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Determining the Interest in Pain and Analgesic During and Before the COVID-19 Pandemic Period Using Google Trends Data: An Infodemiological Study

Google Trend Verilerini Kullanarak COVID-19 Pandemi Döneminde ve Öncesinde Ağrı ve Analjeziklere Olan İlginin Belirlenmesi: İnfodemiyolojik Bir Çalışma

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Abstract

Introduction: This study aims to evaluate the public's interest in pain and painkillers using Google search activity in countries with the most cases before and during the COVID-19 pandemic (January 2018 - December 2021).

Material and Method: United States (USA), England (UK), France, Germany, Italy, India, Spain, Russia, Brazil and Turkey, the countries where the COVID-19 epidemic was most intense, were determined along with the world for the analysis. The words `Back pain`, `Chest pain`, `Headache`, `Knee pain`, `Sore throat`, `Aspirin`, `Ibuprofen`, and `Paracetamol` were written into the Google Trend search engine. RapidMiner and Microsoft Office Excel were used to analyze the data. Correlation tests were used to determine the strength of the relationship between pain regions and drugs.

Results: The terms `ibuprofen`, `aspirin`, and `paracetamol` peaked in Google searches on March 15, 2020. The search frequencies for sore throat, chest pain, and headache peaked worldwide between March 15, 2020, and March 22, 2020. Strong correlations were obtained, ranging from 0.627 to 0.901 for chest pain and headache and 0.629 to 0.749 for ibuprofen and paracetamol terms.

Conclusion: As a result of the research, it is seen that the frequency of searching for pain and analgesics has increased significantly during the COVID-19 period. Our data can be considered an indicator of the increasing incidence of pain with the COVID-19 pandemic since internet searches are a proxy for the public good.

Keywords: Pain, analgesic, COVID-19, Google trend

Öz

Giriş: Bu çalışmanın amacı, COVID-19 pandemisi öncesinde ve sırasında (Ocak 2018 - Aralık 2021) en çok vaka görülen ülkelerde Google arama etkinliğini kullanarak halkın ağrı ve ağrı kesicilere olan ilgisini değerlendirmektir.

Gereç ve Yöntem: Dünya geneli ile COVID-19 salgınının en yoğun olduğu ülkeler Amerika Birleşik Devletleri (ABD), İngiltere, Fransa, Almanya, İtalya, Hindistan, İspanya, Rusya, Brezilya ve Türkiye olarak belirlendi. Google Trend arama motoruna `Sırt ağrısı`, `Göğüs ağrısı`, `Baş ağrısı`, `Diz ağrısı`, `Boğaz ağrısı`, `Aspirin`, `İbuprofen` ve `Parasetamol` kelimeleri yazıldı. Verilerin istatistiksel analizinde RapidMiner Analiz programı ve Microsoft Excel programı kullanıldı. Ağrı bölgeleri ile ilaçlar arasındaki ilişkinin gücünü belirlemek için korelasyon testleri kullanıldı.

Bulgular: `İbuprofen`, `aspirin`, `parasetamol` terimleri 15 Mart 2020'de Google aramalarında zirveye ulaştı. `Boğaz ağrısı`, `göğüs ağrısı` ve `baş ağrısı` terimlerinin arama sıklığı 15 Mart 2020 ile 22 Mart 2020 arasında dünya çapında zirveye ulaştı. Göğüs ağrısı ve baş ağrısı terimleri için 0,627- 0,901 ile ibuprofen ve parasetamol terimleri için 0,629- 0,749 arasında değişen güçlü korelasyonlar elde edildi.

Sonuç: Araştırma sonucundaCOVID-19 döneminde dünya genelinde ağrı ve analjezik terimlerini arama sıklığının önemli ölçüde arttığı görülmektedir. İnternet aramaları kamu yararı için bir vekil olduğundan, verilerimiz COVID-19 pandemisi ile artan ağrı insidansının bir göstergesi olarak kabul edilebilir.

Anahtar Kelimeler: Ağrı, aneljezik, COVID-19, Google trend

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INTRODUCTION

As a result of the COVID-19 pandemic, the coronavirus disease infected approximately 500 million people and caused the death of approximately 6 million people worldwide. Undoubtedly, this situation created fear and stress in people and caused a decrease in applications to health services. Also, physicians worldwide noted a reduction in hospital admissions for emergencies, including acute myocardial infarction and ischemic stroke, during the COVID-19 pandemic.[1,2] There have been significant concerns that fear of COVID-19 is driving patients to self-triage using internet searches rather than going to the hospital.[3] During the COVID-19 pandemic, chronic pain management has become challenging, especially with increasing evidence that COVID-19 infection is associated with myalgias, referred pain, and diffuse hyperalgesia. Pain is well-known for medical practitioners, according to the biopsychosocial pain model, and it is not only the response to an injury but also the disruption of the body's homeostatic systems due to a multitude of factors that lead to increased stress responses.[4] The increasing process spent at home during the pandemic, the restriction of physical activities, changes in eating habits, and financial burdens triggered stress and paved the way for the emergence of the pain factor.[4,5] The studies using Google Trends, especially in health and medical research and infodemiology have increased in the last ten years with the widespread use of online media.[5] However, the number of large-scale studies, including internet searches in which the interest in pain and painkillers during the pandemic period is discussed together with the pre-pandemic period, is scarce. This study aims to evaluate the public's interest in pain and analgesics using Google search activity in countries with the most cases before and during the COVID-19 pandemic.

MATERIAL AND METHOD

Data Collection

This infodemiological research was conducted at a university in Turkey. The popularity of search terms related to pain and analgesics was evaluated using Google Trends. Google Trends is a freely available search engine that provides an estimate of the relevant search volume of a phrase selected by Google search engine users from a specific region and date.[6] The volume of searching is adjusted for the number of Google users in a given geographic area and ranges from 0 to 100. A value of 100 indicates the peak of popularity (100% popularity in a given period and place), and 0 is the lowest point (0% popularity).[7] Each point of the graph generated by Google Trend is divided by the highest point, traditionally set to 100.[8] A maximum of five words can be typed into the Google Trend search engine at the same time. Google Trend does not count duplicate queries if a search was made from the same IP address within a short period.[9]

