







Can children's oral hygiene and sleep routines be compromised during the COVID-19 pandemic?

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Abstract

Background: During COVID-19 pandemic, children are confined at home, with changes in family routines.

Aim: Evaluate sleep disorders among Brazilian and Portuguese children during social distancing, and its association with parental perception of child's oral hygiene.

Design: In this cross-sectional study, Portuguese and Brazilian parents/caregivers of 3- to 15-year-old children, practicing social distancing due to COVID-19 pandemic, answered an online questionnaire, from April 24-26, 2020, evaluating sociodemographic characteristics, child's school activities online, child's sleep quality during social distancing. Two questions from the questionnaire, developed based on previous studies, evaluated the parental perception of child's oral hygiene quality and routine changes during social distancing. Parents/caregivers answered five domains of the Portuguese-language version of the Sleep Disturbances Scale for Children, evaluating sleep-breathing disorders, disorders of arousal, sleep-wake transition disorders, disorders of excessive somnolence and sleep hyperhidrosis. Descriptive, Linear-by-linear association, Kruskal-Wallis and post hoc analysis were performed ($P \leq .05$).

Results: Participated in the study 253 parents/caregivers, 50.2% from Brazil. Most parents (72.2%) reported changes in child's routine during social distancing. Sleep breathing disorders ($P = .019$), sleep-wake transition disorders ($P = .022$), and disorders of excessive somnolence ($P < .001$) were associated with poor oral hygiene during social distancing.

Conclusion: Sleep disorders are associated with poor oral hygiene during social distancing.

KEYWORDS

COVID-19, epidemiology, oral hygiene, sleep disorders

1 | INTRODUCTION

The new coronavirus SARS-CoV-2, discovered in December 2019 in China, is part of a family of viruses that cause respiratory infections. Since March 2020, the World Health

Organization (WHO) considered its disease, coronavirus disease 2019 (COVID-19), a global pandemic, affecting innumerable individuals with life-threatening outcomes, despite their health conditions.¹ The long incubation period, the absence or the development of nonspecific symptoms,

and the easy chain of transmission through direct and indirect contact with infected surfaces or individuals present a great challenge to healthcare systems.^{1,2} All this has made it extremely difficult to control COVID-19, and the absence of an approved therapy has led many governments to declare a state of emergency, initiating social distancing, and quarantine measures to contain and reduce the spread in their communities.^{1,3}

Social distancing aims to reduce interactions between people in a large community to avoid transmission, and quarantine involves separating ill or possibly infected individuals from others.^{3,4} These measures require families to remain confined to their homes, ensuring intense, and unrelieved contact under stressful conditions as well as reducing existing support networks.⁵ Some parents have had to combine their work activities with household responsibilities and home-schooling their child/children, and many might be experiencing anxiety about their jobs and financial instability.⁶ The associated fear and uncertainty may increase due to the pandemic.⁵ Most children are not attending school, and being confined at home disrupts daily routines, especially in the paediatric population, which can lead to recurrent electronics use, less physical activity, less daylight exposure, and frequent carbohydrate snacking.⁵⁻⁷

Anxious children can experience significant sleep difficulties, and some sleep disturbances can be triggered by stress and anxiety.⁸ Being forced to stay at home under stressful circumstances while managing possible health risks can have an impact on daily functioning and sleep.⁶ Sleep plays an essential role in the development of children and adolescents, and it is essential for their physical and mental health.⁹ Researchers estimate that 25% of all children have experienced at least one sleep problem,¹⁰ and during quarantine, due to COVID-19 pandemic, children presented changes in sleep, increasing sleep duration, changing its routine and negatively impacting on sleep quality.^{11,12} The consequences for sleep problems among children range from daytime sleepiness, headaches, and behavioural and health problems.¹³

Good oral hygiene is the practice of keeping oral cavity, teeth, and gums clean and healthy, in order to prevent disease,¹⁴ and it is important for a person's quality of life and physical and psychological health.¹⁵ Globally, more than 530 million children suffer from caries of primary teeth.¹⁶ With all the advances in research on the risk factors associated with poor oral health, preventive measures are the essential key factor for good oral hygiene, that is through the removal of dental biofilm (plaque), with toothbrushing as the most common means of an effective dental care at home.^{15,17} For parents, toothbrushing at home is usually linked to other routine events in the morning or evening, such as before breakfast and going to bed.¹⁸ There is an association between sleep habits and increased dental caries incidence.⁷

