

Toothbrushing frequency among children and adolescents in 72 countries: Findings from the Global School-based Student Health Survey

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Abstract

Background. Toothbrushing twice daily is essential for maintaining oral hygiene, which is a cornerstone of overall health. This is particularly important during childhood and adolescence, when lifelong habits are established. Nevertheless, many children and adolescents worldwide face challenges in maintaining good oral health due to limited access to resources and education.

Objectives. This study used nationally representative samples from the Global School-based Student Health Survey (GSHS) (2010–2019) to determine the frequency of toothbrushing among school-going students ($N = 266,113$) in 72 countries.

Material and methods. The country-specific sample size ranged from 130 in Tokelau to 25,408 in Malaysia. The outcome variable was the frequency of brushing or cleaning teeth once daily within the past 30 days prior to the survey. Bivariate analysis was conducted following a descriptive study to determine the frequency of toothbrushing or cleaning across different age groups (≤ 12 , 13, 14, 15, ≥ 16 years), sexes, World Health Organization (WHO) regions, and gross domestic product (GDP) per capita quintiles.

Results. The overall proportion of males to females in the sample was 50.9:49.1. In 45 countries or territories (62.5%), the proportion of participants who reported brushing their teeth at least once a day was above 90%. Participants from 10 countries or territories (13.9%) reported never or rarely brushing their teeth. In 69 countries or territories (95.8%), male students were more likely than female students to never or rarely brush their teeth. The highest rate of individuals who never or rarely brush their teeth (32.1%) was reported in the Eastern Mediterranean Region. In comparison, the Region of the Americas had the highest frequency of brushing twice or more daily (82.9%).

Conclusions. Educational interventions focused on dental health implemented in schools and aimed at early adolescents have the potential to promote the formation of healthy habits, which may lead to improved well-being over both short and long terms.

Keywords: adolescent, oral hygiene, toothbrushing, global health

Introduction

Oral hygiene practices are essential for overall health and well-being, especially during childhood and adolescence. Habits formed during these early stages often persist into adulthood.¹ Poor oral health can result in a below-average quality of life, characterized by pain and tooth loss, which many adults experience later in life.² Toothbrushing is considered a universal method for preserving oral health and hygiene.³ The act of brushing twice daily has become a societal standard. Dental professionals and authoritative bodies frequently recommend this regimen.⁴ A meta-analysis of 25 studies revealed that individuals who brush their teeth infrequently exhibit a 50% increase in the odds of developing dental caries compared to frequent brushers. Additionally, the analysis demonstrated that individuals who brush their teeth less than twice a day are at a 45% increased risk of developing dental caries compared to those who adhere to a twice-daily brushing regimen.⁵ Higher toothbrushing frequency is also associated with a lower risk of periodontal diseases.⁶ It is crucial to better understand the global prevalence of toothbrushing frequency, especially among children and adolescents, as this directly impacts oral health, which is an integral component of overall health and well-being. High variability in toothbrushing habits observed across different populations may reflect broader disparities in access to dental care and oral hygiene education.¹ This is particularly important in low- and middle-income countries (LMICs), where the current situation is concerning and data reveals a grim reality. In a previous study, McKittrick and Jacobsen surveyed 146,462 middle school students from 44 LMICs.¹ Of the 44 LMICs included in the study, more than half reported that over 5% of students brushed their teeth less than once a day or not at all. The situation is even more dire in 15 countries, primarily in the Eastern Mediterranean and sub-Saharan Africa regions, where over 10% of students rarely or never engage in dental hygiene practices.¹ The reasons behind the oral health crisis among children and adolescents in these regions are complex. Limited access to oral healthcare services, a lack of knowledge about proper oral hygiene and socioeconomic challenges contribute to the problem.¹ A study in the Dominican Republic, Suriname, and Trinidad and Tobago highlighted substantial deficiencies in oral and hand hygiene among adolescents, which were associated with sociodemographic influences, risky behaviors, mental health issues, and insufficient parental guidance, with few adhering to proper hygiene practices. However, the limited scope of the study to just 3 Caribbean nations calls for a broader investigation into dental hygiene practices across the entire region.⁷

There is a knowledge gap regarding the recent global prevalence of toothbrushing frequency. Therefore,

up-to-date data is essential for understanding current trends and challenges in oral health practices. The most recent research reflects the latest societal, economic and environmental changes that could affect oral hygiene habits. The value of this study lies in its potential to guide interventions aimed at improving toothbrushing practices among children and adolescents in LMICs. By understanding the prevalence and causes of inadequate toothbrushing in these settings, policymakers and healthcare professionals can develop targeted strategies to promote good oral hygiene habits. This could significantly improve oral health and the overall well-being of these populations. Focusing on children and adolescents is crucial, as the formation of healthy habits at this stage can impact their long-term well-being. This study aims to assess the frequency of toothbrushing among children and adolescents across 72 countries, utilizing nationally representative samples.