Starting from January 1, 2018, covering the period of COVID-19 and before, a screening has been planned considering the pain complaints and analgesic needs of the COVID-19 disease. It is stated in the literature that pain symptoms such as headache, backache, chest pain, and sore throat are seen due to COVID-19 disease.[10,11] However, it is stated that there is an increase in knee pain search trends before and after the onset of the COVID-19 pandemic. This condition has been associated with physical activity. It is thought that search trends have increased due to the decrease in physical activity due to the curfew and the increase in complaints of knee pain.[5] In line with this information, search trends related to pain were determined as `Back pain`, `Chest pain`, `Headache`, `Knee pain`, and `Sore throat`. It has been stated that patients frequently use paracetamol, non-steroidal anti-inflammatories (NSAIDs) [10] and aspirin[12] in the treatment process concerning these pain complaints. Search trends for analgesics were determined as `Aspirin`, `Ibuprofen`, and `Paracetamol`. In this context, first of all, a worldwide survey was conducted. Countries, on the other hand, have been determined as the United States (USA), UK, France, Germany, Italy, India, Spain, Russia, Brazil and Turkey, which are the countries where the COVID-19 epidemic is most intense.[13] Search trends from China could not be analyzed due to restrictions limiting access in the country.[9]

In the Google Trend search engine, to cover dates between January 1, 2018, and December 12, 2021, `Back pain`, `Chest pain`, `Headache`, `Knee pain`, `Sore throat`, `Aspirin`, `Ibuprofen`, `Paracetamol` in words by writing the scan were reviewed. Analgesics and pain locations were screened by forming separate groups. Each country was scanned separately in their language.

Data Processing and Statistical Analysis

It was tried to determine the dates with a statistically significant increase in the search trends of pain and analgesics before and after the COVID-19 epidemic, and the data were analyzed graphically. The countries with the highest number of queries (search volume = 100) on the selected topic were determined. The correlation coefficient was used to test the strength of the relationship between pain and pain relievers in the world and selected countries. The test of the given normal distribution was analyzed graphically and then formally tested with the Kolmogorov-Smirnov test. As a result of these examinations, it was determined that the data were not normally distributed. Therefore, the Spearman rank correlation coefficient, a non-parametric correlation coefficient, was calculated in cases where the variables were not normally distributed and/or had slight deviations from linearity. Values below $p<0.01$ and $p<0.05$ were considered to differ significantly.[14] RapidMiner analysis program[15] and Microsoft Excel program were used to obtain information from the large-scale data set for statistical data analysis.

Ethic

The study was carried out in accordance with the Declaration of Helsinki and in accordance with the provisions of the relevant local legislation. Informed consent or Ethics Committee approval is not required as the study data was obtained from a public database, there were no human participants, and it did not contain animal experiments.

RESULTS

The frequency of searches for the terms `ibuprofen`, `aspirin`, and `paracetamol` worldwide between January 2018 and December 2021 is presented in **Figure 1**. It was observed as a peak for these terms in Google searches worldwide on March 15, 2020. Also, during the related week, the rate of Google Trends scores was highest for Ibuprofen, and paracetamol 100%, but aspirin was 84% more precisely, while aspirin 100% was searched on October 10, 2021.

Trajectories for frequency of search items were reviewed from January 2018 to December 2021, using the pain terms `sore throat`, `back pain`, `chest pain`, `headache`, and `knee pain` worldwide. The frequency of searching for related terms between January 2018 and December 2021 is presented in **Figure 2**. A peak was found in Google searches for the terms sore throat, chest pain, and headache worldwide between March 15, 2020 and March 22, 2020. During this time period, the highest percentage of Google Trends scores were searched for sore throat, chest pain, and headache (100%). Knee pain was searched on August 18 2019 (100%). Backache was sought on July 29 2018 (100%).

Trajectories for frequency of search items were examined from January 2018 to December 2021, using the analgesic terms `ibuprofen`, `aspirin`, and `paracetamol` for USA, UK, France, Spain, Germany, Italy, Brazil, Russia, Turkey, India. The frequency of searching for related terms between January 2018 and December 2021 is presented in **Figure 3**. A peak was found in Google searches for the analgesic terms ibuprofen and paracetamol on March 15, 2020, for the countries USA, Spain, Italy, Germany, Brazil, UK and Turkey. The highest percentage of Google Trends scores searched for Ibuprofen and paracetamol (100%) in the countries listed during this week. However, the terms of aspirin analgesic were searched in Spain (81%), Italy (74%), and the UK (96%) of even date, while on April 4, 2021 (100%), Brazil (69%) on March 21 2021 (100%), in Turkey (33%) on October 25 2021 (100%), in Germany (76%). On the same date, while paracetamol and aspirin (100%) were searched in France, Ibuprofen (77%) was searched. In Russia, the terms of paracetamol were searched (100%) on March 22, 2020, aspirin (100%) on November 1, 2020, and Ibuprofen (100%) on November 28, 2021. In India, the terms of ibuprofen and paracetamol analgesic (100%) were searched on May 2 2021, and the terms aspirin analgesic was searched on September 5, 2021 (100%).

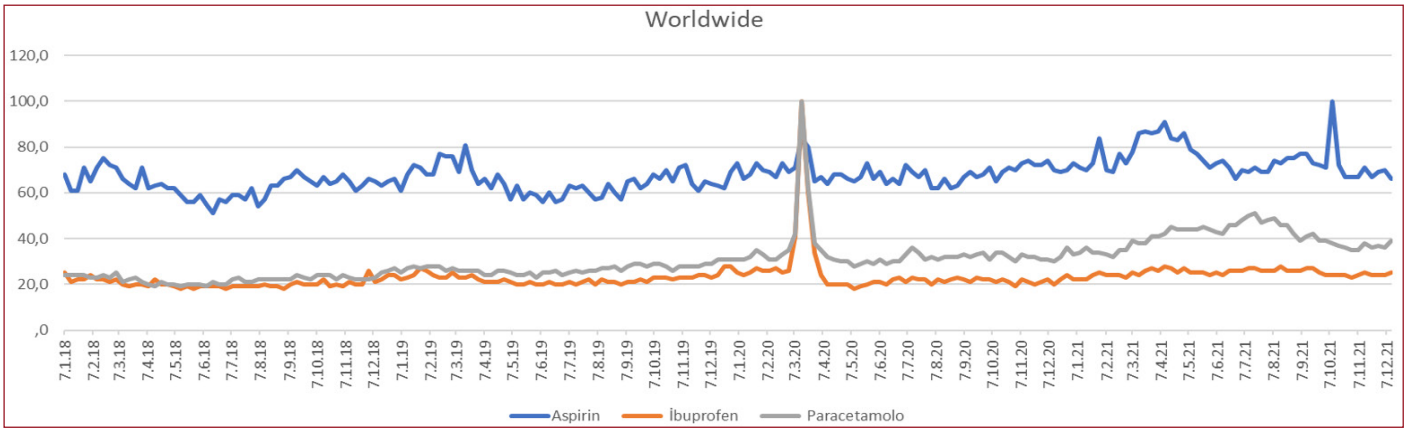

Figure 1. Monthly Google Trend search scores for the terms `aspirin`, `ibuprofen`, and `paracetamol` between January 2018 and December 2021 worldwide