Why this paper is important to paediatric dentists

- This study evaluates sleep disturbances and parental perception of oral hygiene in children and adolescents during social distancing and quarantine. Based on the results, some types of sleep disturbances were associated with poor oral hygiene in children during social distancing, as reported by parents/caregivers.
- Paediatric dentists and health professionals can help families maintain their oral hygiene and sleep routines through educative measures during the COVID-19 pandemic, reducing possible negative impacts on children's oral and general health after social distancing ends.
- After the COVID-19 pandemic, paediatric dentists are encouraged to reinforce preventive measures and oral hygiene orientation for their patients and parents in the dental office and perform a detailed clinical examination for possible new carious lesions.

The impact of quarantine on oral hygiene and sleep routines is still at the nascent stage of investigation. Although stress, confusion, anger, and other negative psychological disorders have been reported during quarantine, exploring how this context may be reflected in the child's routine is fundamental.¹⁹ Parental perception plays an essential role in identifying and resolving their children's issues.²⁰ Due to the COVID-19 pandemic, the Brazilian and Portuguese governments have declared a state of emergency, leading families to adhere to social distancing at home. The changes in the family routines, anxiety related to a new infection spreading worldwide and being confined at home might interfere with child's sleep and consequently with their oral hygiene. This study aimed to evaluate sleep disturbances in the Brazilian and Portuguese paediatric populations and whether there is an association between sleep disturbances and parental perception of child's oral hygiene during the COVID-19 confinement period.

2 | MATERIAL AND METHODS

2.1 | Study design, settings, and participants

This cross-sectional study involved Portuguese and Brazilian parents/caregivers of children and adolescents aged 3-15 years who were socially isolated at home during

the COVID-19 pandemic. The participants were invited to participate in the study by answering a questionnaire available on the Google Forms platform (Google Inc, Menlo Park, CA, USA) from 24 to 26 April 2020. Due to social distancing measures, schools had closed in Portugal on 16 March 2020 and in Brazil on 17 March 2020. The link to the questionnaire was disseminated via WhatsApp and online web forums for parents of schoolchildren. The contacted parents/caregivers were mainly from the cities of Coimbra, Aveiro (Central Portugal), Porto (Northern Portugal) and Belo Horizonte (Southeast Brazil). Although the pandemic imposed limitations on the collection of epidemiological data, the evidence has shown equivalences in the data results between paper-and-pencil and computerized survey modes.²¹

To be included in the study, each parent/caregiver completed an informed consent form and answered the questionnaire. Parents and children who were not under social distancing or quarantine measures were excluded. After answering all questions, the parents/caregivers received an e-mail with information and orientations about children's sleep and oral health.

2.2 | Data collection

The parents/caregivers answered a questionnaire with eight questions on whether the family was practising social distancing or was under quarantine, the family's demographic information, the child's sex, the child's age, if the child's routine had changed due to social distancing, if the child was having school activities online during social distancing, and parental perception of the child's sleep quality during social distancing (Supplementary Material A). Parental perception of the child's oral hygiene during social distancing was evaluated through the question:

- When comparing your child's oral hygiene before the pandemic and now, during social distancing, how would you classify it?
 - a. Is the same
 - b. Is poorer
 - c. Is better

The question was developed by authors considering how parents perceived their child's oral hygiene before the pandemic compared to the period during social distancing. The question was developed based on the questions of previous studies evaluating mother perception of child's oral health.^{22,23}

The parents/caregivers also answered the Portuguese-language validated version of the Sleep Disturbance Scale for Children (SDSC).^{24,25} The instrument is composed by

