ORIGINAL RESEARCH ARTICLE

An Infodemiological Study on Google Search Trends for 'Gum Bleeding': Demographic, Economic, and Temporal Perspectives

Ezgi Sıla Taşkaldıran ⓘ * and Süleyman Emre Meşeli ⓘ

Istanbul Aydin University, Faculty of Dentistry, Periodontology Department, Istanbul, Turkey

*Corresponding Author; ezgisilataskaldiran@aydin.edu.tr

Abstract

Purpose: The presented study was aimed to investigate the level of interest in gingival bleeding among internet users and its relationship with demographic, economic and temporal variables.

Materials and Methods: In this study, the relative search volume of the term "gum bleeding" both quarterly and annually from the data provided by Google Trends for 2017-2021 was analyzed. The provincial level of interest in this term was analyzed along with the gross domestic product, population, data on illiteracy and data on dental visit obtained from the Turkish Statistical Institute and the Ministry of Health of the Republic of Türkiye. Statistical significance was set at p<0.05.

Results: The study showed lower relative search volume for the term "gum bleeding" in 2017 than in other years (p<0.001). The highest volume was observed in 2021, although no difference was revealed among the remained years (p>0.05). Analysis of quarter-based data showed a lower volume for the term in the third quarters each of 2021, 2020 and 2018 compared to the other quarters (p=0.012, p=0.035, p<0.001, respectively). However, no correlation was found between the interest level in the term "gum bleeding" and any other variables (p >0.05).

Conclusions: The outcomes revealed that gingival bleeding, an early sign of periodontal disease, exhibits seasonal variations with a decrease during the summer months. No relationship was observed between provincial interest level and any variables. Google Trends data provides valuable insights into user interest in gingival bleeding, contributing to the understanding of public awareness of periodontal diseases.

Key words: Gingival bleeding; Google Trends; Periodontal diseases; Google search volume; Health literacy.

Introduction

Online search engines have emerged as essential platforms for accessing a wide range of information including health-related topics.[1] Google has become the forefronted option for the individuals who are seeking an information related to own oral health problems.[2–4]

Google Trends (GT) is a free-of-charge tool provided by Google, which integrates users' search trends with temporal and geographical parameters. While GT is extensively utilized in marketing, sales and advertising, it also holds great potential for scientific studies regarding on oral health.[5–7]

Periodontal diseases are characterized with a chronic inflammatory host response emerges against pathogenic microorganisms colonized in dental biofilm. These inflammation leads the destruction of the periodontal tissues that support the teeth. Since generally no pain emerges during the progression of periodontal diseases,

the individuals may perceive that have not a problem to need applying clinicians. The success in periodontal treatment does not only depend on an accurate diagnosis of periodontal disease by the clinician, but also awareness of patient about the own periodontal status. Gingival bleeding is a well-described indicator of progression of periodontal destruction, which can be self-detected by patients.[8–10] Deng et al. reported that gingival bleeding on brushing must be considered a sign of periodontal disease activity.[11]

Seasonal changes may influence the individuals' mental health and behavior. It has been shown that the number of suicide cases can vary according to the seasons.[12] Additionally, more sedentary behaviors were exhibited in winter compared to summer.[13] Based on this information, it can be assumed that effects of seasonal variables on patient's self-performed oral hygiene behaviors may alter periodontal status of the patient.

This study is based on the H1 hypothesis that the tendency to search for the term "gum bleeding" on Google in Türkiye (formerly

known as Turkey) varies according to seasonal periods with the effect of demographic and economic variables. The aim of the study is to determine the search trend of the term "gum bleeding" on the internet through GT and to determine the possible seasonal, demographic and economic effects on this trend. In line with this purpose, we examine the possible relationship between geographic, economic and social factors and the tendency of internet users in Türkiye to search for the term "gum bleeding".