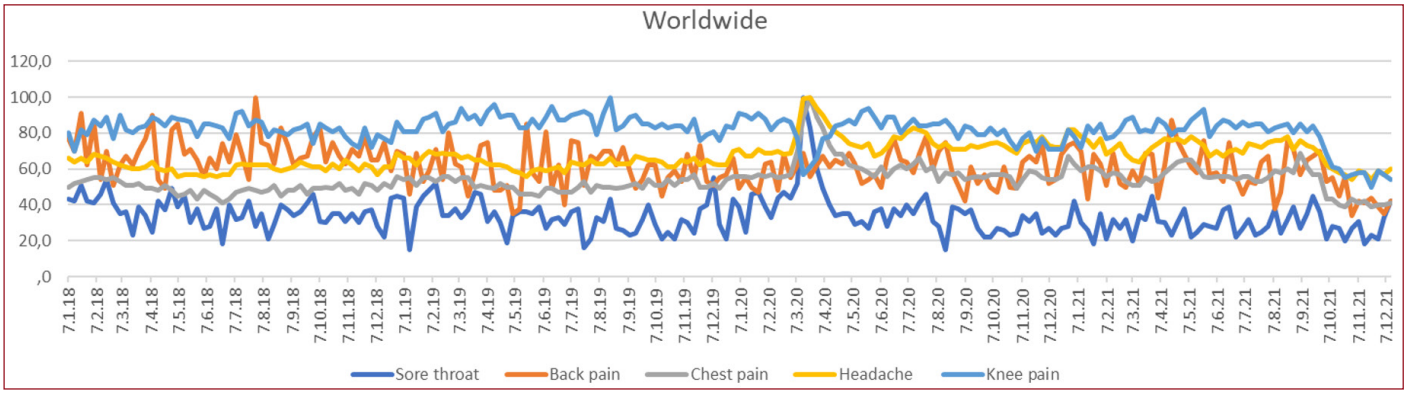

Figure 2. Monthly Google Trend search scores for the terms `sore throat`, `backache`, `chest pain`, `headache`, and `knee pain` between January 2018 and December 21 across the world

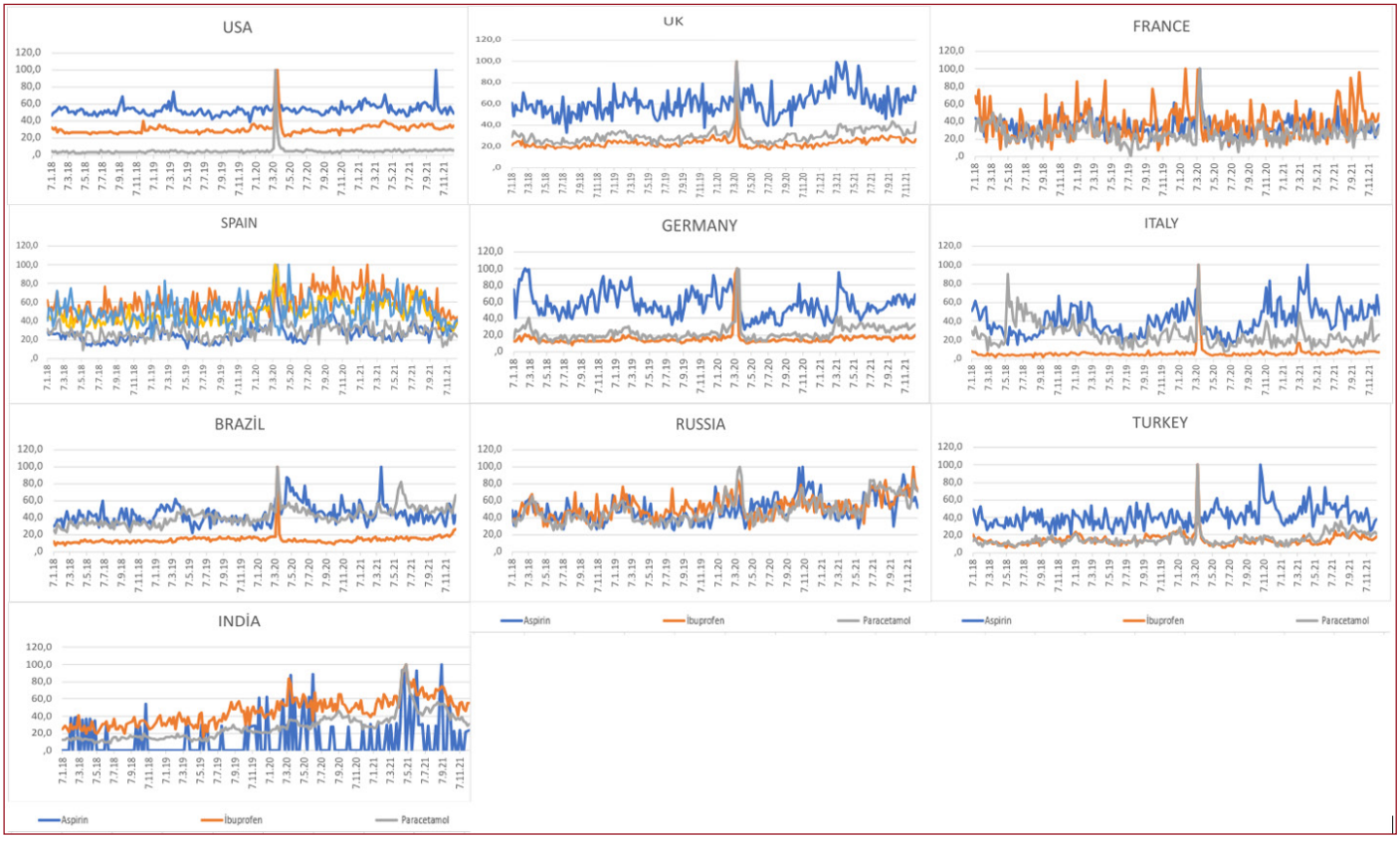

Figure 3. Bi-monthly Google Trend search scores for the terms `aspirin`, `ibuprofen`, and `paracetamol` for the USA, UK, France, Spain, Germany, Italy, Brazil, Russia, Turkey, India countries between January 2018 and December 2021

