently, the collected data was compiled and analysed statistically with SPSS software version 20 using Kruskal Wallis test A p-value of 0.05 was considered significant.

**Results:** The study identified a TDI prevalence of 153 (25.5%) among 600 participants. Significant association (p=0.033) was observed between TDI and SBQ scores. Mean SBQ scores reflected a BMI-related trend (obesity> overweight> healthy), indicating that overweight or obese children experience more sleep issues. The link between TDI and BMI was notably strong (p<0.001), with individuals having high BMI being 2.436 times more likely to exhibit TDI.

**Conclusion:** The present study provides a positive correlation among childhood sleeping disorders, TDIs and BMI among school children. Information gathered about sleep habits before a dental visit can help educate parent/caregivers on preventing dental injuries.

**Keywords:** Obesity, Sleep apnoea, Tooth fracture

## INTRODUCTION

Sufficient sleep is a crucial factor in child's behaviour and overall well-being. Observable indications of insufficient sleep among youngsters include increased daytime drowsiness and frequent lateness or absence from school [1]. Important side effects include overeating/weight gain and susceptibility to accidental injuries [2].

Accidental falling while walking or running comprises the main events associated with TDI in children. Boto LR et al., (2012) found significant correlation between sleep deprivation and accidental falls in children aged 1-14 years, mostly seen among male subjects [3]. The BMI is the key point to classify obesity/overweight. In children, body weight classifications are distinct from adults due to varying body composition during development, influenced by differences in sexual maturation between boys and girl. Various studies have shown shorter sleep duration is related with high BMI [4-7]. Goettms ML et al., states that the obese children do less physical activity than lean children which suggest obese children are clumsier and more prone to injuries.

TDI in children are common and present challenges for dentists in managing complications and promoting education and prevention. TDI has a worldwide incidence of about 2.82% [8]. A meta-analytical study done by Correa-Faria P and Petti S stated that the prevalence of TDI was more among overweight/obese children than lean children [9]. Todero SRB et al., (2019) found the prevalence of TDI was 1.51-fold more among children having daytime drowsiness [10].

Based on the importance of the above said parameters in social and health aspects, it is quite evident that sleep problems have a profound effect on TDI and BMI. So in the present study, it was exploring the link between childhood sleeping disorder, TDI and BMI and it is novel because it examines how these factors interact, potentially revealing new insights into childhood health. The null hypothesis was childhood sleeping disorders have no significant effect on the occurrence of TDI and BMI among school children and the alternate hypothesis was childhood sleeping disorders significantly influence the occurrence of TDI and BMI among school children. So the main aim of the present study was to determine any association between childhood sleeping disorders with TDI and BMI among school children. The primary objective was to find any association between TDI and SBQ and secondary objective was to find the association between BMI and SBQ.

## MATERIALS AND METHODS

The present cross-sectional study was done in the Department of Paediatric and Preventive dentistry, GNIDSR and the different

schools in Kolkata sub urban region, West Bengal, India which were selected through simple random sampling method for the study in the period of January, 2020 to March 2021. After obtaining the ethical clearance (IEC No- GNIDSR/IEC/19-22/29) from the Institutional Ethics Committee a cross-sectional study that included 600 healthy school children aged 6-13 years. Before the clinical examination written informed consent was obtained from parents/guardians and the demographic data of the children were recorded.

**Sample size calculation:** Sample size was calculated using the formula $n=z^2p(1-p)/e^2$ where 'p' is proportion, e is precision. Here, $\alpha$= 5% hence z$\alpha$ (the value of the standard normal variate at 5% error)=1.96. Again, p (Incidence of TDI)=2.82%, e=1.5% [8]. Using these values in the above formula, n was coming as 468. Assuming a 20% drop out rate, a minimum of 562 patients was essential for the study. So, the final sample included in the study is 600.

**Inclusion and Exclusion criteria:** The inclusion criteria were: 1) School children between 6-13 years of age; 2) Children with at least one or more erupted permanent anterior teeth; 3) Complete physical health, with no confounding medical history. The exclusion criteria were: 1) Patients having diagnosed with systemic diseases or mental disorders; 2) TDI of posterior teeth; 3) Parents not willing to give consent for study; 4) Children not staying in the study area permanently.