26 multiple-choice questions divided into six domains (six groups of the most common types of sleep disorders in children and adolescents): disorders of initiating and maintaining sleep (DIMS); sleep breathing disorders (SBD); disorders of arousal (sleepwalking, sleep terrors, nightmares) (DA); sleep-wake transition disorders (hypnic jerks, rhythmic movement disorders, hypnagogic hallucinations, nocturnal hyperkinesia, bruxism) (SWTD); disorders of excessive somnolence (DOES); and sleep hyperhidrosis (SHY). Questions could be answered with 'never' (score = 1), 'seldom' ($\leq 1-2$ times/month) (score = 2); 'sometimes' (1-2 times/week) (score = 3), 'frequent' (3-5 times/week) (score = 4), or 'always' (daily) (score = 5). Each domain has an individual score; a higher score indicates a higher frequency of the occurrence of sleep disorder symptoms.²⁴

Five domains (SBD, DA, SWTD, DOES, and SHY) were applied to the parents/caregivers.²⁴ Questions were also adapted to refer to social distancing/quarantine period (Appendix).

2.3 | Sample size

The sample size was calculated using an online power and sample size calculator (<http://powerandsamplesize.com/>) considering a 95% confidence interval, 5% standard error, 95% power, and sleep disorders prevalence of 30%, based on the study of Ferreira et al.²⁵ The estimated sample was 251 participants. Considering possible losses, an increase of 20% was applied, and the final sample determined was 301.

2.4 | Statistical analysis

The study results were analysed using the Statistical Package for the Social Sciences (SPSS for Windows, version 21.0, SPSS Inc, Chicago, IL, USA). Descriptive statistics were performed to characterize the sample. The likelihood ratio chi-square test, Kruskal-Wallis test, and post-tests were performed to compare the differences between parental perception of the child's oral hygiene and sociodemographic characteristics, the child's changes of habits during social distancing and sleep disturbances. Statistical significance was set at 5%.

2.5 | Ethical aspects

This study was conducted following the principles expressed in the Declaration of Helsinki (revised in World Medical Association, 2013). It was approved by the Human Research

Ethics Committee of the Federal University of Minas Gerais, Brazil (protocol #33872020.5.0000.5149).

3 | RESULTS

A total of 253 parents/caregivers participated in the study (99.2% response rate), and two (0.8%) were excluded because they were not practising social distancing due to the COVID-19 pandemic (Figure 1). A total of 50.2% of families were from Brazil and 49.8% were from Portugal. The majority of children were male (52.2%) and had school activities online (77.5%) during social distancing. The children's mean age was 7.5 years (± 3.4). Most parents/caregivers reported that their child's routine had changed due to social distancing (72.2%). A total of 42.7% of parents reported that their child's sleep quality was poor during social distancing, and 22.9% of parents reported that their child's oral hygiene was poor during social distancing. Table 1 presents the descriptive statistics.

Children whose oral hygiene became poorer during social distancing had higher scores of SBD ($P = .019$) and SWTD ($P = .022$) when compared to children whose oral hygiene remained the same. Children whose oral hygiene became poorer during social distancing had higher DOES scores when compared to children whose oral hygiene unchanged or improved during social distancing ($P < .001$). Tables 2 and 3 present the bivariate analysis results.

4 | DISCUSSION

The aim of this study was to evaluate sleep disturbances in the Brazilian and Portuguese paediatric populations and its association with parental perception of child's oral hygiene during COVID-19 confinement period. COVID-19 was first reported in China in December 2019 and quickly became a global pandemic, spreading worldwide (181 countries as of 16 May 2020). Without a specific treatment and vaccine, social distancing and quarantine are necessary to reduce transmission.^{3,4} Psychological symptoms, emotional disturbance, depression, stress, low mood, irritability, insomnia, post-traumatic stress symptoms, anger, and emotional exhaustion are symptoms of psychological distress and disorders previously reported in situations of quarantine and social distancing.¹⁹ These factors might explain sleep disturbances in children during this stressful period, as well as the decrease in a child's oral hygiene and sleep quality. Every family is experiencing difficult times with necessary adaptations, which makes it difficult to maintain a child's sleep and hygiene routines.²⁶

Sleep breathing disorders are characterized by abnormal respiration during sleep, including snoring and obstructive sleep apnoea, and are the most common reasons for parents

to seek sleep clinics. Most reported symptoms are daytime sleepiness, inattentiveness, and behavioural and academic problems.²⁷ The changes in the child's routine,²⁶ as reported by most parents/caregivers, anxiety due to a pandemic