Material and methods

Data source

The study employed a nationally representative sample of the Global School-based Student Health Survey (GSHS), conducted in 72 countries from 2010 to 2019. The GSHS is an international collaborative project aimed at facilitating the measurement and evaluation of behavioral risk factors and protective factors in 10 crucial domains among adolescents.⁸ The GSHS employs a self-administered questionnaire and is an affordable, school-based survey method that gathers data on the health behaviors and protective factors associated with significant causes of illness and death worldwide, encompassing children and adults. In our study, all GSHS surveys followed a two-stage probability sampling design. At first, the schools were selected based on the probability proportional to size sampling, and then the classrooms were chosen randomly. All students enrolled in a specific class were eligible for inclusion in the study, irrespective of age. They were provided with a self-administered questionnaire. The participants completed the questionnaire in their preferred language under the supervision of competent survey administrators external to the school. In each participating country, the GSHS received ethical approval from either the Ministry of Health or Education, the relevant institutional ethics review committee, or both. Prior to conducting the survey, verbal or written consent was obtained from the participating schools, parents and students in accordance with the established protocols. The study adhered to the ethical principles outlined in the World Medical Association Declaration of Helsinki regarding research involving human subjects.⁸

Outcome variable

The outcome variable was the frequency of tooth-brushing. The participants were asked about the frequency with which they had cleaned or brushed their teeth over the past 30 days. The following 6 options were provided: A. I did not clean or brush my teeth during the past 30 days; B. Less than once per day; C. Once per day; D. 2 times per day; E. 3 times per day; F. 4 or more times per day. The categories A and B were merged to generate a new category representing subjects who either never or rarely brushed or cleaned their teeth. We also merged the categories D, E and F to generate a “twice or more” category.

Statistical analysis

All analyses were conducted using STATA v. 18.0 (StataCorp LLC, College Station, USA). The survey data from each country was analyzed separately. The survey weight was adjusted throughout the course of the study. At first, descriptive analyses were conducted to determine the frequency of toothbrushing or cleaning among the participants. Then, bivariate analyses were carried out to assess the distribution of brushing or cleaning teeth according to age groups and sexes. The Rao–Scott χ^2 test was conducted to compare the frequency of never or rarely brushing or cleaning teeth

across age groups and sexes. The study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. The gross domestic product (GDP) per capita data from the survey year was retrieved from the World Bank or Index Mundi (when the World Bank data was unavailable), and it was categorized into quintiles (with quintile 1 representing the lowest and quintile 5 representing the highest values).^{9,10} We also conducted subgroup analyses for the entire sample by age (≤ 12 , 13, 14, 15, and ≥ 16 years old), sex (male/female), World Health Organization (WHO) regions (South-East Asian Region, Western Pacific Region, Eastern Mediterranean Region, African Region, Region of the Americas), and GDP per capita (quintile 1–5).

Results

In total, data from 266,113 participants was included in the study. The country-specific sample size ranged from 130 in Tokelau to 25,408 in Malaysia. In most countries, the number of male participants was higher than that of female participants. The overall proportion of males to females in the sample was 50.9:49.1. The largest proportion of participants were aged ≥ 16 years (28.6%) (Table 1).

Table 1. Background characteristics of the participants

Region	Country	Year	Sample size, <i>n</i>	Sex		Age [years]				
				male [%]	female [%]	≤ 12 [%]	13 [%]	14 [%]	15 [%]	≥ 16 [%]
African Region (<i>n</i> = 41,809)	Algeria	2011	4,436	48.0	52.0	20.8	18.3	18.5	23.7	18.7
	Benin	2016	2,508	73.0	27.0	1.2	4.1	7.8	11.8	75.1
	Eswatini	2013	3,590	48.6	51.4	1.6	8.1	13.4	15.9	61.1
	Ghana	2012	3,555	51.3	48.7	7.3	9.9	14.0	15.6	53.3
	Liberia	2017	2,529	52.0	48.0	3.8	4.1	7.6	8.9	75.7
	Mauritania	2010	1,948	54.6	45.4	5.9	9.4	19.8	29.2	35.8
	Mauritius	2017	2,990	46.4	53.6	0.5	22.5	20.3	18.9	37.8
	Mozambique	2015	1,811	53.3	46.7	6.0	9.5	12.4	21.1	51.1
	Namibia	2013	4,417	46.8	53.2	1.9	10.3	12.8	16.5	58.6
	Sierra Leone	2017	2,714	51.7	48.4	3.9	13.4	17.9	19.8	45.0
	Sudan	2012	2,079	52.9	47.2	1.1	14.9	23.6	28.5	31.8
	United Republic of Tanzania	2014	3,651	49.1	50.9	20.0	20.1	20.6	20.4	18.9
	Zimbabwe	2013	5,581	50.3	49.7	1.4	12.4	25.7	31.6	28.9

