

Consumption of Carbonated Soft Drinks Among Young Adolescents Aged 12 to 15 Years in 53 Low- and Middle-Income Countries


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Objectives. To compare consumption of carbonated soft drinks among young adolescents in 53 low- and middle-income countries (LMICs).

Methods. We used 2009 to 2013 Global School-based Student Health Survey data to assess 137 449 young adolescents aged 12 to 15 years with available data (via a standardized questionnaire) on frequency of carbonated soft drink consumption.

Results. Overall, young adolescents reported having consumed carbonated soft drinks 1.39 times per day (95% confidence interval [CI] = 1.26, 1.51), and 54.3% of adolescents reported consuming a carbonated soft drink at least once per day. Frequency (times per day) varied greatly across countries, ranging from 0.52 (95% CI = 0.43, 0.60) in Kiribati to 2.39 (95% CI = 2.25, 2.53) in Suriname.

Conclusions. Our data confirm that consumption of carbonated soft drinks is frequent among young adolescents in LMICs. Our findings highlight the need for interventions in these countries to reduce adolescents' carbonated soft drink consumption. (*Am J Public Health*. 2017;107:1095–1100. doi:10.2105/AJPH.2017.303762)

 See also Singh, p. 1025.

Sugar-sweetened beverages (SSBs) are the leading source of added sugars in Western diets.¹ Carbonated soft drinks, such as Coke, Pepsi, Sprite, and Fanta, are the major contributors of sugar from all SSBs.^{2,3} Since World War II, there has been a vast transition in dietary patterns in low- and middle-income countries (LMICs)⁴ from traditional to Western diets; soft drink sales have increased markedly in LMICs,⁵ whereas consumption has leveled off or even decreased in the past decade in several Western countries such as the United States⁶ and Australia.⁷

There is strong evidence that consumption of SSBs, which are energy dense and nutrient poor, is associated with an increased risk of obesity,⁸ dental caries,⁹ early puberty¹⁰ and aggressive behaviors¹¹ among children and adolescents, and obesity, diabetes, and other chronic diseases in adulthood.^{12,13} In 2010, according to one estimate, 180 000 deaths and 8.5 million disability-adjusted life-years lost as a result of noncommunicable diseases were attributable to SSBs, with 75% of these deaths and

85% of disability-adjusted life-years lost occurring in LMICs.¹⁴

The World Health Organization (WHO) recommends that intake of added sugars be restricted to less than 10% of total energy intake (i.e., <50 g of sugar/day among most adults and less among children) and, if possible, less than 5%.¹⁵ Similarly, the recent 2015 to 2020 US national dietary guidelines suggest that less than 10% of calories per day should come from added sugars,¹⁶ and the American Heart Association recommends that sugar intake be restricted to less than 25 grams of added sugar daily among children.¹⁷ This advised

added sugar consumption among children (<25 g/day) is therefore lower than the approximately 30 grams of sugar contained in a typical 3-decilitr bottle of carbonated soft drink.

In 2010, global consumption of SSBs among adults aged 20 years or older in 187 countries was estimated as 0.58 servings per day.¹⁸ However, SSB consumption among adolescents has not been reviewed recently at the worldwide level, although data have been reported for some countries and regions.

In this study, we sought to compare the frequency of carbonated soft drink consumption among young adolescents aged 12 to 15 years by region and country. Our data were derived from 53 LMICs taking part in the Global School-based Student Health Survey (GSHS) that had available information on adolescents' diets.

METHODS

The GSHS, a school-based surveillance project led by WHO and the United States Centers for Disease Control and Prevention (CDC), has been conducted among 12- to 15-year-old adolescents in LMICs since 2003. The aim of the project is to provide data on the health behaviors of young adolescents to help countries develop priorities and establish related health programs and policies.^{19,20} Countries are encouraged to

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conduct GSHS studies at regular intervals to monitor trends in the variables assessed.

A standardized 2-stage cluster sampling process is applied in each participating country to obtain a nationally representative sample. In the first stage, schools are selected with a probability that is proportional to the size of the population; in the second stage, classes of the included schools are selected randomly.^{19,20} All students in the selected classes are invited to participate in the survey. The data are anonymous, and survey participation is voluntary.

