IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 2 Ser. 5 (February. 2025), PP 61-69
www.iosrjournals.org

Little Bruxers At Sleep: A Review And Meta-Analyses

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Abstract
Background: *In children bruxism is often reported by parents and caretakers. This para function although a self-limiting condition may indicate underlying psychological and medical disorders. The aim of the study is to answer the question regarding global prevalence of sleep bruxism in children over the past decade and how the study characteristics like sample size, age group and diagnostic criteria have an impact on the overall estimate.*
Materials and methods: *A systematic search was done in PubMed and Google Scholar database to identify all the studies related to bruxism in children in sleep. A total of 11 articles with 5519 subjects were discussed in the review. Sleep bruxism assessment was done using parental/caretakers report and questionnaire.*
Results: *Statistical analysis was performed with the SPSS version 28.0 and the data were presented using descriptive statistics such as number and percentage. R Studio was used in preparation of graphs. Sleep bruxism was found to have a positive correlation with nail biting, biting objects, gastroesophageal disorder, tooth wear, increased screen time and sugar consumption. The average prevalence in unified age groups was found to be higher in mixed dentition (6-13 years) with a rate of 32.765%.*
Conclusion: *Sleep bruxism among children is a disturbing factor and a matter of anxiety among parents which needs urgent definite diagnostic tool like polysomnography which is a gold standard in diagnosis that should be made accessible and economical.*
Keywords: *Sleep bruxism, children, prevalence, associated factors, systematic review and meta-analysis*

Date of Submission: 17-02-2025 Date of Acceptance: 27-02-2025

I. Introduction

Sleep bruxism (SB) involves people grinding their teeth unconsciously while sleeping leading to dental problems and concerns like headaches, faicial pain, and jaw discomfort [1] putting stress on periodontal structures, leading to occlusal trauma and temporomandibular disorders [2]. In children, bruxism is seen often as self-limiting though undiagnosed [3]. Polysomnography is the best method for diagnosis [4]. In spite of its anatomical insignificance [6], Ramfjord suggested elimination of SB with occlusal adjustments [7]. Unemployed tensed mothers [8], stressed children [9], disrupted sleep [10], allergic rhinitis and asthma [11], obstructive sleep apnoea, nutritional deficiencies and gastrointestinal disorders [12,13,14,15] are associated with SB, also noted in autistic children [16] and dermatoglyphics [17].

II. Material And Methods

This systematic review and meta-analyses followed the Preferred Reporting Item for Systematic Review and Meta-Analyses (PRISMA) guidelines (Figure 1) [18].

Study Design: Review article

Study Duration: Between 2014 to 2024

Literature search: A comprehensive literature search was done to find out studies published between 2014 to 2024 on the prevalence of sleep bruxism and its associated factors. An electronic database search was done in PubMed and Google Scholar using the keywords “Prevalence of sleep bruxism in children” and “Associated Factors”.

Inclusion criteria:
1.) Studies available with complete data for prevalence of sleep bruxism
2.) Published in English.
3) Studies done among children.
4) Studies cross-sectional, review, and meta-analyses in nature.

Exclusion criteria:
1) Case series, reports.
2) Adult population
3) Studies published in other languages.

Data extraction

The eligibility of the article based on criteria search was completed by 2 authors (S.P.P and P.H.B) and the full text of the studies was analysed by using Microsoft Excel 2016. The two authors assessed the methodology and the quality of the articles by using the New Castle Ottawa assessment scale [19]. The authors independently judged the text without any disagreement. Finally, a total of 11 studies met the quality of assessment. The SB Children were studied from healthcare and day-care clinics, rehabilitation centres, private and public schools, kindergarten and dental clinics. The two authors read as per the PICO (Patient/population, Intervention, Comparison and Outcomes) guidelines format [20]. The ultimate quality of the article was judged by the quality assessment tool for experimental bruxism studies Qu-ATEBS (Quality assessment tool for experimental bruxism study) [21] and the JBI (Joanna Briggs Institute) appraisal tool [22]. The quality for these was evaluated by STROBE (Strengthening the reporting of observational studies in epidemiology) and was found to be good [23]. The data regarding author names, geographical regions, sample size, characteristics of the studies, prevalence (%) and diagnostic criteria were tabulated (Table 1).