### Study Procedure

The dental examinations performed at the schools were done with the child seated in a wooden chair under natural light with the aid of a disposable mouth mirror and UNC-15 periodontal probe. During examination the type of tooth trauma, causes of trauma, tooth affected, overjet was recorded. CDC BMI calculator for child and teen was used for measurement of BMI. Child's height (in feet and inches) and weight (in pounds) were measured using height measuring chart and digital weight machine respectively. Age (in years and months) and sex were also taken into consideration for the calculation.

As per the CDC guidelines, children falling between the 85$^{th}$ and 95$^{th}$ percentile for age and gender related BMI are considered at risk of becoming overweight. Those whose age and gender related BMI reaches or exceeds the 95$^{th}$ percentile is considered as overweight [11,12].

Children were divided into three age groups, which were classified as: Group A (6-8 years), Group B (8-10 years) and Group C (10-13 years). Subject was asked to assume his/her habitual facial rest position or observe the child when he/she was distracted to check for lip seal/competency. Overjet was determined by using UNC-15 periodontal probe. Visual inspection for clinical signs of TDI was done based on the IADT guidelines (2020) [12]. Parents were given SBQ [Table/Fig-1] primarily used by Cortesi F et al., (1999), and was validated for using in this study with context to the Bengali population, along with proper guidance for filling up the questionnaires [13,14]. Compilation and statistical analysis of data was then done. While the questionnaire did not diagnose a formal sleep disorder, it can evaluate sleep issues. It focused on sleep quality, bedtime habits, parental involvement, and daytime drowsiness. The questionnaire consisted of 29 items; each item rated on a Likert scale from 1 (never) to 5 (always) by rating how often each item occurred in the last six months [14].

The questionnaire consisted of five subscales, namely,

- Factor 1 (Bedtime Difficulties: Items 1, 2, 3, 4),
- Factor 2 (Parent/Child interaction during the night: Items 9, 10, 14, 15),
- Factor 3 (Sleep Fragmentation: Items 5, 6, 7, 8, 11),
- Factor 4 (Parasomnias: Items 13, 16, 17, 18, 19, 20, 22) and factor 5 (Daytime Drowsiness: Items 25, 26, 27, 28, 29).

Items 12, 21, 23, 24 did not load in any factors, therefore they don't contribute to the total score. However, in order to obtain more information about child's sleep, they were retained in the questionnaire. Up to that the effective items are 25 in number. So minimum score will be 25 (If we consider 1 score for every item) and maximum score will be 125 (If we consider 5 score for every item). But one point is included in the SBQ instruction that is Sleep Latency and the score is 5 (If it is >30-min) and 1 (If it is <30-min). So SBQ scores can range from 26 to 130. Higher scores indicate higher possibility of having sleep problems. Higher scores indicate higher possibility of having sleep problems.

## STATISTICAL ANALYSIS

Continuous variables are expressed as mean, median and standard deviation and compared across the groups using Kruskal Wallis Test as appropriate. The statistical software SPSS version 25 has been used for the analysis. An alpha level of 5% has been taken, i.e., if any p-value is less than 0.05 it has been considered as significant.

## RESULTS

Out of 600 subjects, 319 (53.16%) were males and 281 (46.83%) were female. Among all the study sample 541 (90.16%) children were healthy weight 51 (8.50%) children were overweight while 8 (1.33%) children were obese. The prevalence of TDI was found to be 25.50% (153 out of 600). Inadequate lip seal and increased overjet was found in 131 (21.83%) and 220 (36.66%) of the subjects, respectively. Most common cause of TDI was due to sports activities 73 (47.71%), followed by falls 40 (26.14%), collisions 28 (18.30%), road traffic accidents 7 (4.57%), violence 4 (2.61%) and other 1 (0.65%). A total of 187 traumatic occurrences were found in 153 subjects who underwent trauma, majority of which exhibited fractures restricted to the enamel [Table/Fig-2]. Most commonly injured teeth were maxillary central incisors 110 (58.82%) followed by maxillary lateral incisors 67 (35.83%) with the least injured teeth being maxillary canines 2 (1.07%) [Table/Fig-3]. The association found between TDI and SBQ score was significant (p-value=0.033). Mean SBQ scores were higher in subjects with TDI than subjects with absence of TDI [Table/Fig-4].