Data are collected through a structured questionnaire self-administered during regular school hours. The questionnaire is translated to the appropriate language for each country. It includes 10 modules of questions in different areas, and countries can select the modules they wish to use. However, the questions within the modules cannot be altered, and results are therefore directly comparable between countries. The GSHS has included questions on consumption of carbonated soft drinks among young adolescents only since 2009.

Students answer all questions on a computer-scannable answer sheet. The completed answer sheets are sent to the CDC for data entry via automatic optical recognition reading, and the CDC subsequently sends the electronic database as well as summary results to each participating country.

In our study, we included information from all 53 countries that had available data on carbonated soft drinks between 2009 and 2013. We included the latest survey for countries that had conducted several surveys. Our analysis was based on 137 449 adolescents (48.6% of whom were boys) aged 12 to 15 years who had complete data on gender, age, and carbonated soft drink consumption.

Consumption of Carbonated Soft Drinks

Frequency of consumption of carbonated soft drinks was assessed with the question “During the past 30 days, how many times per day did you usually drink carbonated soft drinks, such as Coca Cola, Fanta [add country-specific examples]?” Response options were “I did not drink carbonated soft drinks during the past 30 days,” “less than 1

time per day,” “1 time per day,” “2 times per day,” “3 times per day,” “4 times per day,” and “5 or more times per day.” We calculated mean carbonated soft drink consumption (times per day) in each country after transforming responses as follows: never was coded as 0, less than 1 time per day was coded as 0.5 times per day, 5 or more times per day was coded as 5.5 times per day, and the other responses maintained the same values as the raw variables.

Statistical Analysis

We weighted all reported percentages and mean estimates of carbonated soft drink consumption in each country to account for the cluster sample design of the GSHS and to take into consideration primary sample units and strata at the country level. Nonoverlapping 95% confidence intervals (CIs) between gender and age groups were considered to indicate a statistically significant difference (with such CIs corresponding to a conservative estimation of differences).²¹

Because there was significant heterogeneity between country-specific estimates in the majority of regions according to the I^2 statistic, we conducted a meta-analysis with a random-effects model to calculate pooled regional and overall estimates. The complex samples module in SPSS version 13.0 (SPSS Inc, Chicago, IL) was used to calculate weighted estimates, and pooled regional or overall estimates were calculated with Stata version 11.0 (StataCorp LP, College Station, TX).

RESULTS

Table 1 shows the characteristics of the country samples. There were 53 countries with data on carbonated soft drink consumption from 5 WHO regions (Africa, $n = 8$; Americas [with data from only Central America and South America, including the Caribbean islands], $n = 21$; Eastern Mediterranean, $n = 10$; Southeast Asia, $n = 2$; and Western Pacific, $n = 12$). As noted, 137 449 young adolescents were included in our analysis, corresponding to 99.3% of the initial sample. Sample sizes ranged from 82 in Niue (Western Pacific) to 21 124 in

Argentina (South America), with 90% of surveys having a sample size of at least 1000 (the median sample size was 1806). Consumption of carbonated soft drinks was lowest in Kiribati, Syria, Malaysia, Benin, and Maldives and highest in Trinidad and Tobago, Kuwait, Algeria, Niue, and Suriname.

Table 2 presents data on the frequency of carbonated soft drink consumption among young adolescents across the 5 regions. The overall frequency of consumption of carbonated soft drinks was 1.39 (95% CI = 1.26, 1.51) times per day. The frequency was lowest in Southeast Asia (0.85 times/day; 95% CI = 0.77, 0.94) and highest in Central and South America (1.68 times/day; 95% CI = 1.51, 1.84). The frequency varied greatly across countries, ranging from 0.52 (95% CI = 0.43, 0.60) times per day in Kiribati (Pacific region) to 2.39 (95% CI = 2.25, 2.53) times per day in Suriname (South America; Figure 1 and Appendix A, available as a supplement to the online version of this article at <http://www.ajph.org>).