Material and Methods

Study Design

This cross-sectional study analyzed the searching trends for the term "gum bleeding" in Türkiye considering seasonal, demographic and economic factors. It was also conducted with obtained data both the GT (https://trends.google.com/trends), Turkish Statistical Institute (TurkStat) and Turkish Ministry of Health (TMoH) websites. Since the data analyzed in this study is publicly available, the study was not subject to any ethics committee approval.

Data Collection

To determine the most relevant term for "gum bleeding" ("diş eti kanaması" in Turkish), the relative search volumes (RSV) provided by GT both of the aforesaid term and Turkish synonyms of this key term ("dişeti kanaması"/"kanayan diş eti"/"diş etinde kanama"/"kanamalı diş eti", all is Turkish) were compared. Prior to this comparison, Türkiye as the geographical filter and 01.01.2017–31.12.2021 as the temporal filter were set.

The RSV, calculated by mean, was recorded regarding based on weekly. Starting January 1st of each year, the first 7-day period was defined as 1st week. Considering this, Quarter 1 (Q1) included the first 13 weeks and each subsequent 13 weeks constitute consecutive quarters from Q2-Q4. So, the mean RSV values both of quarterly and of annually were obtained by considering the weekly mean RSV values of the weeks of calculated period.

The evaluation of the provincial interest level on any time, the level of interest for the province with the highest and lowest RSV values were accepted as "100" and "0", respectively. Following, a score ranged between "0" and "100" was assigned to each province by GT considering an algorithm based on RSV values of provinces.

Demographic and economic variables were obtained from the most recent data provided by TurkStat and by TMoH. Gross domestic product (GDP), population data and the number of illiterate people were taken from TurkStat data, while total number of dental visits and the number of dental visits per person were obtained from TMoH data.

Statistical Analyses

Statistical analyses were conducted using the SPSS 24 package program. Descriptive statistics were presented as number, percentage, median, arithmetic mean, and standard deviation. The Shapiro-Wilk test was used to assess the normality of distribution of numerical variables and it was observed the data did not meet the normal distribution criteria.

Therefore, multiple and pairwise comparisons were performed using the Kruskal-Wallis test, and Mann-Whitney U Test with Bonferroni Correction, respectively. The relationship between the variables was examined using Spearman's correlation analysis. Statistical significance was set at p<0.05 level.

Table 1. Relative search volume of the term "gum bleeding" by annually.

	RSV	p*
2021	52.35	
2020	50.15	
2019	50.31	<0.001
2018	51.23	
2017	38.27**	

RSV: Relative Search Volume. *Kruskal-Wallis Test. p<0.05 **Mann-Whitney U Test with Bonferroni Correction. p<0.05

Table 2. Relative search volume for the term "gum bleeding" by quarterly.

	Quarters	RSV	p*
2021	Q1	62	
	Q2	39.5	
	Q3	33.5**	0.012
	Q4	53.5	
2020	Q1	52	
	Q2	44.5	
	Q3	33.5**	0.035
	Q4	45.5	
2019	Q1	55	
	Q2	55	
	Q3	33.5	0.235
	Q4	62.5	
2018	Q1	66	
	Q2	58	
	Q3	39.5**	<0.001
	Q4	40	
2017	Q1	23.5	
	Q2	43.5	
	Q3	29.5	0.259
	Q4	32.5	

RSV: Relative Search Volume; *Kruskal-Wallis Test. p<0.05; **Mann-Whitney U Test with Bonferroni Correction. p<0.05

Results

Table 1a and Table 1b show the mean RSV regarding both annually and quarterly respectively. The highest and lowest RSV median was in 2021 and 2017 respectively (for both of 2017 and of 2021 with all remained years, p<0.001) But the RSV of remained years were statistically similar (p>0.05).

Considering data based on quarterly, it was found that the RSV for the term 'gum bleeding' was significantly lower in third quarter (Q3) of 2021, of 2020 and of 2018 than in other quarters (for 2021, Q1-Q3 p=0.02, Q2-Q3 p=0.04, Q4-Q3 p=0.03; for 2020, Q1-Q3 p=0.04, Q2-Q3 p=0.04, Q4-Q3 p=0.01; for 2018, Q1-Q3 p<0.01, Q2-Q3 p<0.01, Q4-Q3 p=0.02.) The RSV in Q3 of 2019 was lower than in the other quarters without any difference (p>0.05) (Table 1b).