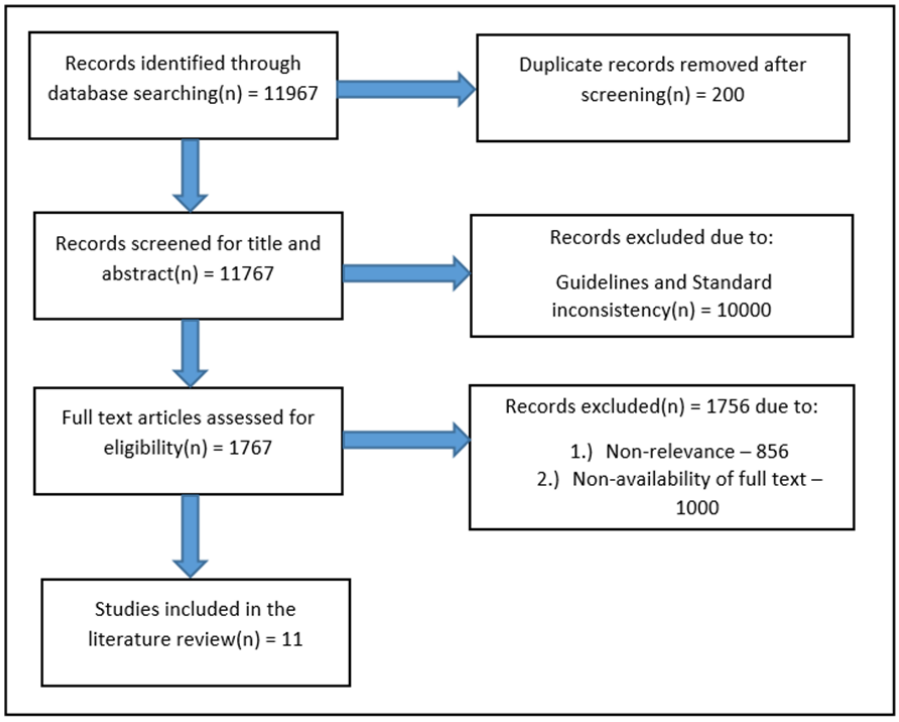

Figure 1. Flowchart for systematic review and meta analyses on SB in children

Statistical analysis:

Statistical analysis was performed with the SPSS version 28.0 and the data were presented using descriptive statistics such as number and percentage. R Studio was used in preparation of graphs.

III. Result

Screening flow

According to the search strategy set in advance, a total of 11967 articles were retrieved in the target database (Figure 1). Then 200 duplicate articles were removed. The remaining 10000 articles that didn't meet the eligibility criteria were removed from 11767 articles by reading the titles and abstracts. Finally, 11 articles were determined to be included in the analysis after excluding 1756 records from 1767 articles during full text screening (Figure 1). A total of 5519 subjects were studied.

Funnel's test and egger's test

The meta-analysis of studies on children with SB revealed extremely significant heterogeneity ($p<0.001$, $I^2 = 95.353$ %). The pooled prevalence of children with SB was noted as 0.30(95%CI: 0.24 to 0.35) (Figure 2).

To assess the risk of publication bias, funnel plot analysis, and Egger's test were conducted. Asymmetry was noted in the funnel plot indicating publication bias. The results should be interpreted with caution (Figure 3). The asymmetry was attributed to chronological differences and variations in sample size. The Egger's test showed a p-value of 0.003 depicting bias in publication. The meta regression analysis resulted in following linear equation: -

$y = 0.376 – 0.00015x$, where

y = effect size, x = sample size,

intercept = 0.376(0.276,0.475), standard error = 0.0000736, p = 0.070

The negative slope depicted that as sample size increased effect size decreased in spite of marginal significance of this trend($p>0.05$) (Figure 4). Zero is crossed by the confidence interval of slope (-0.00032, 0.000015) indicating non-significance of sample size and effect size relationship statistically for $\alpha = 0.05$. Publication bias was suggested by the model.