Using the pain terms of `sore throat`, `back pain`, `chest pain`, `headache`, and `knee pain` for the USA, UK, France, Spain, Germany, Italy, Brazil, Russia, Turkey, India, search trajectories for the frequency of elements were studied from January 2018 to December 2021. The frequency of searching for related terms between January 2018 and December 2021 is presented in **Figure 4**. A peak was found in Google searches for the terms head, throat, and chest pain between March 15, 2020, and March 29, 2020, for the US, UK, France, Brazil, and Spain. During these three weeks, the highest percentage of Google Trends scores for head, throat, and chest pain (100%) were searched in the indicated countries. In Germany, sore throat (100%) and headache (92%) were screened on March 15 2020, while headache was screened on March 21 2021 (100%). Chest pain was screened on December 13 2020 (100%). In Italy, unlike other countries, sore throat was scanned on March 8 2020 (100%), chest pain was scanned on March 15 2020 (100%), and the headache was scanned on December 16 2018 (100%) before the COVID-19 period, while there is no peak value during the COVID-19 period of headache. In India, sore throat (100%) on March 29 2020, chest pain on February 26 2020 (100%), and headache on November 7 2021 (100%) were screened. In Russia, sore throat was screened on March 15 2020 (100%), chest pain on January 10 2021 (100%), and headache on July 25 2021 (100%). In Turkey, throat and chest pain (100%) were screened on 15-22 March 2020 and headache was screened on November 29 2020 (100%). The frequency of search items for knee and back pain varies country by country. Knee pain was scanned on April 11 2021 in UK, August 29 2021 in France, October 25 2020 in Brazil, August 1 2021 in Germany, April 26 2020 in Spain, May 24 2020 in India, August 22 2021 (100%) in Russia. Knee pain before COVID-19 period peaked on October 20 2019 in Turkey and on March 24 2019 in the USA, while it was 100% scanned before the COVID-19 period in Italy on November 11 2018, and it is not available a value peaking in these countries during the COVID-19 period. On the other hand, back pain was screened 100% on December 30, 2018, in the USA, and there was no peak value during the COVID-19 period. However, the trend of seeking back pain was determined in the UK on February 17, 2021, in France on August 29, 2021, in Brazil on December 27, 2020, in Germany on January 3, 2021, in Italy on October 04, 2020, in Spain on January 31, 2021, in India on April 11, 2021, in Russia on October 24, 2021, and in Turkey on November 15, 2020 (100%).

The strengths of the associations between drugs and analgesics were tested using the Spearman rank correlation. Strong correlations between 0.627 and 0.901 were obtained for chest pain and headache. The moderate correlations were obtained for chest pain and aspirin, ranging from 0.355 to 0.541, for chest pain and ibuprofen terms ranging from 0.348 to 0.427, for chest pain and paracetamol terms

ranging from 0.375 to 0.629; for headache and paracetamol terms ranging from 0.390 to 0.663, for headache and ibuprofen terms ranging from 0.397 to 0.434, for the headache and aspirin terms ranging from 0.389 to 0.571, for aspirin and paracetamol terms ranging from 0.367 to 0.676, for the aspirin and ibuprofen terms ranging from 0.385 to 0.636. Strong correlations for the ibuprofen and paracetamol terms ranged from 0.629 to 0.749. All correlations were found to be statistically significant ($p < 0.001$) (**Table 1**) and (**Table 2**).

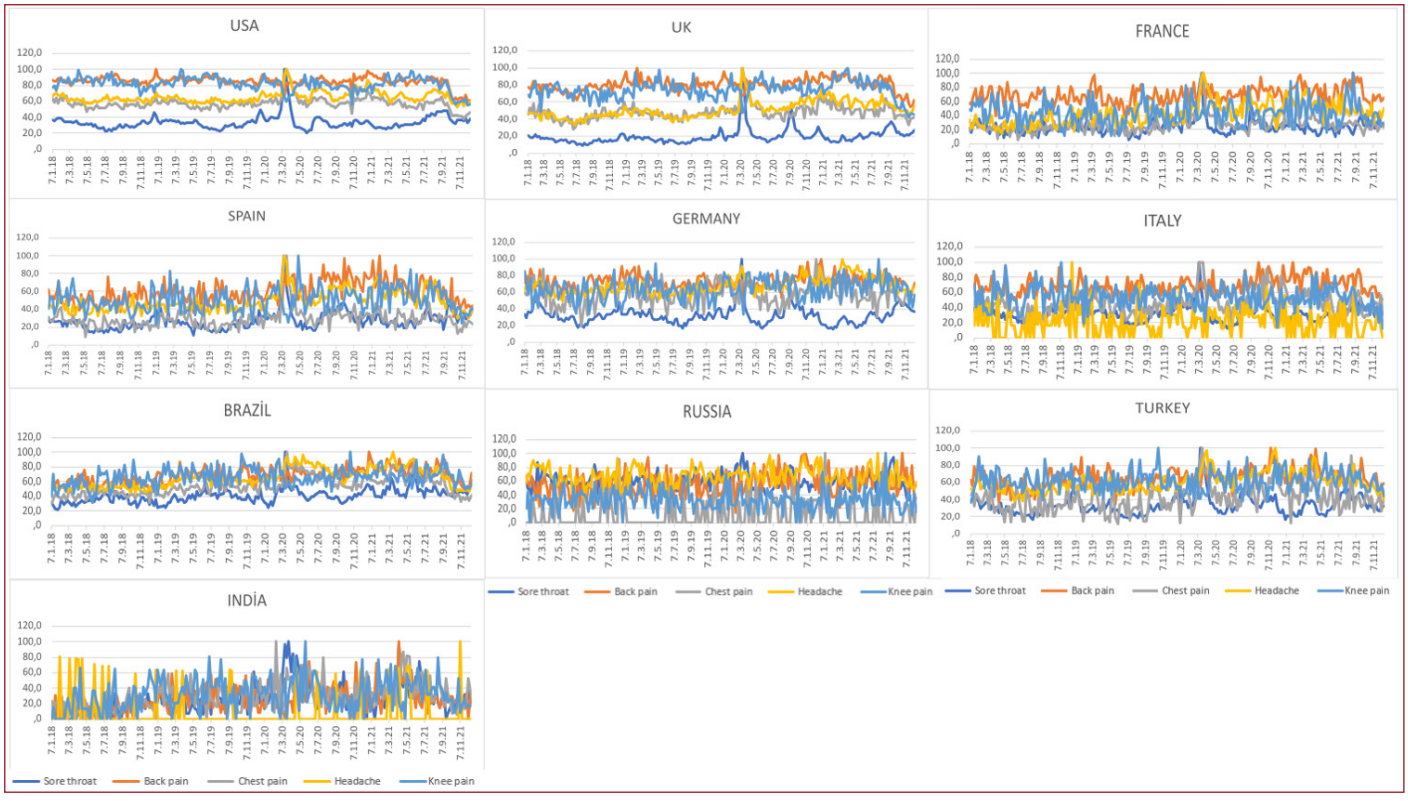

Figure 4. Bi-monthly Google Trend search scores for the terms `sore throat`, `back pain`, `chest pain`, `headache`, and `knee pain` for the USA, UK, France, Spain, Germany, Italy, Brazil, Russia, Turkey, India countries between January 2018 and December 2021