Table 2 shows the mean provincial levels of interest over the 5-year period alongside other variables belong to provinces. Interestingly, interest level in the term was obtained from only 24 out of 81 provinces. Among these provinces, Balikesir and Sanliurfa was on the first and last place on ranking respectively.

The correlation analyses between the level of interest in the term "gum bleeding" and other variables was performed. No correlation was found between the level of interest and any of the variables (p>0.05) (Table 3).

Discussion

In the current digital age, websites are commonly preferabe for seeking health information even accuracy and reliability of the content are questionable. This cross-sectional study aimed to examine the level of interest in "gum bleeding" via GT, as the most

Table 3. Level of interest and demographical and economic variables of provinces.

	Level of Interest	GDP	Population	Illiterate Person	Illiteracy Rate	Number of Dental Visits	Rate of Dental Visit
Balıkesir	100	44b	1.25m	19b	1.49	0.40m	0.32
Eskisehir	93	56b	0.90m	11b	1.26	0.39m	0.43
Mugla	91	56b	1.02m	11b	1.06	0.32m	0.32
Mersin	91	43b	1.89m	29b	1.53	0.39m	0.21
Izmir	90	61b	4.42m	46b	1.04	1.50m	0.34
Adana	90	37b	2.26m	58b	2.55	0.57m	0.25
Gaziantep	89	38b	2.13m	50b	2.35	0.64m	0.30
Aydin	88	38b	1.13m	15b	1.35	0.40m	0.36
Sakarya	86	50b	1.06m	19b	1.77	0.31m	0.29
Denizli	85	47b	1.05m	11b	1.01	0.37m	0.35
Ankara	85	71b	5.75m	75b	1.31	1.66m	0.29
Antalya	84	61b	2.62m	19b	0.74	0.80m	0.31
Manisa	82	49b	1.46m	23b	1.60	0.45m	0.31
Kocaeli	80	81b	2.03m	28b	1.39	0.76m	0.38
Samsun	79	36b	1.37m	24b	1.77	0.56m	0.42
Diyarbakir	77	24b	1.79m	83b	4.65	0.46m	0.26
Bursa	77	59b	3.15m	52b	1.64	0.95m	0.31
Hatay	76	32b	1.67m	25b	1.48	0.53m	0.32
Kahramanmaras	75	34b	1.17m	41b	3.53	0.37m	0.32
Kayseri	74	44b	1.43m	25b	1.77	0.52m	0.37
Tekirdag	71	71b	1.11m	12b	1.05	0.40m	0.37
Istanbul	69	87b	15.84m	217b	1.37	4.29m	0.28
Konya	62	41b	2.28m	35b	1.53	0.80m	0.36
Sanliurfa	57	17b	2.14m	111b	5.18	0.43m	0.21

GDP: Gross domestic product. b:billion. m:million

Table 4. Correlation analyses

		Level of Interest	GDP	Population	Illiterate Person	Illiteracy Rate	Number of Dental Visits	Rate of Dental Visit
Level of Interest	r	1	.377	.185	.299	.023	.172	.154
	p	–	.432	.327	.109	.683	.109	.101
GDP	r	.377	1	.817	.321	-.287	.034	.120
	p	.432	–	.265	.156	.498	.163	.529
Population	r	.185	.817	1	.432	- .657	.324*	.431*
	p	.327	.265	–	.562	.112	.043	.041
Illiterate Person	r	.299	.321	.432	1	-.844**	.625	.229
	p	.109	.156	.562	–	<0.001	.311	.213
Illiteracy Rate	r	.023	-.287	- .657	-.844**	1	.356*	.458*
	p	.683	.498	.112	<0.001	–	.048	.011
Number of Dental Visits	r	.172	.034	.324*	.625	.356*	1	-.534
	p	.109	.163	.043	.311	.048	–	.042
Rate of Dental Visit	r	.154	.120	.431*	.229	.458*	-.534	1
	p	.101	.529	.041	.213	.011	.042	–