The important findings of each study author wise were summarized (Table 2). The highest prevalence of 45% was noted in a study [26] (Figure 5 and 6). The lowest prevalence reported was 14% [24]. The average prevalence for mixed dentation was found 32.765% vs 29.24% in primary dentition. A PR of 2.49, 2.10 and 1.30 association were noted for biting objects with sleep bruxism [24,26,28]. An OR of 2.28 and 35.5% for association of gastrointestinal disorder with sleeve bruxism were noted in two studies [25,32]. A PR of 1.5 and OR of 1.65 (24 .1%) for the association of nail biting and sleep bruxism were noted [28, 32]. A PR of 1.29 and 1.8 were noted for the association of sleep disorders and restlessness with sleep bruxism [27,29]. A PR of 1.57 for headache association with sleep bruxism was noted and a prevalence of 31% for temporomandibular joint pain was noted in SB children [26, 34]. The prevalence of 98.09% for correlation of dental wear with sleep bruxism was reported [30]. Pacifier use less than two years was noted to be associated with sleep bruxism in children with the prevalence of 62.6% [33]. Similarly, a PR of 0.78 was noted for the same association [28].

Table 1: Author wise study characteristics and prevalence of SB in children

Sl.No	Authors	Geographical Region	Sample Size	Study Characteristics	Prevalence	Diagnosis Criteria
1	Raquel G Vieira et al, 2014[24]	Brazil(healthcare clinic)	749	3-5 year olds(53% female, 10% with/o low birth weight, 49% breastfed <= 12 months, mean age: 48.7 months(± 12.6 month SD)	14%	Questionnaire prepared on the basis of American Academy of Sleep Medicine(AASM)
2	Valeska Aparecida Fernandes De Souza et al, 2015[25]	Brazil	389	1-13 year olds(females had 0.44 fold greater odds)	36.3%	Parental report
3	Kamilla A N Soares et al, 2016[26]	Brazil(public daycare clinic)	151	3-5 year olds	45%	Questionnaire validation method: AASM
4	M.A. Clementino et al,2017[27]	Brazil(paediatric dentistry clinic)	148	3-12 year olds(64.5% females)	32.4%	Parents/caregivers questionnaire based on AASM
5	Clarissa Lopes Drumond et al, 2018[28]	Brazil(5 public & 2 pvt schools)	440	8-10 year olds	40%	Questionnaire Clinical examination: Kappa coefficient Tooth wear diagnosis: Smith and Knight index
6	Peter Wetselaar, et al, 2019[29]	Brazil public schools at Florianopolis	1209	2-5 & 8-10 year olds	27.5% (22.3% in primary dentition), (32.7% in mixed dentition)	STROBE, questionnaire based on PSQI-BR(Pittsburgh sleep questionnaire index scale- Brazilian version)
7	Ana De Lourdes Sa De Lira et al, 2020[30]	Brazil	370	2-6 year olds	28.3%	Questionnaire based on AASM
8	Claudia Restrepo et al, 2021[31]	Colombia(pvt and public schools in Mendellin)	460	4-8 year olds (mean age 6.2 years – 1.8 SD)	35%	Children's sleep habit questionnaire
9	Salma A Shahbour et al, 2022[32]	Kindergarten Tanta city, Egypt	1000	4-6 year olds(51.7% males)	17.6%	Questionnaire
10	Montserrat Dieguez Perez et al, 2023[33]	Spain	343	3-5 year olds	28.9%	Questionnaire
11	Juliana Kois Guimarães et al, 2024[34]	Brazil (2 dental clinics in Maringa)	260	5-12 year olds(mean age 7.81 years)	24.6%	STROBE, AASM based questionnaire