As shown in Appendix A, overall, 54.3% of young adolescents from the 53 LMICs reported having consumed carbonated soft drinks at least once per day during the past 30 days. In 36 of the 53 countries (67.9%), the percentage of adolescents consuming a carbonated soft drink at least once per day exceeded 50%. More than 25% of young adolescents consumed a carbonated soft drink 3 times or more per day in 12 of the 53 countries, including several countries in Central and South America (Bahamas, Trinidad and Tobago, Barbados, Jamaica, Honduras, Chile, Argentina, Uruguay, and Suriname), the Western Pacific region (Niue), and the Eastern Mediterranean region (Qatar and Kuwait). The frequency of carbonated soft drink consumption did not differ significantly according to gender or age group (12–13 years vs 14–15 years; data not shown).

DISCUSSION

This study shows a high frequency of consumption of carbonated soft drinks among young adolescents aged 12 to 15 years in the 53 LMICs we examined. Overall, 54.3% of young adolescents reported having

TABLE 1—Global School-based Student Health Survey Characteristics, by Country: 2009–2013

Region and Country	Survey Year	Overall Response Rate, %	Sample Size	Boys, %	Carbonated Soft Drink Consumption at Least Once Daily, %
Africa					
Algeria	2011	99.5	3 455	45.9	77.8
Benin	2009	99.9	1 160	66.1	32.1
Ghana	2012	99.7	1 326	48.5	54.4
Mauritania	2010	98.3	1 251	53.3	52.0
Mauritius	2011	99.2	3 106	48.9	39.2
Namibia	2013	99.0	1 900	42.7	51.3
Sudan	2012	98.1	1 370	52.0	39.2
Swaziland	2013	99.5	2 614	38.8	45.8
Central and South America					
Anguilla	2009	99.4	692	48.3	64.0
Antigua and Barbuda	2009	99.6	1 193	51.4	58.2
Argentina	2012	99.1	21 124	47.6	66.1
Bahamas	2013	99.2	1 294	47.3	69.2
Barbados	2011	98.7	1 482	51.1	73.2
Belize	2011	98.6	1 575	48.1	63.8
Bolivia	2012	99.7	2 754	49.7	63.0
British Virgin Islands	2009	99.2	1 181	44.2	64.5
Chile	2013	99.6	1 335	49.4	67.4
Costa Rica	2009	100.0	2 258	49.6	52.6
Dominica	2009	99.1	1 296	50.2	56.5
El Salvador	2013	99.8	1 596	50.6	66.0
Guatemala	2009	99.9	4 456	52.2	54.2
Guyana	2010	99.2	1 943	48.5	70.9
Honduras	2012	99.2	1 462	46.2	73.7
Jamaica	2010	99.2	1 186	49.5	72.6
Peru	2010	99.8	2 346	49.9	53.3
Saint Kitts and Nevis	2011	99.7	1 458	43.6	62.1
Suriname	2009	98.9	1 032	45.4	80.4
Trinidad and Tobago	2011	98.4	2 315	49.6	74.0
Uruguay	2012	99.7	2 846	46.2	69.4
Eastern Mediterranean					
Egypt	2011	98.6	2 314	48.9	54.9
Iraq	2012	98.5	1 506	54.5	54.0
Kuwait	2011	99.3	2 274	51.0	74.2
Lebanon	2011	99.5	1 971	46.7	59.2
Morocco	2010	99.2	2 369	53.1	46.4
Pakistan	2009	99.4	4 960	60.9	36.6
Palestine	2010	99.3	4 250	50.1	58.2
Qatar	2011	98.2	1 732	47.0	61.7
Syria	2010	99.4	2 910	51.1	31.1
United Arab Emirates	2010	98.8	2 268	39.9	41.5
Southeast Asia					
Malaysia	2012	99.8	16 214	49.5	31.2
Maldives	2009	99.1	1 953	47.7	32.8

Continued

consumed carbonated soft drinks at least once per day during the preceding 30 days, with substantial differences across regions and countries. WHO recommends that intake of added sugar be less than 25 grams per day among children,¹⁵ and a typical 3.5-decilitr can or bottle of carbonated soft drink contains around 35 grams of sugar; thus, our results show that more than half of all children in the LMICs examined have excess sugar intake solely from carbonated soft drinks.