GDP: Gross domestic product. *Spearman's correlation coefficient (r) is significant at $p<0.05$ level. **Spearman's correlation coefficient (r) is significant at $p<0.01$ level.

opted tool to provide data about a particular health topic over time and across regions.[14−16] The increased level of interest in the term "gum bleeding" during the 5-year period may be attributed to the increase of internet usage from 80% in 2017 to over 90% after 2020. In this regard, both increasing number of people seeking health-related information on web and widespread usage of the internet with technological developments contributed to the increased level of interest.

There are studies on the effects of seasonality to the online interest about various health problems. The findings of limited studies about the linkages between seasonality and the conditions such as obesity, joint pathology and bruxism points to need for research to the reveal the effects of seasonality on healthcare management and public health promotion.[17−19] The outcomes of this study displayed that interest in the term "gum bleeding" varied during different quarters of the year. A lower RSV was found in the third quarter (Q3), which includes July, August and September, compared to other quarters. In addition to the abovementioned linkages, an alteration on individuals' anxiety levels with seasons was stated on former studies.[20,21] Considering this, it can be predicted that the negative impact of mental state in winter will cause inadequate self-care behaviors, including oral hygiene procedures. The rising in quality of the self-performed oral hygiene procedures, such as regular tooth brushing habits, especially in the summer months, may lead to a decrease in interest in the term "gum bleeding" during this period. Additionally, the seasonality of searches for "gum bleeding" can also be attributed to people's changing priorities according to the seasons. It must be taken into account that this study did not analyze the data considering all demographic features of population, such as age, gender and education level. Further analysis regarding these factors may help to develop the strategies and campaigns to raise awareness on gingival bleeding.

On the baseline of this study, it was hypothesized that there might be a relationship between the provincial level of interest in the term "gum bleeding" and the other variables. However, the results showed that no relationship was observed and H0 hypothesis cannot rejected. This may be attributed to the only the data obtained from TurkStat and TMoH were used. Therefore, no information was revealed to assess the outcomes about the number of people who visited private clinics or university hospital dental clinics.

In this study, only the level of interest in term "gum bleeding" was considered for a specific time period and geographical location. Alongside the gingival bleeding, the symptoms such as redness and swelling of the gingiva, bad breath, lost teeth and widening of the spaces between the teeth may be considered in future studies. So, more comprehensive, and up-to-date information may be achieved about the knowledge and awareness of periodontal disease. It must be emphasized that the generalisability of the study is limited due it was conducted with geolocation-based during the interpretation of outcomes. Although, studies show that GT has the potential to represent a large proportion of the population, it must be noted that the GT only provides data from the Google search engine and does not exclude the repeated searches of the same user. In future studies planned on worldwide data sets, the integrated data from different sources such as Bing, Yahoo and Yandex etc. will help to generalize the outcomes.

Conclusion

In conclusion, it was found that the tendency to search for the term "gum bleeding" on Google varies according to seasonal periods. It also supports the idea that the data provided by tools such as GT can guide researchers, policy makers, healthcare workers and healthcare lecturers to promote healthcare management and public health.

Author Contributions

Conceptualization: EST, SEM - Data Curation: EST - Formal Analyses: SEM - Funding Acquisition: EST, SEM - Investigation: EST, SEM - Methodology: EST, SEM - Project Administration: SEM - Resources: EST - Software: EST - Supervision: SEM - Validation: EST, SEM - Visualization: EST, SEM - Writing-original draft: EST - Writing-review&editing: SEM - Final approval the version to be published: EST, SEM.

Conflict of Interest

The authors declare that they have no current or potential conflicts of interest.

Authors' ORCID(s)

E.S.T.   0000-0001-7580-4263
S.E.M.   0000-0002-8922-155X

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