Table 2: Author wise important findings and suggestions of various studies

Sl No	Authors	Suggestions	Important findings
1	Raquel G Vieira et al, 2014[24]	Polysomnography and electromyographic evaluation combination is a gold standard	SB had a positive correlation with low arch crowding- 3.38 PR habit of biting-2.49 PR duration breastfeeding>12 months- 1.98 PR bottle feeding > 24 months 1.93 PR
2	Valeska Aparecida Fernandes De Souza et al, 2015[25]	Longitudinal study suggested to establish relationship between identified factor and bruxism development in children. Could have included clinical assessment.	Correlation with gastro esophageal reflux 2.28 times more in children with bruxism presence of involuntary movement was associated with SB 2.24 folds more than non SB children. Thumb sucking was found more in SB children.
3	Kamilla A N Soares et al, 2016[26]	Longitudinal studies should be conducted	Positive association with biting objects -2 .10 PR, biting one's cheek 1.76 PR, headache 1.57 PR in temporal region.
4	M.A. Clementino et al,2017[27]	Longitudinal studies should be conducted for better understanding.	Positive correlation of bruxism in children with restless sleep 1.39 PR and gender 1.32 PR female
5	Clarissa Lopes Drumond et al, 2018[28]	Sleep Bruxism and oral habits are correlated, future studies may help support this statement Mother's stress and child behaviour Have some correlation that could be confirmed in cohort studies.	SB more prevalent in children with history of nail biting- PR 1.50, biting objects- PR 1.30 less prevalent in females -PR 0.78
6	Peter Wetselaar et al, 2019[29]	Longitudinal studies, further studies suggested in various age groups with mixed dentition and future studies to evaluate SB and Breathing patterns can be conducted to determine cause and effect relationship	Gender, socioeconomic, head of household educational status ,drooling and tooth wear not associated with SB in both dentitions ,SB correlated with poor sleep quality – PR 1.80
7	Ana De Lourdes Sa De Lira et al, 2020[30]	Polysomnography being a gold standard could be employed, Longitudinal studies could be conducted	98.09% SB children exhibited teeth pain, There was positive association between SB and habit of sucking finger, pacifier bottle use and awake bruxism.
8	Claudia Restrepo et al, 2021[31]	Polysomnography being gold standard could've been used in spite of limited availability, high cost complex, technical equipment and unfamiliar lab facility	There was a strong association between screen time and added sugar consumption with SB.
9	Salma A Shahbour et al, 2022[32]	Polysomnography and longitudinal studies could be employed.	Relationship between SB and nail biting 24.1% (1.650 OR), tongue biting 23% (1.527 OR), sleep with hand on face 23.5% (1.580 OR), family history 47.4% (6.565 OR), Gastrointestinal disorders 35.5%. No relationship of SB with occlusion and type of feeding.
10	Montserrat Dieguez Perez et al, 2023[33]	Awareness among parents needs to be created about parafunctional behaviour and further studies need to be undertaken with same factors to draw accurate conclusions.	SB found to be higher in boys- 61.6% vs 38.4% in girls, Bottle use >= 24 months- 51.5%, Pacifier use < 24 months- 62.6%.
11	Juliana Kois Guimaraes et al, 2024[34]	Increase in cases during and after Covid 19 necessitates further studies with clinical approaches.	31% pain in temporomandibular joints, 19% ringing in ears, 52.4% headache, 23.8% joint pain, harmful oral habits 61.4%(onychophagia most prevalent condition). Relationship between malocclusion and SB not found. SB children who snore presented 2.9 times odds of developing condition number of hours of sleep and difficulty in sleeping not associated with SB.

Table 3: Average prevalence across unified age groups in various studies

Unified Age Group	Average Prevalence
1-3 years	30.7%
4-5 years	27.78%
6-8 years	33.2%
9-13 years	32.33%