Since World War II, sales of carbonated soft drinks have increased substantially in LMICs as a result of a rapid nutrition transition from traditional to Western diets⁴ fueled by powerful global marketing and advertising.²² Companies producing SSBs, often large transnational companies with franchises in LMICs, are relying increasingly on sales of carbonated soft drinks in emerging LMIC markets to boost their revenues, and they adapt their marketing strategies to local cultures and contexts for this purpose.²³ The soft drink industry largely targets children and adolescents, as youths are both vulnerable to marketing strategies and easily amenable to adopting new beverage consumption patterns.²⁴

Our findings suggest that frequency of carbonated soft drink consumption varies by region. The frequency was highest in several Central and South American countries (including the Caribbean islands), where both commercial and homemade SSBs are known to be widely consumed,²⁵ and lowest in Southeast Asia, consistent with market research findings by Euromonitor International.²⁶ These trends may reflect the fact that other beverages—particularly tea and soy-based beverages, often without added sugar—are traditionally more popular than SSBs in Southeast Asia.^{27,28} Moreover, a similar geographical distribution of soft drink consumption has been reported among adults.¹⁸ The GSHS does not systematically collect data on other beverages, and thus we were unable to examine this issue.

Within regions, consumption of carbonated soft drinks varied greatly between countries, which may reflect differences in social and cultural environments. For example, the frequency of consumption of carbonated soft drinks in the Western Pacific

TABLE 1—Continued

Region and Country	Survey Year	Overall Response Rate, %	Sample Size	Boys, %	Carbonated Soft Drink Consumption at Least Once Daily, %
Western Pacific					
Cambodia	2013	99.8	1 806	48.4	45.5
Cook Islands	2011	99.6	846	49.3	60.7
Kiribati	2011	99.5	1 330	45.5	22.6
Mongolia	2013	99.8	3 686	49.3	33.0
Niue	2010	100.0	82	58.5	79.3
Philippines	2011	99.6	3 818	48.5	42.4
Samoa	2011	97.4	2 097	47.2	53.9
Solomon	2011	98.7	892	52.1	44.2
Tonga	2010	99.1	1 922	50.1	57.2
Tuvalu	2013	99.3	670	49.0	54.0
Vanuatu	2011	98.9	835	49.7	39.7
Vietnam	2013	99.8	1 738	46.8	34.6
Total		99.3	137 449	48.6	54.3

region ranged from 0.52 times per day in Kiribati to 2.13 times per day in Niue. Consistent with our results, a review of trade data in the Pacific region showed that, in 2011, volumes of soft drink sales were 1 liter per person in Kiribati, 8 in Tuvalu, 31 in Tonga, and 41 in Niue.²⁹

We also found that the frequency of consumption of carbonated soft drinks did not differ markedly between boys and girls in the majority of countries. This is consistent with a systematic assessment in 187 countries showing little difference in consumption of SSBs between men and women,¹⁸ although several studies have reported gender differences among adolescents.^{30,31}

A number of factors can explain high consumption of carbonated soft drinks in LMICs. Bottled soft drinks may be consumed more frequently in environments where tap water is not safe, and cold beverages may be particularly appreciated in warm countries (e.g., countries near the equator). In addition, consumption of beverages among adolescents may be influenced by the consumption habits of their parents and friends, the availability of soft drinks at home and on school premises, taste preferences, and social norms.^{32,33} Further studies should quantify factors promoting SSB consumption among children and adolescents in different regions and

countries to guide interventions and policies aimed at curbing consumption of soft drinks.

Because of the detrimental impact of SSBs on human health, WHO has warned against the consumption of such beverages, including by setting a new lower limit for consumption of free sugars of less than 5% of total calorie intake (e.g., < 25 g/child/day), recommending prohibition of sales of sugar drinks in schools and other settings, and recommending implementation of excise taxes on SSBs.¹⁵ An increasing number of countries are implementing these recommendations.²³

For example, several countries (e.g., Barbados, Mexico, Mauritius, Tonga, France) have introduced an excise tax on sugary beverages (as have several US states), and some countries have earmarked part of this tax revenue for the health sector.²³ Uruguay has banned advertising and marketing of foods and drinks that do not meet healthy nutrition standards, including advertisements on posters and billboards.²³

Other interventions are also needed to reduce SSB consumption, including pricing strategies to make bottled water less expensive than SSBs, and policies that better enable procurement of healthy foods (e.g., healthy nutrition guidelines embedded in contracting agreements). Because nearly none of the LMICs included in our analysis had implemented specific interventions to reduce SSB consumption at the time of the survey, our findings can be regarded as a useful baseline for the frequency of consumption of carbonated soft drinks. Continued