Region	Country	Year	Sample size, <i>n</i>	Sex		Age [years]				
				male [%]	female [%]	≤12 [%]	13 [%]	14 [%]	15 [%]	≥16 [%]
Region of the Americas (<i>n</i> = 48,158)	Bahamas	2013	1,344	48.0	52.0	18.3	32.5	31.7	13.8	3.7
	Barbados	2011	1,617	49.6	50.4	2.0	20.7	36.1	33.1	8.1
	Belize	2011	2,071	48.2	51.8	22.2	19.7	21.7	19.3	17.1
	Bolivia	2018	7,633	50.6	49.4	0.8	10.7	18.7	20.4	49.4
	Curaçao	2015	2,685	48.8	51.2	6.7	9.5	16.4	18.1	49.3
	Dominican Republic	2016	1,419	49.3	50.7	1.9	6.7	16.6	23.3	51.5
	El Salvador	2013	1,847	51.5	48.6	3.8	23.1	31.7	28.2	13.2
	Guatemala	2015	4,212	52.3	47.7	6.3	21.7	28.1	26.1	17.9
	Honduras	2012	1,736	46.8	53.2	16.2	25.7	25.9	18.9	13.3
	Panama	2018	2,874	47.3	52.7	0.4	12.1	20.8	20.0	46.7
	Paraguay	2017	3,044	48.9	51.1	5.6	15.9	21.0	19.6	37.9
	Peru	2011	2,851	50.5	49.5	1.9	19.6	30.3	32.0	16.2
	Saint Kitts and Nevis	2010	1,713	51.3	48.7	0.8	17.7	31.6	32.0	18.0
	Saint Lucia	2018	1,945	47.9	52.1	17.5	18.3	18.1	17.1	29.1
	Saint Vincent and the Grenadines	2018	1,838	48.7	51.3	0.4	9.2	21.1	23.7	45.6
	Suriname	2016	2,104	49.2	50.8	7.2	17.7	23.5	20.2	31.4
	Trinidad and Tobago	2017	3,801	48.0	52.0	17.5	18.5	19.2	19.1	25.7
	Uruguay	2012	3,424	45.9	54.1	0.6	22.2	30.1	30.2	16.8
Eastern Mediterranean Region (<i>n</i> = 59,956)	Afghanistan	2014	2,356	55.7	44.3	3.4	11.8	20.4	20.3	44.2
	Bahrain	2016	7,072	50.8	49.2	13.8	20.7	20.0	19.6	25.9
	Morocco	2016	6,477	53.9	46.2	11.5	15.2	16.6	15.2	41.4
	Egypt	2012	2,421	49.8	50.2	15.4	36.3	29.2	16.4	2.8
	Iraq	2011	1,982	56.9	43.1	7.2	21.2	22.8	24.6	24.2
	Kuwait	2015	3,452	48.9	51.1	1.4	15.0	19.0	21.4	43.2
	Lebanon	2017	5,662	46.9	53.1	14.1	17.1	19.1	16.0	33.7
	Oman	2015	3,389	49.8	50.2	1.7	10.3	17.3	21.1	49.6
	Palestine	2010	14,045	49.7	50.3	9.3	28.0	33.0	26.4	3.4
	Qatar	2011	1,879	48.5	51.5	24.1	29.2	29.3	13.6	3.8
	Syrian Arab Republic	2011	3,061	51.2	48.8	17.4	28.7	29.8	20.7	3.4
	United Arab Emirates	2016	5,709	49.3	50.7	5.2	14.0	19.7	20.0	41.1
	Yemen	2014	2,451	55.1	44.9	7.9	15.9	17.7	18.3	40.2
South-East Asian Region (<i>n</i> = 43,102)	Bangladesh	2014	2,972	65.2	34.8	2.5	25.1	38.0	26.0	8.4
	Bhutan	2016	7,432	48.0	52.0	4.5	10.0	14.4	16.2	54.9
	Indonesia	2015	11,032	48.9	51.2	19.4	24.2	24.1	14.7	17.7
	Myanmar	2016	2,796	46.6	53.4	11.6	27.0	28.8	18.3	14.3
	Nepal	2015	6,356	48.6	51.4	11.9	19.7	24.4	20.2	23.8
	Sri Lanka	2016	3,226	48.8	51.2	2.0	21.2	24.2	21.3	31.3
	Thailand	2015	5,836	47.0	53.0	10.1	20.4	21.2	17.2	31.1
	Timor-Leste	2015	3,452	50.5	49.5	5.2	6.4	12.7	15.3	60.5

Region	Country	Year	Sample size, <i>n</i>	Sex		Age [years]				
				male [%]	female [%]	≤12 [%]	13 [%]	14 [%]	15 [%]	≥16 [%]
Western Pacific Region (<i>n</i> = 73,088)	Brunei	2014	2,567	50.1	49.9	3.7	18.5	26.6	22.4	28.9
	Cambodia	2013	3,791	52.3	47.7	2.3	11.8	18.8	18.7	48.4
	Cook Islands	2015	691	48.5	51.5	0.4	9.1	22.8	20.9	46.8
	Fiji	2016	3,558	49.1	50.9	0.6	3.6	18.5	22.2	55.1
	French Polynesia	2015	3,188	49.6	50.4	10.7	19.2	17.0	18.0	35.2
	Kiribati	2011	1,549	47.2	52.8	3.2	21.6	31.0	31.0	13.2
	Laos	2015	3,640	53.3	46.7	0.2	4.3	11.4	22.9	61.3
	Malaysia	2012	25,408	50.1	49.9	0.8	20.4	20.6	20.2	38.1
	Mongolia	2013	5,343	48.3	51.8	10.7	19.7	18.8	17.8	33.0
	Nauru	2011	525	46.3	53.7	14.1	21.2	22.2	17.5	25.1
	Niue	2010	140	58.2	41.8	26.6	10.0	11.7	16.2	35.6
	Philippines	2015	8,747	49.4	50.6	6.7	19.3	23.7	23.3	27.0
	Samoa	2017	1,875	47.9	52.1	9.1	14.0	18.2	17.4	41.4
	Solomon Islands	2011	1,303	53.9	46.1	6.4	14.7	22.8	28.0	28.1
	Tokelau	2014	130	53.6	46.4	25.6	20.4	13.1	14.8	26.1
	Tonga	2017	3,259	50.7	49.3	23.2	15.9	17.2	17.1	26.6
	Tuvalu	2013	895	48.5	51.5	21.1	20.3	17.6	13.7	27.3
	Vanuatu	2016	2,075	49.5	50.5	3.3	11.5	18.8	22.4	44.0
	Vietnam	2013	3,312	46.8	53.2	0.1	0.4	21.0	22.5	56.0
	Wallis and Futuna	2015	1,092	48.8	51.2	12.7	13.1	17.8	18.2	38.2
Total		–	266,113	50.9	49.1	9.4	18.7	23.3	20.0	28.6

Unweighted frequencies and weighted percentages are reported.