The association found between BMI and SBQ score was highly significant (p-value<0.001) in this study. Mean SBQ scores followed the trend Obesity (61.75±6.16) >overweight (58.63±8.32 >healthy (52.53±6.93 in relation to BMI [Table/Fig-5], which suggested that overweight or obese children suffer from more sleep problems than healthy children. The mean SBQ scores of all five subscales follow the afore-mentioned trend but only subscales 1 (bedtime difficulties), 2 (Parent/child interaction during night) and 3 (sleep fragmentation) had highly significant association (p-value<0.001) with BMI.

The association between TDI and BMI was highly significant (p-value<0.001). Subjects with high BMI were 2.436 times more likely to have occurrence of TDI. An obese child 5 (62.5%) was more prone to TDI than overweight child 22 (43.14%), who was again more prone to TDI than healthy child 126 (23.29%). [Table/Fig-6]. The calculated Odds Ratio (OR) is 2.43 with a 95% Confidence Interval (CI) of 1.524-3.894. This means that individuals in the higher BMI categories (overweight/obese) were 2.43 times more likely to experience TDI compared to those with a healthy BMI. The CI does not include one, further confirming that the association is statistically significant.

The association between TDI and age groups was not significant (p-value=0.619). However, it was found that TDI was more likely to occur in subjects belonging to higher age groups (OR=1.005; 95% CI=0.997-1.013). Children belonging to age group C (27.09%) were more prone to TDI occurrence than children belonging to age Group A (22.73%) or B (25.64%) [Table/Fig-7]. To assess the association between age group and TDI occurrence, an OR was calculated. The reported OR is 1.005, with a 95% CI of 0.997 to 1.013. This OR value, being very close to one and having a CI that includes one, indicates no meaningful increase or decrease in the odds of TDI with age.

- How long does it take to fall asleep? .....
- What time does your child go to bed on weeknights? .....
- What time does your child go to bed on weekend nights? .....
- Does your child take naps during the day? [YES] [NO]
  - If yes, how long? .....

| | | ① NEVER | ② JUST A FEW TIMES | ③ SOMETIMES | ④ QUITE OFTEN | ⑤ ALWAYS |
|---|---|---|---|---|---|---|
| | YOUR CHILD... | | | | | |
| 1 | GOES TO BED WILLINGLY | ① | ② | ③ | ④ | ⑤ |
| 2 | FALLS ASLEEP ALONE | ① | ② | ③ | ④ | ⑤ |
| 3 | FALLS ASLEEP IN HIS/HER OWN BED | ① | ② | ③ | ④ | ⑤ |
| 4 | FALLS ASLEEP IN PARENTAL BED | ① | ② | ③ | ④ | ⑤ |
| 5 | WAKES UP 1-2 TIMES PER NIGHT | ① | ② | ③ | ④ | ⑤ |
| 6 | WAKES UP 3-4 TIMES PER NIGHT | ① | ② | ③ | ④ | ⑤ |
| 7 | REMAINS AWAKE FOR LESS THAN 30 MINUTES | ① | ② | ③ | ④ | ⑤ |
| 8 | REMAINS AWAKE FOR MORE THAN 30 MINUTES | ① | ② | ③ | ④ | ⑤ |
| 9 | FALLS ASLEEP AGAIN WITH PARENTAL PRESENCE | ① | ② | ③ | ④ | ⑤ |
| 10 | AFTER NIGHTWAKING GOES TO PARENT'S BED | ① | ② | ③ | ④ | ⑤ |
| 11 | WAKES UP TO EAT | ① | ② | ③ | ④ | ⑤ |
| 12 | MOVES A LOT WHILE SLEEPING | ① | ② | ③ | ④ | ⑤ |
| 13 | SWEATS A LOT WHILE SLEEPING | ① | ② | ③ | ④ | ⑤ |
| 14 | SHARES THE BEDROOM WITH PARENTS (EVEN IF THERE IS ANOTHER SLEEPING PLACE) | ① | ② | ③ | ④ | ⑤ |
| 15 | SLEEPS IN THE PARENTAL BED | ① | ② | ③ | ④ | ⑤ |
| 16 | TWICHES WHILE SLEEPING OR TRYING TO SLEEP | ① | ② | ③ | ④ | ⑤ |
| 17 | WAKES UP FROM SLEEP CONFUSED AND DISORIENTED | ① | ② | ③ | ④ | ⑤ |
| 18 | TALKS IN SLEEP | ① | ② | ③ | ④ | ⑤ |
| 19 | WALKS IN SLEEP | ① | ② | ③ | ④ | ⑤ |
| 20 | GRINDS THE TEETH DURING SLEEP | ① | ② | ③ | ④ | ⑤ |
| 21 | HAS PROBLEM WITH BEDWETTING | ① | ② | ③ | ④ | ⑤ |
| 22 | WAKES UP FROM SLEEP SCREAMING AND TERRIFIED | ① | ② | ③ | ④ | ⑤ |
| 23 | HAS BAD DREAMS | ① | ② | ③ | ④ | ⑤ |
| 24 | SNORES WHILE SLEEPING | ① | ② | ③ | ④ | ⑤ |
| 25 | IS REFRESHED AND IN A GOOD MOOD AT WAKING UP IN THE MORNING | ① | ② | ③ | ④ | ⑤ |
| 26 | IS SLEEPY WHILE SITTING AND/OR STUDYING | ① | ② | ③ | ④ | ⑤ |
| 27 | IS SLEEPY WHILE WATCHING TV | ① | ② | ③ | ④ | ⑤ |
| 28 | IS SLEEPY WHILE SITTING AND TALKING TO SOMEONE | ① | ② | ③ | ④ | ⑤ |
| 29 | FALLS ASLEEP AT SCHOOL | ① | ② | ③ | ④ | ⑤ |