Table 4: Author wise merits and gaps of various studies

Sl No	Authors	Limitations	Strengths
1	Raquel G Vieira et al, 2014[24]	Study was based on parental information so there might be memory bias. It was cross sectional in nature.	Study encompassed statistical rigour and employed combination of anthropometric measures, oral examinations and questionnaires for data collection.
2	Valeska Aparecida Fernandes De Souza et al, 2015[25]	There was over reliance on parental report and the study was cross sectional in nature.	Robust data set by data collection through 389 dental records.
3	Kamilla A N Soares et al, 2016[26]	There might be information bias.	Bivariate Poisson regression analysis was employed.
4	M.A. Clementino et al,2017[27]	There was information bias which might have led to under notification of the condition and the study was cross sectional in nature.	Bivariate Poisson regression analysis was employed.
5	Clarissa Lopes Drumond et al, 2018[28]	Exposures and outcomes collected together failed to establish cause and effect relationship. There was lack of finger/thumb sucking and pacifier sucking due to recall bias.	Association between psychological stress and SB depicting manifestation of mental health physically in children was shown.
6	Peter Wetselaar et al, 2019[29]	The study was cross sectional in nature. Information collected from parents might not be apt since it was unknown if parents slept in proximity or actually heard grinding , light and noise could have affected sleep that were not taken into consideration too.	Study differentiated sleep and awake bruxism to receive better understanding of varying behaviours and implications for treatment and it consisted of a large sample size. Comparison was possible since all children from both age groups were from same socioeconomic status and same population base.
7	Ana De Lourdes Sa De Lira et al, 2020[30]	The study was cross sectional in nature.	Preschool children were taken helping in early diagnosis in initial development stage of the condition.
8	Claudia Restrepo et al, 2021[31]	The study was cross sectional in nature and absence of definite sleep bruxism diagnosis was also realised.	Gap in literature was overcome by examination of relationship between screen time and sugar consumption with sleep bruxism.
9	Salma A Shahbour et al, 2022[32]	There was information bias in questionnaire that might have led to under notification and the study was cross sectional in nature.	Correlation of sleep bruxism with family history, presence of newborn siblings and gastrointestinal disorders was established.
10	Montserrat Dieguez Perez et al, 2023[33]	They might be under reporting and under notification by parents.	Association of social and orofacial factors was identified with sleep bruxism.
11	Juliana Kois Guimaraes et al, 2024[34]	Covid 19 pandemic might have hampered clinical care.	This observational designed study employed questionnaires and medical record reviews enhancing reliability

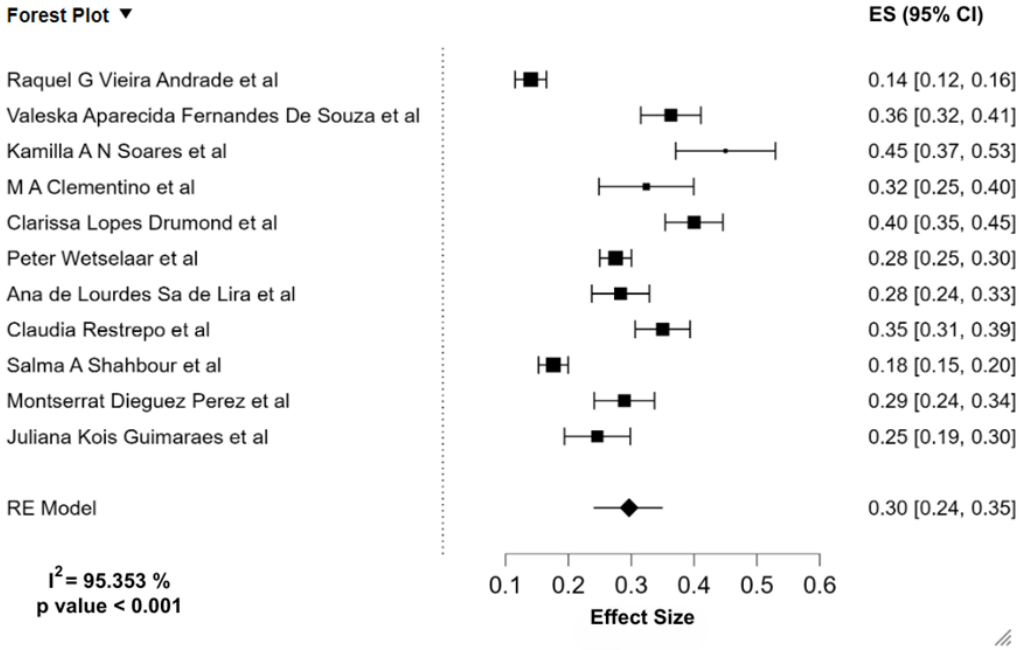

Figure 2: Forest plot for systematic review and meta analyses on prevalence of SB in children