Table 2 illustrates the distribution of participants according to their daily frequency of toothbrushing or cleaning. Overall, 18.8% of participants reported brushing their teeth once a day during the 30 days before the survey, while 70.4% of participants brushed their teeth at least twice a day. The percentage of respondents who reported never cleaning or brushing their teeth ranged from 0.4% in Paraguay to 19.3% in Egypt. In 6 countries, the percentage of respondents who reported never cleaning or brushing their teeth was higher than 10%. These countries were Egypt (19.3%), Yemen (17.8%), Morocco (15.1%), Palestine (13.1%), Syrian Arab Republic (11.2%), and Algeria (10.8%). The proportion of participants who reported cleaning or brushing their teeth at least twice per day ranged from 32.0% in Egypt to 90.1% in Belize. In 16 countries, the percentage of respondents who reported cleaning or brushing their teeth at least twice daily was above 85%. These countries included Belize (90.1%), Paraguay (90.0%), Brunei (89.6%), Indonesia (89.2%), El Salvador (89.1%), Laos (88.6%), Guatemala (88.5%), Uruguay (88.3%), Honduras (87.8%), Barbados

(87.3%), Panama (87.0%), Malaysia (86.6%), Tuvalu (85.9%), the Dominican Republic (85.7%), Suriname (85.7%), and the Philippines (85.2%).

Table 3 illustrates the distribution of participants who reported never or rarely brushing or cleaning their teeth, stratified by sex and age. Overall, the percentage ranged from 2.1% in Belize to 39.3% in Egypt. In 56 countries, the prevalence was higher among male participants. In 32 countries, the age group of ≤12 years demonstrated the highest prevalence of never or rarely brushing or cleaning teeth. For the age group of ≥16 years, 13 countries exhibited the highest prevalence of never or rarely brushing or cleaning teeth. There were no clear trends between the age group and the prevalence of never or rarely brushing or cleaning teeth.

The distribution of the percentages of individuals based on the daily frequency of toothbrushing or cleaning, stratified by age, sex, WHO regions, and GDP quintiles is shown in Table 4. The frequency of toothbrushing or cleaning increases with age. The individuals aged

Table 2. Distribution of the participants according to the daily frequency of toothbrushing or cleaning

Country	Daily frequency of toothbrushing or cleaning					
	Never [%]	<1 [%]	1 [%]	2 [%]	3 [%]	≥4 [%]
Algeria	10.8	9.9	20.5	24.5	21.2	13.2
Benin	0.6	3.0	24.3	35.4	26.2	10.5
Eswatini	1.8	2.7	31.3	43.2	17.1	3.9
Ghana	2.4	5.8	28.7	43.6	9.4	10.0
Liberia	4.5	7.6	16.9	47.1	13.9	10.1
Mauritania	4.6	10.6	21.7	17.7	21.5	24.0
Mauritius	0.8	2.0	24.7	58.5	9.0	5.0
Mozambique	2.3	3.9	13.8	31.1	31.3	17.7
Namibia	3.6	6.8	23.0	29.6	20.4	16.6
Sierra Leone	2.3	5.3	21.2	42.6	21.8	6.9
Sudan	2.8	7.2	37.3	28.7	11.7	12.4
United Republic of Tanzania	6.2	9.2	25.9	20.5	12.8	25.4
Zimbabwe	3.2	3.3	12.1	26.1	55.3	0.0
Bahamas	1.8	4.2	20.7	46.1	17.3	9.9
Barbados	1.4	2.2	9.2	57.3	23.0	7.0
Belize	0.6	1.5	7.9	36.2	40.2	13.7
Bolivia	3.3	7.6	20.0	31.8	28.0	9.3
Curaçao	1.4	2.4	22.3	52.0	17.3	4.5
Dominican Republic	1.8	3.0	9.7	37.0	38.9	9.8
El Salvador	1.0	2.0	8.0	29.4	47.4	12.3
Guatemala	2.4	3.6	5.5	14.7	55.7	18.1
Honduras	1.7	2.4	8.1	21.4	50.2	16.2
Panama	0.5	1.8	10.6	40.3	36.1	10.6
Paraguay	0.4	2.2	7.3	23.8	49.0	17.2
Peru	1.3	3.1	13.0	29.5	43.2	9.9
Saint Kitts and Nevis	1.2	3.1	13.0	48.8	24.7	9.2
Saint Lucia	1.7	3.0	12.5	54.3	20.7	7.9
Saint Vincent and the Grenadines	1.0	2.5	14.6	55.6	18.9	7.3
Suriname	1.3	1.8	11.3	48.0	28.7	9.0
Trinidad and Tobago	2.3	2.7	17.0	55.6	16.2	6.1
Uruguay	0.7	1.9	9.2	28.5	39.3	20.5
Afghanistan	9.6	18.5	33.9	16.1	10.5	11.4
Bahrain	3.8	10.2	23.2	36.4	17.3	9.0
Morocco	15.1	17.3	21.9	18.4	15.1	12.1
Egypt	19.3	20.0	28.7	16.8	6.5	8.7
Iraq	9.5	13.0	27.6	22.0	17.7	10.2