Table 1. Worldwide Correlation tables

Worldwide		Sore Throat	Back Pain	Chest Pain	Headache	Knee Pain	Aspirin	Ibuprofen	Paracetamol
Sore Throat	r	1	0.215[a]	0.103	0.064	0.052	-0.015	0.070	-0.172[b]
	p		0.002	0.140	0.361	0.462	0.831	0.315	0.013
Back Pain	r	0.215[a]	1	0.013	0.036	0.055	-0.174[b]	-0.225[a]	-0.295[a]
	p	0.002		0.852	0.606	0.431	0.012	<0.001	<0.001
Chest Pain	r	0.103	0.013	1	0.901[a]	0.049	0.541[a]	0.427[a]	0.577[a]
	p	0.140	0.852		<0.001	0.487	<0.001	<0.001	<0.001
Headache	r	0.064	0.036	0.901[a]	1	0.021	0.571[a]	0.434[a]	0.663[a]
	p	0.361	0.606	<0.001		0.767	<0.001	<0.001	<0.001
Knee Pain	r	0.052	0.055	0.049	0.021	1	-0.146[b]	-0.111	-0.199[a]
	p	0.462	0.431	0.487	0.767		0.036	0.111	0.004
Aspirin	r	-0.015	-0.174[b]	0.541[a]	0.571[a]	-0.146[b]	1	0.636[a]	0.676[a]
	p	0.831	0.012	<0.001	<0.001	0.036		<0.001	<0.001
Ibuprofen	r	0.070	-0.225[a]	0.427[a]	0.434[a]	-0.111	0.636[a]	1	0.748[a]
	p	0.315	<0.001	<0.001	<0.001	0.111	<0.001		<0.001
Paracetamol	r	-0.172[b]	-0.295[a]	0.577[a]	0.663[a]	-0.199[a]	0.676[a]	0.748[a]	1
	p	0.013	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	

a0.01 Significant correlation at the level, b0.05 Significant correlation at the level

Table 2. Countries Correlation tables

		Sore Throat	Back Pain	Chest Pain	Headache	Knee Pain	Aspirin	Ibuprofen	Paracetamol
ABD									
Sore Throat	r	1	-0,101	0,311[a]	0,341[a]	-0,250[a]	0,18	0,461[a]	0,339[a]
	p		0,148	<0.001	<0.001	<0.001	0,009	<0.001	<0.001
Back Pain	r	-0,101	1	0,310[a]	0,366[a]	0,365[a]	0,082	0,055	-0,027
	p	0,148		<0.001	<0.001	<0.001	0,243	0,435	0,699
Chest Pain	r	0,311[a]	0,310[a]	1	0,769[a]	-0,105	0,504[a]	0,317[a]	0,259[a]
	p	<0.001	<0.001		<0.001	0,133	<0.001	<0.001	<0.001
Headache	r	0,341[a]	0,366[a]	0,769[a]	1	-0,112	0,471[a]	0,397[a]	0,316[a]
	p	<0.001	<0.001	<0.001		0,109	<0.001	<0.001	<0.001
Knee Pain	r	-0,250[a]	0,365[a]	-0,037	-0,105	1	-0,078	-0,063	-0,175[b]
	p	<0.001	<0.001	0,133	0,109		0,265	0,369	0,012
Aspirin	r	0,180[a]	0,082	0,504[a]	0,471[a]	-0,078	1	0,417[a]	0,240[a]
	p	0,009	0,243	<0.001	<0.001	0,265		<0.001	<0.001
Ibuprofen	r	0,461[a]	0,055	0,317[a]	0,397[a]	-0,063	0,417[a]	1	0,468[a]
	p	<0.001	0,435	<0.001	<0.001	0,369	<0.001		<0.001
Paracetamol	r	0,260[a]	-0,027	0,259[a]	0,316[a]	-0,175[b]	0,240[a]	0,468[a]	1
	p	<0.001	0,699	<0.001	<0.001	0,012	<0.001	<0.001	
		Sore Throat	**Back Pain**	**Chest Pain**	**Headache**	**Knee Pain**	**Aspirin**	**Ibuprofen**	**Paracetamol**
UK									
Sore Throat	r	1	0.141[b]	0.460[a]	0.599[a]	-0.029	0.165[b]	0.436[a]	0.590[a]
	p		0.043	<0.001	<0.001	0.675	0.018	<0.001	<0.001
Back Pain	r	0.141[b]	1	0.538[a]	0.517[a]	0.438[a]	0.209[a]	0.165[b]	0.252[a]
	p	0.043		<0.001	<0.001	<0.001	0.003	0.018	<0.001
Chest Pain	r	0.460[a]	0.538[a]	1	0.627[a]	0.165[b]	0.314[a]	0.348[a]	0.422[a]
	p	<0.001	<0.001		<0.001	0.018	<0.001	<0.001	<0.001
Headache	r	0.599[a]	0.517[a]	0.627[a]	1	0.312[a]	0.430[a]	0.299[a]	0.513[a]
	p	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001
Knee Pain	r	-0.029	0.468[a]	0.165[b]	0.312	1	0.183[a]	0.011	0.044
	p	0.675	<0.001	0.018	0,109		0.008	0.873	0.534
Aspirin	r	0.165[b]	0.209[a]	0.314[a]	0.430[a]	0.183[a]	1	0.304[a]	0.367[a]
	p	0.018	0.003	<0.001	<0.001	0.008		<0.001	<0.001
Ibuprofen	r	0.436[a]	0.165[b]	0.348[a]	0.299[a]	0.011	0.304[a]	1	0.747[a]
	p	<0.001	0.018	<0.001	<0.001	0.873	<0.001		<0.001
Paracetamol	r	0.590[a]	0.252[a]	0.420[a]	0.513[a]	0.044	0.367[a]	0.747[a]	1
	p	<0.001	<0.001	<0.001	<0.001	0.534	<0.001	<0.001	
		Sore Throat	**Back Pain**	**Chest Pain**	**Headache**	**Knee Pain**	**Aspirin**	**Ibuprofen**	**Paracetamol**
FRANCE									
Sore Throat	r	1	0.088	0.257[a]	0.215[a]	-0.045	0.140[b]	0.257[a]	0.233[a]
	p		0.210	<0.001	0.002	0.524	0,045	<0.001	<0.001
Back Pain	r	0.088	1	0.228[a]	0.304[a]	0.198[a]	0.068	0.068	-0.040
	p	0.210		<0.001	<0.001	0.004	0.330	0.329	0.573
Chest Pain	r	0.257[a]	0.228[a]	1	0.419[a]	0.111	0.098	0.149[b]	0.111
	p	<0.001	<0.001		<0.001	0.113	0.162	0.033	0.113
Headache	r	0.215[a]	0.304[a]	0.419[a]	1	0.081	-0.038	0.040	-0.086
	p	0.002	<0.001	<0.001		0.244	0.592	0.569	0.221
Knee Pain	r	-0.045	0.198[a]	0.111	0.081	1	0.028	-0.209[a]	-0.090
	p	0.524	0.004	0.113	0.244		0.689	0.003	0.200
Aspirin	r	0.140[b]	0.068	0.098[a]	-0.038[a]	0.028	1	0.127[a]	0.322[a]
	p	0.045	0.330	<0.001	<0.001	0,265		<0.001	<0.001
Ibuprofen	r	0.257[a]	0.068	0.149[b]	0.040	-0.209[a]	0.127	1	0.222[a]
	p	<0.001	0.329	0.033	0.569	0.003	0.069		<0.001
Paracetamol	r	0.233[a]	-0.040	0.111	-0.086	-0.090	0.322[a]	0.222[a]	1
	p	<0.001	0.573	0.113	0.221	0.200	<0.001	<0.001	