**SBQ scoring instructions**

1) Recode in the opposite direction (5 = 1) (4 = 2) (1 = 5) (2 = 4) Items #1, 2, 3

2) Factor based scores-Compute the sum of items enumerated below:

*Bedtime Difficulties:* Items #1, 2, 3, 4

Sleep latency >30 min score 5
<30 min score 1

*Parent-Child interaction during the night* Items #9, 10, 14, 15

*Sleep Fragmentation* Items #5, 6, 7, 8, 11

*Parasomnias* Items #13, 16, 17, 18, 19, 20, 22

*Daytime Drowsiness* Items #25, 26, 27, 28, 29

3) Items #12, 21, 23, 24 did not load in any factors. therefore they don't contribute to the total score. However, in order to obtain more information about child's sleep, we decided to retain these items in the questionnaire.

4) Total score: sum of items of each subscale (range 26-130);

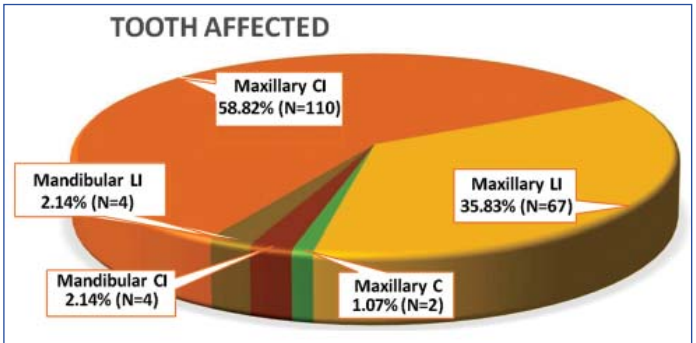
5) Higher scores = more sleep problems

6) The recall period is six months

**[Table/Fig-1]:** Sleep Behaviour Questionnaire (SBQ).

| Trauma | Frequency | Percentage |
|---|---|---|
| Enamel infarction | 1 | 0.53 |
| Uncomplicated crown fracture (enamel only) | 89 | 47.59 |
| Uncomplicated crown fracture (enamel-dentin fracture) | 53 | 28.34 |
| Complicated crown fracture (enamel-dentin fracture with pulp exposure) | 30 | 16.04 |
| Subluxation | 4 | 2.14 |
| Extrusive luxation | 2 | 1.07 |
| Lateral luxation | 1 | 0.53 |
| Intrusive luxation | 1 | 0.53 |
| Avulsion | 6 | 3.21 |
| Total | 187 | 100.00 |