Country	Daily frequency of toothbrushing or cleaning					
	Never [%]	<1 [%]	1 [%]	2 [%]	3 [%]	≥4 [%]
Kuwait	6.4	8.8	25.7	35.2	18.4	5.5
Lebanon	3.3	5.3	26.3	37.7	21.2	6.2
Oman	4.2	9.6	30.2	34.9	13.8	7.4
Palestine	13.1	15.3	22.9	25.7	14.1	8.9
Qatar	7.7	12.4	17.3	25.8	17.7	19.1
Syrian Arab Republic	11.2	22.4	26.2	22.5	13.1	4.7
United Arab Emirates	3.0	9.6	24.5	42.2	12.8	8.0
Yemen	17.8	18.2	26.8	12.9	12.8	11.6
Bangladesh	1.2	11.7	23.6	52.4	10.2	0.9
Bhutan	2.1	5.4	50.8	28.7	4.7	8.3
Indonesia	0.5	1.8	8.5	55.4	30.5	3.3
Myanmar	1.4	4.7	33.3	45.6	12.8	2.2
Nepal	4.8	9.9	37.0	42.9	4.3	1.2
Sri Lanka	1.0	1.9	27.6	57.3	9.7	2.5
Thailand	2.5	2.6	11.2	66.6	13.6	3.7
Timor-Leste	3.8	11.1	13.3	31.1	35.7	4.9
Brunei	0.5	1.9	8.1	37.4	41.5	10.7
Cambodia	1.0	2.9	16.2	44.5	33.9	1.4
Cook Islands	2.4	9.6	23.3	41.5	13.6	9.6
Fiji	0.9	2.2	12.2	45.5	25.8	13.5
French Polynesia	1.6	5.5	15.0	48.0	17.2	12.8
Kiribati	6.6	12.2	16.3	35.9	14.9	14.1
Laos	0.5	1.8	9.2	47.7	38.0	2.9
Malaysia	0.6	2.1	10.8	41.3	34.4	10.9
Mongolia	1.5	3.7	27.7	42.7	14.9	9.4
Nauru	4.4	8.2	18.3	25.5	13.5	30.1
Niue	3.4	6.2	24.8	42.8	12.6	10.4
Philippines	1.5	4.0	9.3	31.1	46.2	7.9
Samoa	0.7	3.7	11.7	38.3	26.9	18.9
Solomon Islands	7.9	15.4	18.3	21.4	18.2	18.9
Tokelau	3.1	13.5	17.7	35.2	16.4	14.2
Tonga	2.7	5.0	12.8	30.0	8.5	41.0
Tuvalu	3.1	3.9	7.2	18.7	35.0	32.2
Vanuatu	3.3	7.1	16.9	20.8	33.9	18.1
Vietnam	1.1	1.6	20.5	64.3	11.4	1.1
Wallis and Futuna	2.4	6.3	11.7	34.7	29.7	15.2

Table 3. Distribution of the participants who reported never or rarely brushing or cleaning their teeth, stratified by sex and age