		Sore Throat	Back Pain	Chest Pain	Headache	Knee Pain	Aspirin	Ibuprofen	Paracetamol
SPAIN									
Sore Throat	r	1	0.287[a]	0.376[a]	0.412[a]	-0.003	0.181[a]	0.483[a]	0.619[a]
	p		<0.001	<0.001	<0.001	0.960	0.009	<0.001	<0.001
Back Pain	r	0.287[a]	1	0.374[a]	0.559[a]	0.223[a]	0.180[a]	0.062	0.240[a]
	p	<0.001		<0.001	<0.001	<0.001	<0.001	0.374	<0.001
Chest Pain	r	0.376[a]	0.374[a]	1	0.535[a]	0.145[b]	0.265[a]	0.045	0.196[a]
	p	<0.001	<0.001		<0.001	0.038	<0.001	0.525	0.005
Headache	r	0.412[a]	0.559[a]	0.535[a]	1	0.297[a]	0.200[a]	0.139[b]	0.390[a]
	p	<0.001	<0.001	<0.001		<0.001	0.004	0.047	<0.001
Knee Pain	r	-0.003	0.223[a]	0.145[b]	0.297[a]	1	0.067	0.017	0.097
	p	0.960	<0.001	0.038	<0.001		0.337	0.809	0.167
Aspirin	r	0.181[a]	0.180[a]	0.265[a]	0.200[a]	0.067	1	0.071	0.136
	p	0.009	0.010	<0.001	0.004	0.337		0.313	0.052
Ibuprofen	r	0.483[a]	0.062	0.045	0.139[b]	0.017	0.071	1	0.712[a]
	p	<0.001	0.374	0.525	0.047	0.809	0.313		<0.001
Paracetamol	r	0.619[a]	0.240[a]	0.196[a]	0.390[a]	0.097	0.136	0.712[a]	1
	p	<0.001	<0.001	0.005	<0.001	0.167	0.052	<0.001	
		Sore Throat	**Back Pain**	**Chest Pain**	**Headache**	**Knee Pain**	**Aspirin**	**Ibuprofen**	**Paracetamol**
GERMANY									
Sore Throat	r	1	0.118	0.229[a]	0.093	-0.100	0.519[a]	0.380[a]	0.431[a]
	p		0.091	<0.001	0.184	0.154	<0.001	<0.001	<0.001
Back Pain	r	0.118	1	0.170[b]	0.408[a]	0.073	0.127	0.191[a]	0.236[a]
	p	0.091		0.014	<0.001	0.299	0.069	0.006	<0.001
Chest Pain	r	0.229[b]	0.170[b]	1	0.259[a]	-0.020	0.173[b]	0.122	0.152[b]
	p	0.013	0.014		<0.001	0.780	0.013	0.080	0.029
Headache	r	0.093	0.408[a]	0.259[a]	1	0.176[b]	0.101	0.418[a]	0.489[a]
	p	0.184	<0.001	<0.001		0.012	0.150	<0.001	<0.001
Knee Pain	r	-0.100	0.073	-0.020	0.176[b]	1	-0.122	0.088	0.049
	p	0.154	0.299	0.780	0.012		0.080	0.211	0.485
Aspirin	r	0.519[a]	0.127	0.173[b]	0.101	-0.122	1	0.385[a]	0.428[a]
	p	<0.001	0.069	0.013	0.150	0.080		<0.001	<0.001
Ibuprofen	r	0.380[a]	0.191[a]	0.122	0.418[a]	0.088	0.385[a]	1	0.749[a]
	p	<0.001	0.006	0.080	<0.001	0.211	<0.001		<0.001
Paracetamol	r	0.431[a]	0.236[a]	0.152[b]	0.489[a]	0.049	0.428[a]	0.749[a]	1
	p	<0.001	0.001	0.029	<0.001	0.485	<0.001	<0.001	
		Sore Throat	**Back Pain**	**Chest Pain**	**Headache**	**Knee Pain**	**Aspirin**	**Ibuprofen**	**Paracetamol**
ITALY									
Sore Throat	r	1	0.051	0.312[a]	0.053	-0.102	0.483[a]	0.408[a]	0.256[a]
	p		0.469	<0.001	0.446	0.143	<0.001	<0.001	<0.001
Back Pain	r	0.051	1	0.201[a]	0.085	0.106	0.217[a]	0.195[a]	-0.013
	p	0.469		0.004	0.226	0.130	0.002	0.005	0.848
Chest Pain	r	0.312[a]	0.201[a]	1	0.066	-0.032	0.441[a]	0.269[a]	-0.027
	p	<0.001	0.004		0.347	0.644	<0.001	<0.001	0.703
Headache	r	0.053	0.085	0.066	1	0.067	-0.002	0.022	0.018
	p	0.446	0.226	0.066		0.338	0.974	0.749	0.799
Knee Pain	r	-0.102	0.106	-0.032	0.067	1	-0.155[b]	-0.169[b]	0.028
	p	0.143	0.130	0.644	0.338		0.026	0.015	0.694
Aspirin	r	0.483[a]	0.217[a]	0.441[a]	-0.002	-0.155[b]	1	0.505[a]	0.136
	p	<0.001	0.002	<0.001	0.974	0.026		<0.001	0.052
Ibuprofen	r	0.408[a]	0.195[a]	0.269[a]	0.022	-0.169[b]	0.505[a]	1	0.128
	p	<0.001	0.005	<0.001	0.749	0.015	<0.001		0.067
Paracetamol	r	0.256[a]	-0.013	-0.027	0.018	0.028	0.136	0.128	1
	p	<0.001	0.848	0.703	0.799	0.694	0.052	0.067	