**[Table/Fig-2]:** Distribution of type of dental trauma.




**[Table/Fig-3]:** Pie chart depicting tooth affected distribution.

(OR=0.953; 95% CI=0.934-0.972). Children belonging to age group A (54.76) had higher mean SBQ scores compared to Group B (54.21) or Group C (51.38), which indicated more sleep problems among children in Group A [Table/Fig-8]. The OR for sleep disturbances across age groups is reported as 0.953 with a 95% CI of 0.934 to 0.972. Since the OR is less than one and the CI does not cross one, this indicates a statistically significant negative association between age and sleep disturbances. In other words, with increasing age, the odds of experiencing problematic sleep behaviour decrease.

## DISCUSSION

The prevalence of TDI involving in permanent dentition was found to be 25.5% (153 subjects out of 600) in the present study. This was higher than the global figure of 20% for young children and adolescents as stated by Anderssen [15] in his study. However, Tewari N et al., in their meta-analytical study had found the prevalence of TDI for children aged more than six years to be 12% in India [16]. Uncomplicated crown fracture (involving enamel only) (47.59%) was mostly commonly seen followed by uncomplicated crown fracture (enamel-dentin fracture) (28.34%) and complicated crown fracture (enamel-dentin fracture with pulp exposure) (16.04%) (based on IADT classification). Previous study also stated similar findings, where enamel fracture was most commonly encountered type of TDI followed by enamel-dentin fracture (based on other classifications) [17].

Children who do not get adequate sleep (i.e., less than 8 hours) often tend to be drowsy and erratic on waking up in the morning. This affects his/her daily activities since they may fall asleep while doing any chores or may not be able to work properly because of being tired. Such clumsy states often lead to accidental falls or

| TDI | | Bedtime difficulties | Parent/child interaction during the night | Sleep fragmentation | Parasomnias | Daytime drowsiness | Sleep Behaviour Questionnaire (SBQ) score |
|---|---|---|---|---|---|---|---|
| NO | Mean | 14.81 | 13.40 | 6.28 | 10.19 | 8.25 | 52.80 |
| | Median | 16.00 | 12.00 | 5.00 | 10.00 | 9.00 | 51.00 |
| | Std. Deviation | 2.69 | 3.54 | 1.94 | 2.46 | 1.28 | 7.07 |
| YES | Mean | 15.33 | 13.45 | 6.61 | 10.60 | 8.29 | 54.25 |
| | Median | 16.00 | 12.00 | 5.00 | 10.00 | 9.00 | 53.00 |
| | Std. Deviation | 2.70 | 3.77 | 2.22 | 2.39 | 1.21 | 7.90 |
| | p-value | 0.010 | 0.966 | 0.185 | 0.059 | 0.820 | 0.033 |
| | Significance | Significant | Not Significant | Not Significant | Not Significant | Not Significant | Significant |

**[Table/Fig-4]:** Descriptive statistics mentioned in terms of mean SBQ score of the children with dental trauma and without dental trauma.
Compared using Krushkal Wallis Test; p<0.05-*statistically significant

| BMI | | Bedtime difficulties | Parent/child interaction during the night | Sleep fragmentation | Parasomnias | Daytime drowsiness | Sleep Behaviour Questionnaire (SBQ) score |
|---|---|---|---|---|---|---|---|
| Healthy weight | Mean | 14.80 | 13.13 | 6.23 | 10.24 | 8.23 | 52.63 |
| | Median | 16.00 | 12.00 | 5.00 | 10.00 | 9.00 | 51.00 |
| | Std. Deviation | 2.75 | 3.40 | 1.92 | 2.41 | 1.26 | 6.93 |
| Overweight | Mean | 16.18 | 15.96 | 7.37 | 10.69 | 8.49 | 58.69 |
| | Median | 16.00 | 20.00 | 7.00 | 10.00 | 9.00 | 58.00 |
| | Std. Deviation | 1.90 | 4.32 | 2.42 | 2.77 | 1.29 | 8.32 |
| Obesity | Mean | 16.25 | 16.00 | 9.13 | 11.50 | 8.63 | 61.51 |
| | Median | 16.00 | 16.00 | 9.00 | 11.50 | 9.00 | 62.50 |
| | Std. Deviation | 0.71 | 4.28 | 2.53 | 2.14 | 1.30 | 6.16 |
| | p-value | <0.001 | <0.001 | <0.001 | 0.210 | 0.395 | <0.001 |
| | Significance | Highly significant | Highly significant | Highly significant | Not significant | Not significant | Highly significant |