Country	Total [%]	Sex			Age [years]					
		male [%]	female [%]	p-value	≤12 [%]	13 [%]	14 [%]	15 [%]	≥16 [%]	p-value
Algeria	20.6	24.9	16.7	<0.001*	17.0	19.6	21.3	20.4	25.3	0.031*
Benin	3.6	4.2	2.1	<0.01*	1.3	4.3	1.7	3.5	3.8	0.381
Eswatini	4.5	5.9	3.1	<0.01*	1.7	6.0	5.4	4.3	4.2	0.388
Ghana	8.2	8.1	8.4	0.752	15.7	9.5	10.2	11.4	5.5	0.008*
Liberia	12.1	13.1	11.0	0.140	27.9	17.2	10.0	15.2	10.9	<0.001*
Mauritania	15.3	17.0	13.1	<0.01*	16.5	10.7	14.7	15.7	16.2	0.393
Mauritius	2.8	3.4	2.2	0.223	0.0	3.4	2.1	2.7	2.8	0.790
Mozambique	6.2	6.3	6.0	0.784	10.2	9.5	0.7	7.4	5.9	0.033*
Namibia	10.4	11.1	9.8	0.197	16.5	13.9	12.1	11.7	8.9	0.030*
Sierra Leone	7.6	8.6	6.5	0.106	7.0	6.1	9.1	8.2	7.2	0.689
Sudan	10.0	12.1	7.6	0.105	1.8	7.2	11.3	11.1	9.4	0.478
United Republic of Tanzania	15.4	16.0	14.8	0.323	25.1	14.6	15.0	10.3	11.9	<0.001*
Zimbabwe	6.5	8.2	4.8	<0.001*	9.2	5.8	5.7	6.7	7.3	0.437
Bahamas	6.0	8.2	3.9	<0.001*	6.0	6.3	5.3	6.4	7.7	0.893
Barbados	3.5	4.2	2.9	0.251	7.1	3.2	4.5	2.9	2.3	0.448
Belize	2.1	2.6	1.7	0.115	1.3	2.0	2.4	1.9	3.0	0.560
Bolivia	10.9	13.2	8.6	<0.001*	23.7	11.6	11.1	10.6	10.6	0.059
Curaçao	3.8	4.6	3.1	0.060	4.0	3.8	4.1	3.4	3.9	0.966
Dominican Republic	4.7	6.4	3.1	0.013*	34.4	3.1	5.9	5.4	3.1	0.001*
El Salvador	2.9	3.5	2.3	0.060	5.2	3.2	1.8	2.7	5.1	0.091
Guatemala	6.0	6.3	5.7	0.712	7.9	3.1	6.8	6.5	6.8	0.147
Honduras	4.1	5.0	3.2	0.067	4.9	4.9	2.9	3.4	4.8	0.379
Panama	2.3	2.4	2.3	0.835	9.3	2.0	3.2	1.9	2.2	0.288
Paraguay	2.6	3.4	1.9	0.028*	3.7	2.7	1.9	1.8	3.3	0.164
Peru	4.4	5.1	3.8	0.290	1.8	3.3	5.0	4.3	5.2	0.449
Saint Kitts and Nevis	4.3	5.4	3.1	<0.001*	5.5	3.6	5.0	3.1	5.7	<0.001*
Saint Lucia	4.7	6.7	2.9	<0.002*	4.7	5.8	3.9	6.0	3.7	0.626
Saint Vincent and the Grenadines	3.5	4.2	2.9	0.131	11.8	2.7	3.0	2.1	4.6	0.076
Suriname	3.1	3.6	2.5	0.160	0.0	1.7	2.4	4.2	4.3	0.104
Trinidad and Tobago	5.0	6.6	3.6	0.016*	4.3	5.5	4.1	4.9	6.0	0.662
Uruguay	2.6	3.8	1.5	0.001*	8.4	2.7	2.4	2.6	2.5	0.575
Afghanistan	28.1	35.6	18.6	0.001*	19.0	23.7	23.4	29.6	31.4	0.177
Bahrain	14.0	21.0	6.8	<0.001*	11.2	14.4	12.9	15.4	15.0	0.410
Morocco	32.4	38.7	25.1	<0.001*	25.3	37.1	32.8	34.3	31.8	0.018*
Egypt	39.3	42.1	36.6	0.282	45.9	38.4	36.1	38.3	55.3	0.509
Iraq	22.4	27.2	16.1	<0.001*	20.1	20.2	20.3	24.1	25.4	0.445

Country	Total [%]	Sex			Age [years]					
		male [%]	female [%]	<i>p</i> -value	≤12 [%]	13 [%]	14 [%]	15 [%]	≥16 [%]	<i>p</i> -value
Kuwait	15.2	21.8	8.9	<0.001*	23.6	14.1	14.7	14.9	15.6	0.691
Lebanon	8.6	11.7	5.8	<0.001*	7.3	6.1	9.0	9.3	9.7	0.085
Oman	13.8	19.8	7.8	<0.001*	17.5	11.8	15.1	17.1	12.3	0.157
Palestine	28.4	35.2	21.7	<0.001*	26.6	27.4	26.7	31.5	34.0	0.001*
Qatar	20.1	27.8	12.9	<0.001*	20.8	15.3	20.9	28.2	16.8	0.138
Syrian Arab Republic	33.6	38.2	28.9	<0.001*	34.5	33.5	35.8	30.3	31.9	0.515
United Arab Emirates	12.6	19.6	5.8	<0.001*	9.1	9.4	12.1	13.3	14.1	0.018*
Yemen	36.0	43.6	26.6	<0.001*	26.3	37.1	36.5	35.6	37.3	0.168
Bangladesh	12.9	15.2	8.5	0.002*	8.3	10.9	14.3	11.0	19.1	0.124
Bhutan	7.5	8.6	6.5	<0.001*	7.4	8.7	7.8	7.1	7.3	0.733
Indonesia	2.3	3.5	1.1	<0.001*	3.1	2.0	2.8	1.9	1.3	0.040*
Myanmar	6.1	7.5	4.9	0.019*	4.8	6.7	7.1	4.2	6.6	0.226
Nepal	14.7	13.5	15.8	0.282	23.8	14.9	13.4	11.0	14.4	0.008*
Sri Lanka	3.0	3.5	2.5	0.113	2.9	4.2	2.8	2.5	2.5	0.444
Thailand	5.0	8.3	2.1	<0.001*	5.1	6.2	6.1	4.0	4.0	0.183
Timor-Leste	14.9	16.1	13.7	0.083	28.7	18.6	15.5	17.9	12.5	<0.001*
Brunei	2.3	2.9	1.7	0.047*	4.5	2.2	2.0	2.1	2.5	0.693
Cambodia	3.9	4.6	3.2	0.034*	1.5	7.0	5.0	3.4	3.1	0.012*
Cook Islands	12.0	14.5	9.6	0.035*	0.0	6.2	13.2	14.5	11.5	0.497
Fiji	3.1	4.2	2.0	0.001*	10.1	4.9	3.1	3.2	2.8	0.443
French Polynesia	7.1	9.2	4.9	<0.001*	7.4	9.9	6.3	8.0	5.3	0.074
Kiribati	18.8	23.0	15.0	<0.001*	20.3	22.2	20.7	16.4	14.0	0.119
Laos	2.3	2.1	2.5	0.423	0.0	3.0	2.4	2.1	2.3	0.935
Malaysia	2.7	3.7	1.7	<0.001*	6.6	3.3	2.6	2.6	2.4	0.052
Mongolia	5.2	6.9	3.7	<0.001*	6.3	6.2	5.7	4.5	4.4	0.199
Nauru	12.6	16.5	9.2	<0.001*	12.4	14.7	11.4	16.2	9.4	<0.001*
Niue	9.5	12.0	6.1	<0.001*	18.4	7.9	16.0	4.6	3.5	<0.001*
Philippines	5.5	6.3	4.7	0.138	4.3	5.0	5.9	6.6	4.9	0.771
Samoa	4.3	5.0	3.7	0.194	8.9	4.3	4.1	5.0	3.2	0.235
Solomon Islands	23.3	26.9	19.0	0.003*	17.2	26.9	24.7	21.9	23.1	0.640
Tokelau	16.6	20.5	12.0	0.042*	24.2	13.2	16.3	13.5	13.7	0.415
Tonga	7.7	11.8	3.4	<0.001*	11.0	7.0	6.5	7.9	5.8	0.021*
Tuvalu	7.0	10.9	3.3	<0.001*	12.2	6.1	7.8	5.4	3.9	<0.001*
Vanuatu	10.4	13.3	7.6	<0.001*	17.8	12.2	7.4	9.1	11.3	0.142
Vietnam	2.7	3.7	1.9	0.004*	0.0	6.7	4.1	2.7	2.2	0.121
Wallis and Futuna	8.7	11.4	6.1	0.006*	12.8	9.7	7.6	9.2	7.2	0.383