		Sore Throat	Back Pain	Chest Pain	Headache	Knee Pain	Aspirin	Ibuprofen	Paracetamol
BRAZIL									
Sore Throat	r	1	0.400	0.566[a]	0.548[a]	0.070	0.184[a]	0.527[a]	0.702[a]
	p		0,148	<0.001	<0.001	0.317	0.008	<0.001	<0.001
Back Pain	r	0.400[a]	1	0.598[a]	0.657[a]	0.374[a]	0.126	0.299[a]	0.488[a]
	p	<0.001		<0.001	<0.001	<0.001	0.072	<0.001	<0.001
Chest Pain	r	0.566[a]	0.598[a]	1	0.869[a]	0.145[b]	0.355[a]	0.224[a]	0.629[a]
	p	<0.001	<0.001		<0.001	0.038	<0.001	<0.001	<0.001
Headache	r	0.548[a]	0.657[a]	0.869[a]	1	0.147[b]	0.411[a]	0.232[a]	0.658[a]
	p	<0.001	<0.001	<0.001		0.035	<0.001	<0.001	<0.001
Knee Pain	r	0.070	0.374[a]	0.145[b]	0.147[b]	1	0.025	0.209[a]	0.115
	p	0.317	<0.001	0.038	0.035		0.718	0.003	0.100
Aspirin	r	0.184[a]	0.126	0.355[a]	0.411[a]	0.025	1	-0.065	0.292[a]
	p	0.008	0.072	<0.001	<0.001	0.718		0.354	<0.001
Ibuprofen	r	0.527[a]	0.299[a]	0.224[a]	0.232[a]	0.209[a]	-0.065	1	0.580[a]
	p	<0.001	<0.001	<0.001	<0.001	0.003	0.354		<0.001
Paracetamol	r	0.702[a]	0.488[a]	0.629[a]	0.658[a]	0.115	0.292[a]	0.580[a]	1
	p	<0.001	<0.001	<0.001	<0.001	0.100	<0.001	<0.001	
		Sore Throat	**Back Pain**	**Chest Pain**	**Headache**	**Knee Pain**	**Aspirin**	**Ibuprofen**	**Paracetamol**
RUSSIA									
Sore Throat	r	1	-0.104	-0.051	0.109	0.024	0.082	0.245[a]	0.296[a]
	p		0.137	0.466	0.118	0.733	0.240	<0.001	<0.001
Back Pain	r	-0.104	1	0.090	0.042	0.048	0.144[b]	0.071	0.100
	p	0.137		0.198	0.545	0.733	0.039	0.310	0.154
Chest Pain	r	-0.051	0.090	1	-0.084	-0.112	0.127	0.040	0.061
	p	0.466	0.198		0.231	0.107	0.070	0.569	0.384
Headache	r	0.109	0.042	-0.084	1	0.109	0.180[a]	0.161[b]	0.201[a]
	p	0.118	0.545	0.231		0.120	0.010	0.021	0.004
Knee Pain	r	0.024	0.048	-0.112	0.109	1	-0.140[b]	-0.138[b]	-0.065
	p	0.733	0.495	0.107	0.120		0.044	0.048	0.352
Aspirin	r	0.082	0.144[b]	0.127	0.180[a]	-0.140[b]	1	0.395[a]	0.609[a]
	p	0.240	0.039	0.070	0.010	0.044		<0.001	<0.001
Ibuprofen	r	0.245[a]	0.071	0.040	0.161[b]	-0.138[b]	0.395[a]	1	0.629[a]
	p	<0.001	0.310	0.569	0.021	0.048	<0.001		<0.001
Paracetamol	r	0.296[a]	0.100	0.061	0.201[a]	-0.065	0.609[a]	0.629[a]	1
	p	<0.001	0.154	0.384	0.004	0.352	<0.001	<0.001	
		Sore Throat	**Back Pain**	**Chest Pain**	**Headache**	**Knee Pain**	**Aspirin**	**Ibuprofen**	**Paracetamol**
TURKEY									
Sore Throat	r	1	0.350[a]	0.287[a]	0.371[a]	-0.102	0.125	0.592[a]	0.453[a]
	p		<0.001	<0.001	<0.001	0.144	0.074	<0.001	<0.001
Back Pain	r	0.350[a]	1	0.209[a]	0.424[a]	0.105	0.296[a]	0.213[a]	0.205[a]
	p	<0.001		0.003	<0.001	0.135	<0.001	0.002	0.003
Chest Pain	r	0.287[a]	0.209[a]	1	0.445[a]	0.027	0.117	0.058	0.176[b]
	p	<0.001	0.003		<0.001	0.705	0.095	0.406	0.011
Headache	r	0.371[a]	0.424[a]	0.445[a]	1	0.042	0.389[a]	0.024	0.183[a]
	p	<0.001	<0.001	<0.001		0.550	<0.001	0.736	0.008
Knee Pain	r	-0.102	0.105	0.027	0.042	1	0.188[a]	-0.058	-0.160[b]
	p	0.144	0.135	0.705	0.550		0.007	0.411	0.022
Aspirin	r	0.125	0.296[a]	0.117	0.389[a]	0.188[a]	1	0.024	0.181[a]
	p	0.074	<0.001	0.095	<0.001	0.007		0.732	0.009
Ibuprofen	r	0.592[a]	0.213[a]	0.058	0.024	-0.058	0.024	1	0.535[a]
	p	<0.001	0.002	0.406	0.736	0.411	0.732		<0.001
Paracetamol	r	0.453[a]	0.205[a]	0.176[b]	0.183[a]	-0.160[b]	0.181[a]	0.535[a]	1
	p	<0.001	0.003	0.011	0.008	0.022	0.009	<0.001	