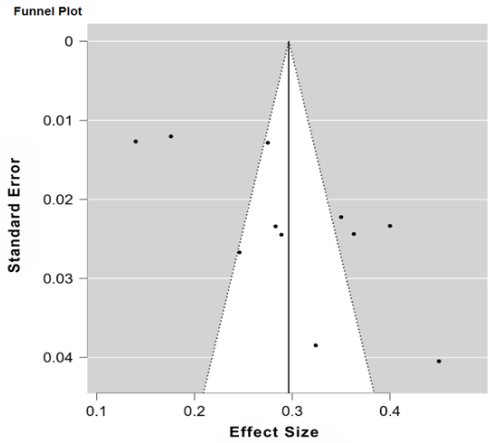

Figure 3: Funnel plot for the systematic review and meta analysis

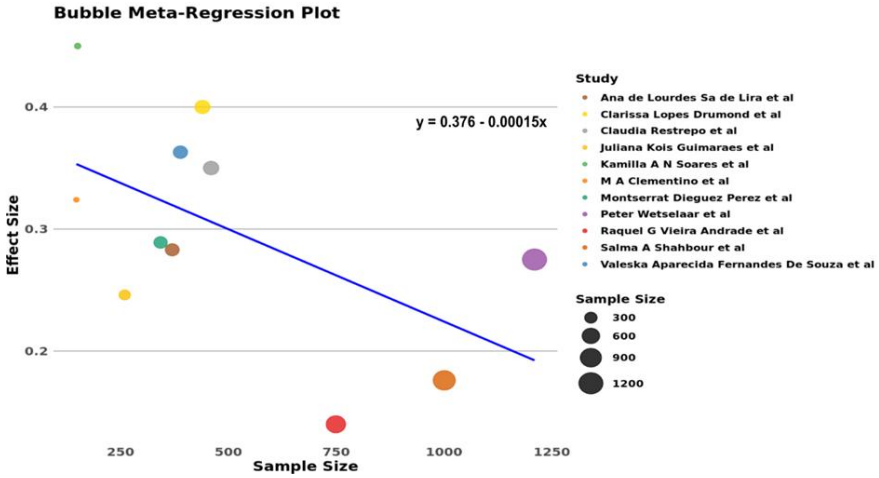

Figure 4: Bubble meta regression analysis plot for systematic review and meta analyses