**[Table/Fig-5]:** Descriptive statistics mentioned in terms of mean SBQ score among the healthy children, overweight children and obese children.
Compared using Krushkal Wallis Test; p<0.05-*statistically significant

The association found between age and SBQ score was highly significant (p-value<0.001). It was found that sleep problems were more likely to occur in subjects belonging to lower age groups injuries. These findings were in accordance to previous study, done by Boto LR et al., where significant association was found between TDI and sleep disturbances [3].

| TDI | BMI | | | Total | p-value | Significance |
|---|---|---|---|---|---|---|
| | Healthy weight | Overweight | Obesity | | | |
| No | 415 (76.71) | 29 (56.86) | 3 (37.5) | 447 (74.5) | <0.001 | Highly significant |
| Yes | 126 (23.29) | 22 (43.14) | 5 (62.5) | 153 (25.5) | | |
| Total | 541 (100) | 51 (100) | 8 (100) | 600 (100) | Odd's ratio: 2.43 (1.524-3.894) | |

**[Table/Fig-6]:** Distribution of Traumatic Dental Injuries (TDI) according to BMI.
BMI: Body mass index; compared using Krushkal Wallis Test; p<0.05-*statistically significant

| TDI | Age group | | | Total | p-value | Significance |
|---|---|---|---|---|---|---|
| | Group A | Group B | Group C | | | |
| No | 119 (77.27) | 145 (74.36) | 183 (72.91) | 447 (74.5) | 0.619 | Not significant |
| Yes | 35 (22.73) | 50 (25.64) | 68 (27.09) | 153 (25.5) | | |
| Total | 154 (100) | 195 (100) | 251 (100) | 600 (100) | Odd's ratio 1.005 (0.997-1.013) | |

**[Table/Fig-7]:** Traumatic Dental Injuries (TDI) according to different age group.
Compared using Krushkal Wallis Test; p<0.05-*Statistically significant

| Age group | | Bedtime difficulties | Parent/child interaction during the night | Sleep fragmentation | Parasomnias | Daytime drowsiness | Sleep Behaviour Questionnaire (SBQ) score |
|---|---|---|---|---|---|---|---|
| Group A | Mean | 15.75 | 13.94 | 6.51 | 10.42 | 8.22 | 54.76 |
| | Median | 16.00 | 12.00 | 5.00 | 10.00 | 9.00 | 53.00 |
| | Std. Deviation | 1.99 | 3.60 | 2.14 | 2.40 | 1.37 | 7.25 |
| Group B | Mean | 15.44 | 13.50 | 6.42 | 10.51 | 8.37 | 54.21 |
| | Median | 16.00 | 12.00 | 5.00 | 10.00 | 9.00 | 53.00 |
| | Std. Deviation | 1.92 | 3.42 | 2.05 | 2.55 | 1.25 | 6.70 |
| Group C | Mean | 14.05 | 13.03 | 6.23 | 10.05 | 8.20 | 51.38 |
| | Median | 16.00 | 12.00 | 5.00 | 9.00 | 9.00 | 50.00 |
| | Std. Deviation | 3.29 | 3.69 | 1.92 | 2.38 | 1.21 | 7.45 |
| | p-value | <0.001 | 0.113 | 0.477 | 0.101 | 0.253 | <0.001 |
| | Significance | Highly significant | Not significant | Not significant | Not significant | Not significant | Highly significant |
| | Odd's ratio 0.953 (0.934-0.972) | | | | | | |