		Sore Throat	Back Pain	Chest Pain	Headache	Knee Pain	Aspirin	Ibuprofen	Paracetamol
INDIA									
Sore Throat	r	1	0.315[a]	0.348[a]	-0.028	0.262[a]	0.216[a]	0.553[a]	0.503[a]
	p		<0.001	<0.001	0.686	<0.001	0.002	<0.001	<0.001
Back Pain	r	0.315[a]	1	0.220[a]	-0.021	0.106	0.105	0.362[a]	0.377[a]
	p	<0.001		<0.001	0.765	0.130	0.135	<0.001	<0.001
Chest Pain	r	0.348[a]	0.220[a]	1	-0.043	0.258[a]	0.117	0.365[a]	0.375[a]
	p	<0.001	<0.001		0.542	<0.001	0.093	<0.001	<0.001
Headache	r	-0.028	-0.021	-0.043	1	-0.027	0.079	-0.027	-0.054
	p	0.686	0.765	0.542		0.699	0.257	0.699	0.438
Knee Pain	r	0.262[a]	0.106	0.258[a]	-0.027	1	0.015	0.168[b]	0.154[b]
	p	<0.001	0.130	<0.001	0.699		0.827	0.016	0.027
Aspirin	r	0.216[a]	0.105	0.117	0.079	0.015	1	0.250[a]	0.207[a]
	p	0.002	0.135	0.093	0.257	0.827		<0.001	0.003
Ibuprofen	r	0.553[a]	0.362	0.365	-0.027[b]	0.168[b]	0.250[a]	1	0.874[a]
	p	<0.001	0.310	0.569	0.021	0.048	<0.001		<0.001
Paracetamol	r	0.503[a]	0.377[a]	0.375[a]	-0.054	0.154[b]	0.207[a]	0.874[a]	1

DISCUSSION

The results of this study show that the frequency of search queries related to pain and analgesics has increased significantly during the COVID-19 era. The search trends of related concepts reached a peak by the declaration a pandemic with the World Health Organization (WHO) declaring a pandemic on March 11, 2020. The terms `chest pain`, `headache`, `sore throat` and `back pain` search queries seem to have increased significantly worldwide, especially in countries with the highest number of COVID-19 cases. A significant increase in pain-related search parameters was observed for the specified pain types, except for back and knee pain in the world and the USA, head and knee pain in Italy and knee pain in Turkey. However, at the end of the study, the frequency of analgesic search queries increased during the COVID-19 period. It was determined that the incidence of `ibuprofen`, `aspirin`, and `paracetamol` analgesic search criteria increased after the Covid-19 epidemic while evaluating the trends for the world and the countries with the highest number of Covid-19 cases. It can be said that the frequency of searching for terms related to pain reflects the signs and symptoms of COVID-19. For example, it is explained that sore throat, headache, chest pain and back pain are among the symptoms of COVID-19.[11-16] So, it is obvious that there is a temporal relationship in online pain search trends with the increase in COVID-19 cases. However, as chest pain is also an essential manifestation of major cardiac events, our data should be interpreted with caution in this context, as a significant increase in heart attacks and cardiovascular deaths was reported during the first wave of the COVID-19 pandemic.[17] There has been no increase in the search trend for knee pain worldwide and in some countries. This condition has been associated with physical activity.[18] Due to the possible consequences of the curfew, a decrease in physical activity can be expected. The volume of Google searches for Ibuprofen, aspirin, paracetamol analgesics is significantly correlated with the epidemic trend. This is thought to be related to the common symptoms of myalgia, sore throat, headache and chest pain in COVID-19 patients. It is stated in the literature that this information obtained is an essential finding for governments and public health officials in preventing the possible limitation of such drugs.[19]

It is stated in studies that there is thromboembolism in severe COVID-19 patients.[20] Therefore, some healthcare institutions around the world recommend the use of anticoagulants in severe cases of COVID-19.[21,22] Since aspirin is one of the well-known antithrombotic drugs, it is stated that its use has increased during the COVID-19 period.[20] It is thought that the search intensity for aspirin is related to this situation. A meta-analysis study stated that COVID-19 patients with aspirin use indicate a lower probability of death compared to the group without aspirin use.[20] In a contrary meta-analysis study, it is stated that there is no relationship between aspirin use and mortality in COVID-19 patients.[12] As a result of the correlation analysis showed a strong correlation between chest pain and headache, a moderate correlation between chest pain and NSAIDs, headache and NSAIDs, and strong and moderate correlation analysis within drugs. It can be said that this situation is related to the use of NSAIDs by patients to reduce COVID-19 symptoms. It is stated that patients use paracetamol, especially at night, to reduce symptoms and sleep more comfortably, and they need NSAIDs for symptoms such as musculoskeletal pain. However, it is stated that NSAIDs are preferred to reduce the symptoms of the cardiovascular and respiratory systems.[23]

While the evidence supports that NSAIDs will have a harmful effect in the presence of infection anywhere in the body, there is insufficient evidence to suggest that they pose a risk in the case of COVID-19. However, it is stated that the use of an NSAID for symptoms suggestive of COVID-19 may be more harmful than beneficial.[24] On the other hand, in a study evaluating the effect of Ibuprofen on cardiac fibrosis in a rat diabetes model, it was observed that Ibuprofen increased the expression level of angiotensin-converting enzyme 2 (ACE2).[25] As a result of

some in vitro studies found a positive correlation between the level of ACE2 expression and the risk of coronavirus infection.[26] However, it is stated that NSAIDs can suppress the immune system. Although the precise role of NSAIDs is under investigation, it is thought that their use in the viral contamination phase of COVID-19 may be harmful.[24] Therefore, with a pragmatic and cautionary approach, it is recommended to avoid using NSAIDs to treat non-severe COVID-19 symptoms.

CONCLUSION

As a result of the study, it is seen that there is a strong relationship between the frequency of searching for analgesic terms such as aspirin, Ibuprofen, paracetamol and the pain terms such as backache, chest pain, headache, knee pain, sore throat for the USA, UK, France, Germany, Italy, India, Spain, Russia, Brazil and Turkey, the countries where the COVID-19 epidemic is most intense the onset of COVID-19 infection. Also, the strong correlation between chest pain and headache, which are accepted as COVID-19 symptoms, the moderate correlation of chest pain and headache with drugs, strong and moderate correlation within drugs themselves were obtained as a result of the analysis. Our study describes the relationship and analysis of trends in pain and analgesic-related search parameters in the pre and post-COVID-19 Google search network over four years. There appears to be an increase in search volume for analgesics or pain with increasing pain complaints. Our data can indicate the increasing incidence of pain with the COVID-19 pandemic since internet searches are a proxy for the public good.

ETHICAL DECLARATIONS

Ethics Committee Approval: Ethics Committee approval is not required as the study data was obtained from a public database, there were no human participants, and it did not contain animal experiments.

Informed Consent: Informed consent is not required as the study data was obtained from a public database.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The author has no conflicts of interest to declare.

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