TABLE 2—Frequency of Carbonated Soft Drink Consumption Among Adolescents Aged 12–15 Years, by Region: Global School-based Student Health Survey, 2009–2013

Region	Never, %	< Once per Day, %	Once per Day, %	Twice per Day, %	3 Times per Day, %	4 Times per Day, %	≥ 5 Times per Day, %	Mean Frequency per Day (95% CI)
Africa	26.1 (16.0, 36.2)	24.8 (19.7, 29.9)	24.6 (21.8, 27.4)	11.6 (8.2, 14.9)	5.0 (3.8, 6.1)	2.7 (1.8, 3.5)	4.9 (3.1, 6.7)	1.14 (0.89, 1.39)
Central and South America	10.6 (9.2, 11.9)	23.8 (21.6, 26.1)	24.6 (22.4, 26.7)	18.0 (16.7, 19.4)	9.6 (8.5, 10.8)	3.8 (3.0, 4.5)	9.1 (6.8, 11.4)	1.68 (1.51, 1.84)
Eastern Mediterranean	17.1 (12.6, 21.6)	30.8 (25.0, 36.6)	24.1 (20.4, 27.8)	11.7 (9.1, 14.2)	6.2 (4.4, 8.0)	2.6 (1.7, 3.4)	6.6 (4.5, 8.6)	1.30 (1.00, 1.59)
Southeast Asia	25.8 (23.6, 28.1)	42.1 (40.7, 43.6)	16.2 (15.3, 17.1)	7.6 (6.6, 8.5)	3.5 (2.9, 4.1)	1.3 (1.1, 1.5)	3.0 (1.8, 4.1)	0.85 (0.77, 0.94)
Western Pacific	20.7 (15.4, 26.1)	31.8 (27.0, 36.7)	21.6 (20.0, 23.3)	10.2 (7.5, 12.8)	5.0 (3.5, 6.4)	2.2 (1.5, 2.8)	6.1 (4.3, 7.9)	1.21 (0.97, 1.46)
Total	16.8 (14.9, 18.7)	27.8 (25.5, 30.1)	23.5 (22.2, 24.9)	13.7 (12.3, 15.2)	7.1 (6.2, 7.9)	2.9 (2.5, 3.3)	7.1 (6.1, 8.0)	1.39 (1.26, 1.51)

Note. CI = confidence interval.