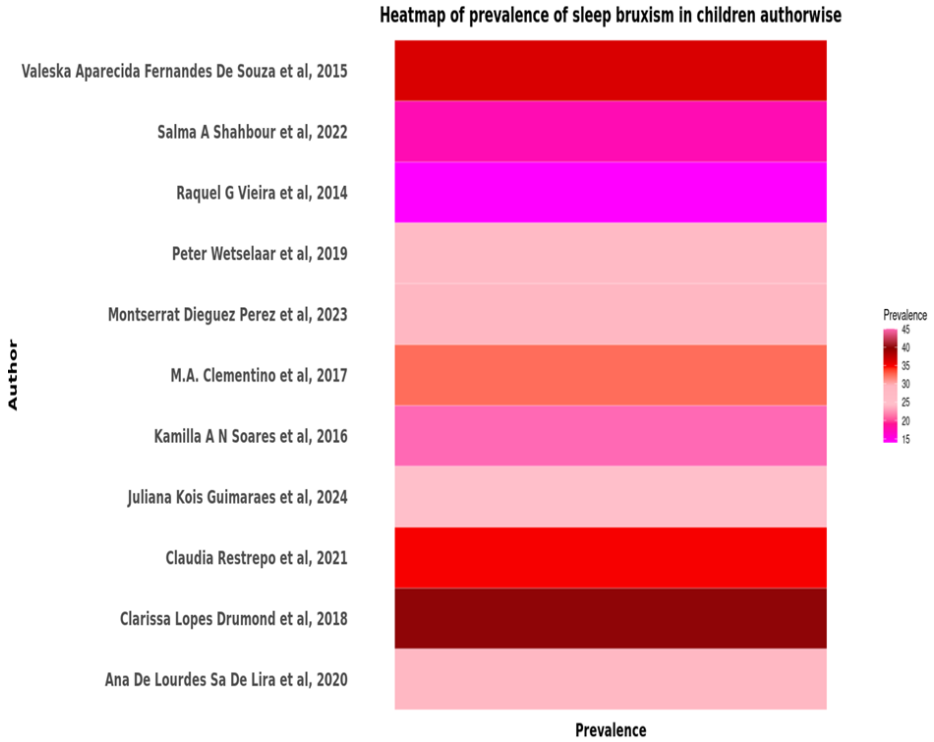

Figure 5: Heatmap depicting prevalence of SB in children authorwise

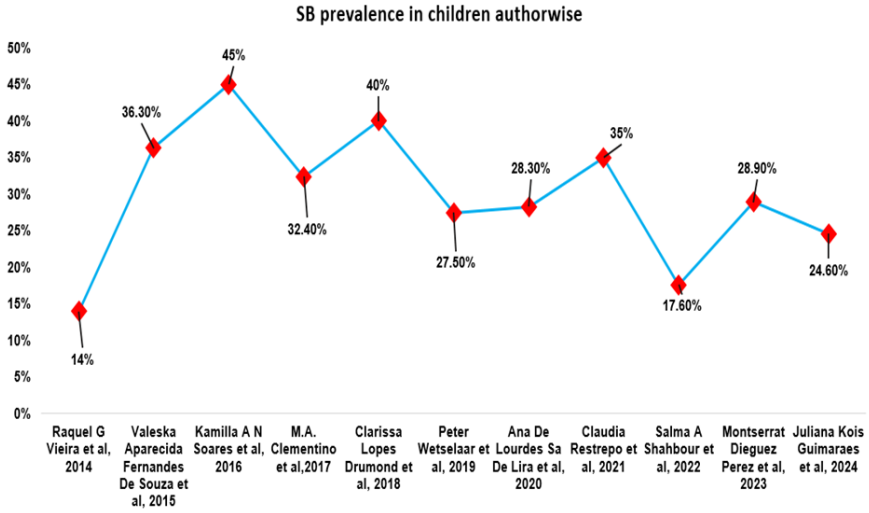

Figure 6: Line chart depicting SB prevalence in children author wise

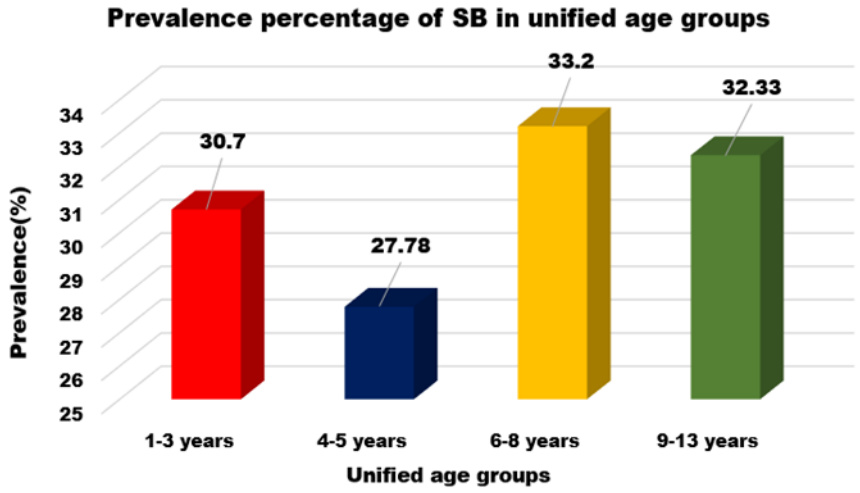

Figure 7: Bar graph indicating prevalence of SB in unified age groups across studies