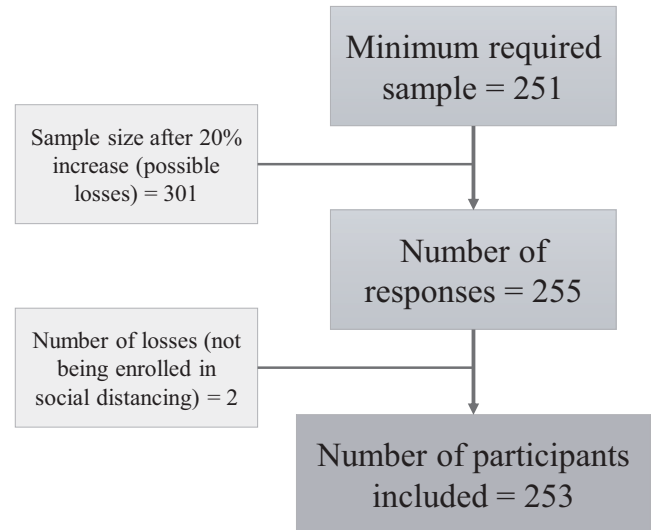


FIGURE 1 Flow diagram of the sample

TABLE 1 Descriptive statistics of sociodemographic characteristics and parents' perception about habits of children aged 3-15 years from Brazil and Portugal during social distancing due to COVID-19

Variable	Frequency (%)
<i>Country of residence</i>	
Portugal	126 (49.8)
Brazil	127 (50.2)
<i>Child's sex</i>	
Male	132 (52.2)
Female	121 (47.8)
<i>Child's routine has changed due to social distancing</i>	
Yes	183 (72.2)
No	70 (27.8)
<i>Child is having school activities online due to social distancing</i>	
Yes	196 (77.5)
No	57 (22.5)
<i>Parent's perception of child's sleep quality during social distancing</i>	
Is unchanged	117 (46.2)
Is poorer	108 (42.7)
Is better	9 (3.6)
Does not know	19 (7.5)
<i>Parent's perception of child's oral hygiene during social distancing</i>	
Is unchanged	145 (57.3)
Is poorer	58 (22.9)
Is better	50 (19.8)

situation⁵ in addition to the consequences of SBD, that is daytime sleepiness and inattentiveness,²⁷ might have a negative influence on a child's oral hygiene once the child might not be so worried about brushing and flossing their teeth or about doing it properly. Also, due to an increase in responsibilities and activities, including work, caring for the child, and household tasks,⁶ parents/caregivers might not be able to pay close attention and supervise their child's oral hygiene.

Several anatomic consequences of chronic mouth breathing are risk factors for sleep breathing disorders.²⁸ A study found that mouth breathing adolescents have a higher increase of plaque index when compared nose breathing adolescents.²⁹ This might indicate that sleep breathing disorder could also influence on child's bad oral hygiene. Future studies evaluating the association between sleep breathing disorders, mouth breathing, and oral hygiene are encouraged.

TABLE 2 Descriptive and comparative analysis of parent's perception of child's oral hygiene and age and sleep disturbances during social distancing due to COVID-19 in children aged 3-15 years from Brazil and Portugal in 2020

Variable	Parent's perception of child's oral hygiene during social distancing due to COVID-19								P*
	Total sample		Is unchanged		Is poorer		Is better		
	Mean (SD)	Median [Min-Max]	Mean (SD)	Median [Min-Max]	Mean (SD)	Median [Min-Max]	Mean (SD)	Median [Min-Max]	
SBD	3.9 (±1.6)	3.0 [3-13]	3.8 (±1.5)	3.0 [3-13] ^a	4.4 (±1.9)	4.0 [3-11] ^b	3.8 (±1.2)	3.0 [3-9] ^{a,b}	.019
DA	3.9 (±1.3)	3.0 [3-10]	3.9 (±1.4)	3.0 [3-10]	3.9 (±1.1)	4.0 [3-9]	4.0 (±1.3)	4.0 [3-10]	.468
SWTD	9.8 (±3.6)	9.0 [6-21]	9.4 (±3.4)	8.0 [6-20] ^a	10.9 (±4.0)	10.0 [6-21] ^b	9.7 (±3.2)	9.0 [6-19] ^{a,b}	.022
DOES	7.9 (±3.2)	7.0 [5-19]	7.2 (±2.5)	6.0 [5-17] ^a	10.0 (±4.0)	9.0 [5-19] ^b	7.5 (±2.6)	7.0 [5-15] ^a	<.001
SHY	2.9 (±1.5)	2.0 [2-10]	2.9 (±1.6)	2.0 [2-10]	3.1 (±1.3)	3.0 [2-7]	2.9 (±1.8)	2.0 [2-10]	.180
Age	7.5 (±3.4)	7.0 [3-17]	7.5 (±3.4)	7.0 [3-17]	7.9 (±3.3)	8.0 [3-14]	7.1 (±3.7)	6.0 [3-16]	.305