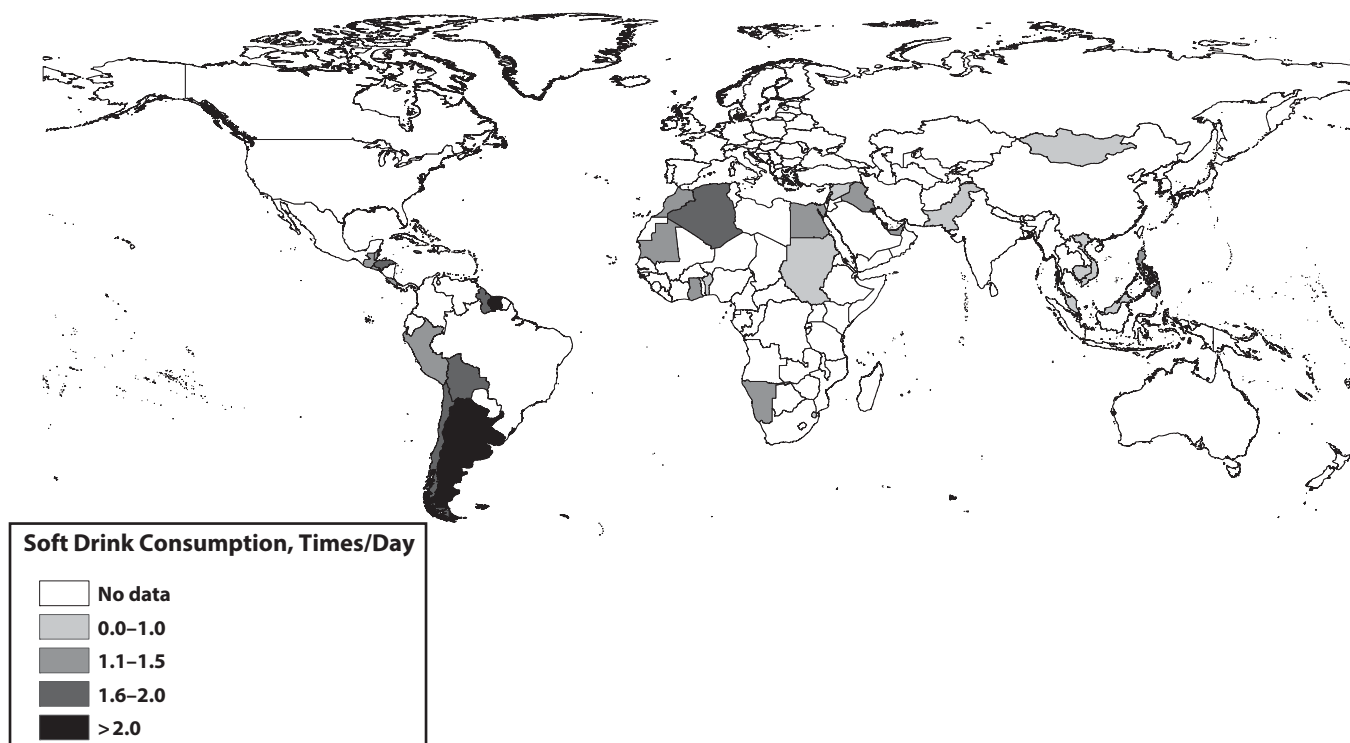


FIGURE 1—Mean Carbonated Soft Drink Consumption (Times per Day) Among Young Adolescents, by Country: Global School-based Student Health Survey, 2009–2013

implementation of GSHS studies in these and other LMICs will be useful to monitor trends in consumption of carbonated soft drinks over time and provide information on the effects of policies designed to reduce consumption.

To our knowledge, this study is the first to provide, via a standardized instrument, comparable estimates of the frequency of carbonated soft drink consumption among adolescents in a large number of LMICs. However, our study is also subject to several limitations. First, consumption of carbonated soft drinks was based on a self-reported questionnaire, and thus our data may have been prone to biases including recall bias. Second, we assessed the daily frequency, rather than the volume, of carbonated soft drinks consumed. Although it is reasonable to assume that the number of times a carbonated soft drink is consumed each day (as asked in the survey) will correspond to an equivalent number of soft drink servings (as carbonated soft drinks are often available in 3- to 4-dL bottles or glasses typically containing around 30–40 g of sugar), our data can only grossly approximate the daily

volume of carbonated soft drinks consumed and the related daily intake of added sugar.

Third, we had data from only 2 countries (Malaysia and Maldives) in Southeast Asia, and data from other countries in the region should be assessed. Similarly, we had no data on consumption of carbonated soft drinks in several other areas (e.g., Europe and North America); data from these regions would be useful for purposes of comparison. Fourth, we did not have data on the cost of soft drinks in each country. In view of the fairly large price elasticity of SSBs among youths,³⁴ it will be informative to analyze consumption of carbonated soft drinks among young people over time in relation to beverage costs, particularly in countries that have introduced an excise tax on SSBs.

PUBLIC HEALTH IMPLICATIONS

Our study identified a high frequency of carbonated soft drink consumption among young adolescents in LMICs. Our results emphasize the need to develop policies and

programs designed to limit the consumption of carbonated soft drinks and other sugary beverages among youths, including through public awareness campaigns, taxation, regulations on marketing targeting children and adolescents, reduced availability in schools and other settings, and front-of-pack labeling of manufactured foods including calories from added sugars.⁵ **AJPH**

CONTRIBUTORS

L. Yang and P. Bovet are co-first authors. L. Yang, P. Bovet, and B. Xi conceptualized the study, contributed to the interpretation of the results, and drafted the article. L. Yang and C. Ma contributed to the data analysis. Y. Liu, M. Zhao, and Y. Liang contributed to data collating and revisions of the article.

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HUMAN PARTICIPANT PROTECTION

The GSHS was approved, in each country, by both a national government administration (most often the ministry of health or education) and an institutional review board. Verbal or written consent was obtained from adolescents and their parents in all countries.

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