**[Table/Fig-8]:** Descriptive statistics for the mean Sleep Behaviour Questionnaire (SBQ) score of the children among different age group.
Compared using Krushkal Wallis Test; p<0.05-*Statistically significant

activity of obese children was significantly less than physical activity of healthy children as a result of which obese children were clumsier and more prone to injuries [5]. Also, the result of TDI in overweight or obese children was due to falls at home rather than due to sports activities, which was the most commonly reported cause of TDI in various studies done previously. These findings were in accordance to Petti S et al., Vijaykumar S et al., where significant association was found between TDI and BMI (obese/overweight status) [20,21]. On the contrary, Garg K et al., found no significant association between BMI and TDI [22].

With increasing age, a child gains more freedom from his/her parents and tends to get involved in outdoor activities or adventurous acts which often leads to increased TDI scenarios. Children aged between 10-13 years have more freedom in their movements than children aged between 6-10 years, which often predisposes to TDI instances in an individual. Similar findings were seen in previous literature. Garg K et al., stated that children aged 9-14 years were at 1.18 times greater risk of having TDIs compared to children aged 7-8 years [22].

The link between inadequate sleep and obesity is intricate and remains a topic of ongoing debate. Growth Hormone (GH) is primarily released during non-REM sleep phases early in the night, with some additional release during subsequent hours throughout the night. Longer sleep duration may lead to a greater overall GH excretion. An active somatotropic axis could enhance GH-mediated fat breakdown, potentially reducing the risk of overweight and obesity. Both clinical and experimental research has demonstrated that inadequate sleep is linked to various metabolic and hormonal alterations. These include reduced glucose tolerance, elevated cortisol levels, and changes in the sympathovagal response [18]. Furthermore, inadequate sleep is linked to various neuroendocrine and metabolic changes, including decreased leptin levels and elevated ghrelin levels. Both of these alterations can potentially lead to increased appetite and, consequently, weight gain [19]. Padez C et al., found that an inverse relationship exists between long sleep duration and overweight/obesity prevalence in Portuguese children [4]. Silva GE et al., stated children with reduced amounts of sleep (≤7.5 h/night) had an increased risk for higher body weight in early adolescence [5]. Garmy P et al., found that school-age children who got inadequate sleep were at a higher risk of being overweight and engaging in excessive television and computer usage [6]. On the contrary, Boles RE et al., in their study found no association between obesity and child's sleep [7].

Studies on the behaviour of obese children states that overweight or obese subjects were mostly sedentary which suggested they should be less exposed to injuries than healthy children. However, the physical

A viable reasoning for this finding could be the fact that most Indian children aged between 6-8 years sleep with their parents, which makes it easier for their parents to monitor and keep track of their sleep activity and problems. On the contrary, Calhoun SL et al., in their study stated that sleep problems (like insomnia) were seen more in the age group of 11-12 years (which is Group C in this study) [23]. Falch-Madsen J et al., also stated a sharp increase in the prevalence of sleep disorders after eight years of age [24]. Hence, the alternate hypothesis stating the positive corelation among childhood sleeping disorders, TDI and obesity was accepted in this study.

## Limitation(s)

The present study could be further improvised with the inclusion of radiographic investigations and proper follow-ups for the assessment of TDI and thorough evaluation of underlying sleep problems and their cause. The study acknowledges certain limitations, mainly due to its school-based nature and the need for consistency in hospital settings. The absence of radiographic evaluations restricted clinical assessments to visual examinations, potentially leading to an underestimation of healed injuries. Additionally, sleep behaviour data relied on parents' recollections from the past six months, introducing the possibility of memory bias. While these factors did not affect the study's main hypothesis, they should be addressed in future research.

# CONCLUSION(S)

In conclusion, the present findings broaden understanding on the complex causal network associated with TDI by investigating potential

risk factors that have not been addressed elaborately in previous literature. The association between sleep problems and a higher prevalence rate of TDI and higher BMI percentiles suggest that sleep quality should be investigated in scientific research using other samples and methodological delineations in order to confirm these findings. If so, data on sleep behaviours acquired when collecting the patient's history prior to a dental appointment, may be useful for a better orientation to parents/caregivers regarding the prevention of TDI.

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