Note: Different letters represent statistically significant differences ($P \leq .05$); values in bold represent statistically significant associations ($P \leq .05$).

Abbreviations: DA, disorders of arousal; DOES, disorders of excessive somnolence; Max, maximum; Min, minimum; P, probability value; SBD, sleep-disordered breathing; SD, standard deviation; SHY, sleep hyperhidrosis; SWTD, sleep-wake transition disorders.

*Kruskal-Wallis and post hoc.

Variable	Parent's perception of child's oral hygiene during social distancing			P*
	Is unchanged	Is poorer	Is better	
	Frequency (%)	Frequency (%)	Frequency (%)	
<i>Child's sex</i>				
Male	74 (56.1)	34 (25.8)	24 (18.2)	.514
Female	71 (59.2)	24 (20.0)	25 (20.8)	
<i>Child is having school activities online due to social distancing</i>				
Yes	110 (56.4)	49 (25.1)	36 (18.5)	.521
No	35 (61.4)	09 (15.8)	13 (22.8)	
<i>Child's routine has changed due to social distancing</i>				
Yes	99 (54.4)	50 (27.5)	33 (18.1)	.338
No	45 (65.2)	08 (11.6)	16 (23.2)	
<i>Parent's perception of child's sleep quality during social distancing</i>				
Is unchanged	73 (62.4)	20 (17.1)	24 (20.5)	.156
Is poorer	58 (54.2)	33 (30.8)	16 (15.0)	
Is better	04 (44.4)	0 (-)	05 (55.6)	
Does not know	10 (52.6)	05 (26.3)	04 (21.1)	

Note: Values in parenthesis represent the percentage of the line.

Abbreviation: P = probability value.

*Linear-by-linear association.

TABLE 3 Comparative analysis of parent's perception of child's oral hygiene and sociodemographic characteristics and habits during social distancing due to COVID-19 in children aged 3-15 years from Brazil and Portugal in 2020

Sleep-wake transition disorders occur during sleep-wake transition periods and incorporate a variety of phenomena.^{8,27} The specific causes and physiology of some SWTD are still uncertain, but others, such as hypnic jerks, could be triggered by stress, sleep deprivation, fatigue, and stimulants such as caffeine and nicotine.⁸ Sleep bruxism, part of SWTD, is also associated with stress and anxiety in children.³⁰ The consequences for some SWTD could be difficulty falling asleep, insomnia, fear of falling asleep, anxiety and depression. Excessive daytime sleepiness might be a consequence and clinical sign of SWTD.⁸ The stressful situation caused by the pandemic and social distancing⁵ might be a trigger factor for some SWTD in children with the condition,^{8,31} which might also lead to sleeping problems, increased daytime sleepiness and consequently poor oral hygiene habits.

Disorders of excessive somnolence were also associated with poor oral hygiene in children. The disorders refer to a child's difficulty in waking up in the morning, feeling tired when waking up, excessive daytime somnolence, and sleeping in inappropriate situations.²⁴ Due to excessive sleepiness, children and adolescents might not brush their teeth and floss properly, or might even not brush and floss at all. In the case of younger children, the parents/caregivers are responsible for their oral hygiene. A qualitative study found that for parents/caregivers, toothbrushing was cued by events, such as waking up, eating breakfast, having a bath or shower, getting ready for school, coming home from school, having dinner, doing homework, and going to bed.¹⁸ Also, many parents' morning routines were more predictable than that of evenings, and when considering toothbrushing, parents with consistent routines reported that it was a 'habit'.¹⁸ Changes in the family routine due to social distancing, children not attending school, and parents working from home⁶ might interfere with children's toothbrushing, leading to poor oral hygiene during the pandemic.