IV. Discussion

The studies showed significant association between SB and mouth breathing [32]. This is supported by another study [35]. The same study showed family history [32]. SB and sleep apnoea index had a positive correlation with gene HTR2Ars2770304 TT homozygotes [36]. SB incidence was found to be higher in boys [33]. In fact, it was noted in a study that 75% boys were prone to have sleep bruxism [37]. A study showed prolonged breastfeeding <12 months and also bottle feeding<2 years in children for bruxism [24,33]. This is depicted by another author [38]. In bruxism children involuntary movement was found to be 2.24 folds more in SB than in non SB [25]. This was declared by an author [39].SB was noted along with biting objects [24,26,28]. SB was also characterized by involuntary grinding, clenching of the teeth and thrusting mandible [40]. Association between thumb sucking and SB in children was also noted [25,30]. This is vividly explained in another study [41]. Nail biting was associated with SB [28,32]. Snoring was also correlated with SB [34]. Headache was associated in SB children [26,34]. Another author had reported this [42]. Onychophagia was most prevalent condition noted in a study as high harmful habit [34]. There was correlation between ringing in ears and SB, the habit of sleeping with hands on face was noted in SB children, forgetting things, feeling scared, psychosocial factors, and poor sleep quality were noted in SB children [34, 33, 27, 29]. SB was also associated with tooth wear [24,28,30]. This is further supported by a study [43].SB had correlation with pain in temporo-mandibular joint [34]. This is stated by another author [44]. SB was noted among children who used pacifiers [33]. This is stressed upon by another author [45].SB was reported in tongue biting cases [32]. This is elucidated by another author [46]. The diagnostic criteria for SB was based on questionnaire prepared by AASM basis [24, 26, 27, 30]. AASM comprises of clinical practice guidelines and statements for diagnostic and treatment options in patients with sleep disorders [47]. Smith and Knight Index diagnosis was used for tooth wear; kappa coefficient was used for clinical diagnosis. EMG was

noted in study where there was association between temporal mandibular joint pain and SB [28, 34]. The lifestyle changes such as increased screen time also was noted as key driver for sleep bruxism specially in Covid 19 pandemic period [48]. The blue light from electronic devices can interfere with sleep patterns [49]. Finally, there was higher prevalence of sleep bruxism in mixed dentition than primary dentition (Table 3 and Figure 7) [29]. Lately novel methods such as jaw movement tracking systems with the use of mouthpiece type sensing device to detect sleep bruxism have been emerging [50]. However, it might not be of much use in children. The merits and gaps of the studies by various authors were outlined (Table 4).

V. Conclusion

This systematic review and meta-analysis depicts the need for future longitudinal studies in order to find the exact strategy for management. Further for this a definite diagnostic tool and criteria comprising of clinical evaluation is mandatory. The other significant role of polysomnography is missing in most of the studies that should be utilized and should be accessible and economical.

Our study aimed to vividly explain the associated factors with SB in children along with the prevalence rates over a decade to the best of our knowledge by conducting systematic review and meta analyses. Of course, it is not without limitations. The study was conducted only among the paediatric population and most of the studies and research that we took for the review were from Brazil making it incidental not a bias. High heterogeneity was noted in our study due to chronological differences and variations in sample size. All the studies taken for review except one being a survey were cross sectional in nature.

Acknowledgements:

We would like to thank our Principal, Dr.Vasanthamalai, and General Manager, Mr.Rahim for their immense involvement. And Miss.Swathi for her technical assistance with data analysis and illustrations in the preparation of this study.

Source of funding:
This research was not supported by any specific grants from public, commercial, or non-profit funding agencies.

Conflicts of interests:
The authors report no conflict of interest.

Author contributions:

Conceptualization and methodology, S.P.P., P.H.B., M.B., N.N.K. and J.H.; Formal analysis, S.P.P., P.H.B. and M.B.; Visualization and writing – original draft S.P.P., P.H.B., and M.B.; Writing – review and editing, S.P.P., P.H.B., M.B., N.N.K. and J.H. All authors have read and agreed to the final version of the manuscript.

Ethical approval:
Not Required

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