* statistically significant ($p < 0.05$, Rao–Scott χ^2 test). The percentage values presented in the table are based on the entire study sample.

Table 4. Distribution of the participants based on the daily frequency of toothbrushing or cleaning, stratified by covariates

Covariates		Daily frequency of toothbrushing or cleaning			p-value
		never or rarely [%]	once a day [%]	twice or more [%]	
Age [years]	≤12	14.2	16.4	69.3	<0.001*
	13	12.6	18.3	69.1	
	14	11.5	18.4	70.2	
	15	10.3	19.7	69.9	
	≥16	8.6	19.5	72.0	
Sex	male	13.1	21.3	65.7	<0.001*
	female	8.6	16.2	75.2	
WHO regions	South-East Asian Region	6.0	16.9	77.1	<0.001*
	Western Pacific Region	3.9	14.7	81.4	
	Eastern Mediterranean Region	32.1	26.5	41.4	
	African Region	12.3	24.7	63.0	
	Region of the Americas	5.4	11.6	82.9	
GDP per capita	quintile 1	13.4	26.7	59.8	<0.001*
	quintile 2	10.5	15.2	74.3	
	quintile 3	10.7	20.1	69.3	
	quintile 4	7.2	14.2	78.6	
	quintile 5	9.3	20.8	69.9	

* statistically significant ($p < 0.05$, Rao–Scott χ^2 test); WHO – World Health Organization; GDP – gross domestic product.

12 years or younger reported the highest rates of never or rarely brushing their teeth (14.2%), which decreased progressively to 8.6% in individuals aged 16 years or older ($p < 0.001$). On the other hand, the proportion of individuals who brushed their teeth twice or more per day increased from 69.3% in the youngest age group to 72.0% in the oldest. Notable sex disparities were observed in the toothbrushing practices. Males reported higher rates of never or rarely brushing their teeth (13.1%) compared to females (8.6%; $p < 0.001$). Conversely, a higher percentage of females (75.2%) reported brushing their teeth twice or more daily compared to males (65.7%; $p < 0.001$). The prevalence of toothbrushing frequency varied significantly across WHO regions ($p < 0.001$). The highest rate of individuals who never or rarely brushed their teeth (32.1%) was observed in the Eastern Mediterranean Region. In comparison, the Region of the Americas had the highest frequency of brushing twice or more daily (82.9%). The lowest GDP quintile (quintile 1) exhibited the highest percentage of individuals who never or rarely brushed their teeth (13.4%), while the frequency of brushing twice or more daily increased with the economic status, reaching a peak in quintile 4 (78.6%). However, quintile 5 showed a slight reduction in the frequency of brushing twice or more daily (69.9%).

Discussion

This study aimed to determine the prevalence of oral hygiene practices among school-going students in 72 countries across 5 WHO regions. Using nationally representative samples, this study determined that the proportion of individuals who never cleaned their teeth ranged from 0.4% in Paraguay to 19.3% in Egypt. In 6 countries, the prevalence of respondents who never cleaned their teeth exceeded 10%, including Egypt (19.3%), Morocco (15.1%) and Yemen (17.8%). On the other hand, 16 countries had the prevalence of more than 85% of respondents who reported cleaning their teeth at least twice daily, with Belize (90.1%) showing the highest proportions. The prevalence of never or rarely brushing teeth was higher among male participants in 56 countries, while the age group of ≤12 years exhibited the highest prevalence in 32 countries. The frequency of toothbrushing twice daily tends to increase with age and is more common among females, with notable geographical variations. The highest adherence was observed in the Region of the Americas, while the lowest adherence was observed in the Eastern Mediterranean Region. The economic status also influenced brushing habits, with a peak in the higher GDP quintiles. However, the highest quintile shows a slight decrease in frequent brushing.