The level of oral hygiene impacts significantly on the oral microbiome.³² *H Pylori* bacteria is responsible for several diseases of the lower digestive tract, such as chronic gastritis, peptic ulcer disease, and gastric carcinoma.^{33,34} This bacterium can be found in biofilm and saliva, and its presence in the oral cavity might contribute to reinfection and gastrointestinal treatment failure.³³ Regular plaque control and improving oral health status plays an important role in reducing and preventing rate of recurrence of *H Pylori*.³⁵ There seems to be an association between sleep-related breathing disorders and gastrointestinal symptoms among children,³⁶ but also the occurrence of gastrointestinal disease can impact sleep quality.³⁷ This could indicate a link between bad oral hygiene habits, gastrointestinal disorders, and sleep disorders. Future studies investigating those factors and how they relate are encouraged.

No association was found between parental perception of the child's oral hygiene during social distancing and changes

in the child's routine, sex, school activities online, and parental perception of child's sleep. The question on changes in the child's routine was not specific to any daily activity, such as sleeping, breakfast, and bath time. Each parent/caregiver could interpret such a broad question differently, resulting in no statistical association. The parents' perception of poorer oral hygiene could also have been due to the quality and time spent toothbrushing, instead of the frequency of the habit. The question referred specifically to the child's routine, and in the case of younger children, who rely on parental help to perform toothbrushing, changes in the family or parental routine might be more relevant to the child's oral hygiene.

Parental perception of children's oral hygiene does not mean that children had good hygiene before the pandemic. Studies with a qualitative design or more specific questions regarding family routine, sociodemographic characteristics, and school activities with multivariate analysis can aid understanding of the influence of COVID-19 pandemic on a child's sleep and oral hygiene. Knowing the parental perception of their child's health is important, once parental decisions and the care they provide have an impact on their children's well-being.³⁸ When considering oral health, in addition to seeking professional dental care, parents will directly participate on children's oral hygiene and care measures, such as tooth brushing and regulating sugar intake.³⁸ While performing social distancing during COVID-19 pandemic, parents are the ones responsible for supervising and helping their children brush their teeth and floss. Based on their perception of child's oral hygiene, paediatric dentists can identify the need for new strategies to help families improve their oral hygiene habits in this difficult time.

This study has some limitations that should be addressed. Due to social distancing measures, clinical assessment of the children's oral hygiene was not possible. The hours of sleep and sleep latency were not evaluated, and it is not possible to know whether the children had sleep disturbances prior to COVID-19 pandemic. Knowing more about children's and adolescents' sleep quality and changes in sleep habits during social distancing might contribute to better understanding of the connection between sleep and oral hygiene. Longitudinal studies evaluating children's sleep and oral hygiene during this period are encouraged, as are studies based on clinical examination after the pandemic.

Social distancing, quarantine, and hygiene measures have been used in the past when there was neither treatment nor vaccines for a new infection.^{3,19,39} When facing a new infection, children can be the key spreaders of a virus even if they are asymptomatic.^{40,41} Staying at home for a long period with children while managing other activities, such as work and household tasks, is a great challenge to parents/caregivers and can be stressful for all members of the family. Maintaining good oral hygiene is a crucial factor for

preventing caries in children and adolescents.¹⁵⁻¹⁷ Paediatric dentists can create alternative measures to help families maintain their oral hygiene habits and a good sleep routine even during social distancing. The present results demonstrate that after the pandemic, paediatric dentists might need to reinforce preventive measures and oral hygiene orientation for their patients and parents in the dental office, as well as perform a detailed clinical examination for possible new carious lesions.

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CONFLICTS OF INTEREST

The authors report no conflicts of interest and are alone responsible for the content and writing of the paper.

AUTHORS CONTRIBUTIONS

JCSN and IAP conceived and designed the experiments; ASB contributed to acquisition of data; ASB, IMP, MFP, JCSN, SMA, and TMP contributed to analysis and interpretation of data; ASB, IMP, and MFP contributed to drafting the manuscript; JCSN, SMA, TMP, and IAP revised and gave final approval of the manuscript; IAP gave funding support.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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