Approximately 90% of participants brushed their teeth at least once daily, while about 71% of respondents brushed their teeth at least twice daily. These findings are similar to those of a previous study that examined oral hygiene practices in 44 LMICs using the GSHS 2003–2010 data.¹ However, the previous study reported a higher prevalence of participants who brushed their teeth at least once per day, with a reported rate of 98.9%. This discrepancy in the percentages may be due to differences in time and place. The finding is similar to the 2017/2018 Health Behaviour in School-aged Children (HBSC) Survey in Europe and Canada, wherein 65% of adolescents reported brushing their teeth twice a day.¹¹

In 56 countries, males were more likely to never or rarely brush their teeth. This aligns with the 2017/2018 HSBC survey, which revealed that European countries demonstrated a higher prevalence of toothbrushing more than once a day among female adolescents compared to their male counterparts.¹¹ Previous rounds of GSHS surveys (2003–2010) also reported a higher prevalence of healthy oral hygiene among females.¹ Poor oral hygiene practice among boys persists into adulthood. As a result, adult males are more prone to developing periodontal disease than adult females.^{12,13} These findings highlight the significance of implementing health education programs that foster healthy dental hygiene behaviors among junior secondary school students, with a particular focus on boys in this age group.

Among the 7 countries with a prevalence of never cleaning or brushing teeth exceeding 5%, 5 were in the Middle East. The GSHS results indicate a notably high rate of rare or never brushing reported in the Middle East and some African countries, which may be attributed to the use of a traditional tooth cleaning stick called miswak.¹ As miswak may not be perceived as a “brushing or cleaning” device, this could have led to an underestimated frequency of reported oral hygiene activities.^{1,14,15} Additionally, since Middle Eastern countries had a higher GDP per capita, this could explain why we observed a lower prevalence of toothbrushing twice daily in the quintile 5 compared to quintile 4.

As 29% of participants do not adhere to the recommended twice-daily toothbrushing regimen, they risk developing dental caries and periodontal diseases.^{16,17} Health promotion programs should raise awareness among school-going individuals about the health benefits of regular toothbrushing.

Dental caries is a major public health problem among children and adolescents, which negatively impacts their quality of life.^{18–20} This condition is associated with impaired cognitive growth, higher rates of school absences, poorer academic achievement, more workdays lost for parents, and a diminished quality of life.^{21–23} Promoting healthy behaviors, including regular toothbrushing in school-age children, is important for establishing life-long habits that contribute to overall well-being.²⁴ When

children learn the importance of maintaining oral hygiene, they are more likely to continue these practices into adulthood, significantly reducing the risk of dental issues and fostering a sense of personal health responsibility. Some studies also suggest that the development of healthy habits should commence at an earlier age.^{25,26} Encouraging such habits through educational programs and parental involvement can ensure the sustainability and a healthier future for next generations.^{27–29}

The implementation of a policy related to toothbrushing frequency in schools will require a comprehensive step-by-step approach and thorough consideration. This may involve the presentation of statistical data or research findings on the knowledge of oral health among parents and dental hygiene conditions among students, with a particular focus on tooth decay and cavities, linking these metrics to overall health, school attendance, etc.^{30,31}

Limitations

The robustness of the study lies in its consistent methodology, which was applied to nationally representative samples from 72 countries. However, it is important to consider the limitations of the study. Causal inference cannot be applied due to the cross-sectional nature of the survey. The GSHS assessed oral hygiene behavior and relied on self-reporting, which may have introduced reporting bias. Nevertheless, it is worth mentioning that self-reported toothbrushing frequency has been utilized as a proxy indicator for clinical oral hygiene incidences among adolescents in other studies.³² Finally, there might be a misinterpretation regarding the act of cleaning or brushing teeth among the participants in the Middle East. Future GSHS studies should also include miswak in order to adapt the study to the local context.

Broader research areas, such as other schools, districts and even different countries, should be explored. Information may be obtained from a variety of sources, including scientific research, dental health organizations, the WHO guidelines, etc. Workshops and classes should be conducted by the local dental institutions and dental health professionals on the recommended frequency of toothbrushing, proper brushing techniques, use of appropriate kinds of toothpaste, expected duration of brushing, and proper storage of toothbrushes. Periodic reviews should be completed to assess effectiveness, address potential issues and make necessary revisions. A general guideline may need to be tailored to fit the specific regulations and conditions of each school or district. Further studies are warranted to identify the determinants of oral hygiene practices among school-going students globally. In addition, appropriate collaboration among dental research teams from these countries is needed to form a task force and action plan in order to improve oral health awareness and conditions among schoolchildren.³³

Conclusions

The results of the study suggest that 9 out of 10 students brush their teeth at least once a day. However, nearly 30% of the students do not brush their teeth at least twice a day. Females exhibited a higher frequency of brushing their teeth than males. School-based educational programs targeting dental health, especially for early adolescents, can significantly foster the development of positive habits that benefit immediate and future well-being. Further research is required to explore the factors influencing oral hygiene behaviors among students worldwide.

Ethics approval and consent to participate

In each participating country, the GSHS received ethical approval from either the Ministry of Health or Education, the relevant institutional ethics review committee, or both. Participants were approached for data collection after written or verbal consent was obtained from the adolescents and their respective parents or guardians. Given that our research employed publicly accessible retrospective data, ethical approval was not required.

Data availability

Data can be accessed from the WHO NCD microdata repository at the following URL: <https://extranet.who.int/ncdsmicrodata/index.php/home>.

Consent for publication

Not applicable.

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