

Analysis of Online Information-Seeking Behaviors Related To Adalimumab in Türkiye Using Google Trends Data (2016–2025)

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ABSTRACT

Objective: This study aims to analyze online information-seeking behaviors of patients in Türkiye regarding adalimumab by using Google Trends data.

Materials and Methods: Weekly normalized search volume index data between 2016 and 2025 were retrieved for a total of 40 keywords related to “adalimumab,” “humira,” “amgevita,” and 10 thematic domains. The results were normalized with reference to “adalimumab.” Temporal trends and regional (provincial) distributions were evaluated.

Results: The most frequently searched term was “humira,” whereas “adalimumab” attracted relatively limited interest. “Amgevita” was searched at a meaningful level only in certain metropolitan areas. General knowledge, patient experience, and drug pricing emerged as dominant themes. In contrast, searches related to specific indications, such as uveitis and pharmacological features were extremely limited. A statistically significant increase in search interest was observed after 2021 ($p < 0.001$).

Conclusion: Digital information-seeking behaviors about adalimumab have increased and diversified over time. The public appears to use commercial names more frequently than the generic name and shows greater interest in non-medical topics, such as pricing and patient experiences. Awareness of biosimilar medications remains limited and is geographically concentrated in specific provinces.

Keywords: Adalimumab, Biosimilar awareness, Google Trends, Online health information, Patient behavior

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INTRODUCTION

Uveitis is defined as a group of inflammatory intraocular diseases, potentially resulting in permanent vision loss if left untreated. The majority of non-infectious uveitis cases are associated with systemic immunological disorders and follow a chronic course, necessitating a prolonged treatment and

monitoring process after diagnosis.^[1] Corticosteroids remain the first-line treatment; however, concerns have been raised regarding their long-term use, regarding its potential inadequacy, and the severity of the side effects that may be associated with their use. Biologic agents have emerged as the preferred options in the stepwise therapeutic approach.^[2,3]

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Adalimumab, an anti-TNF- α monoclonal antibody, was the first and only biologic agent to be FDA-approved in 2016 for the treatment of non-infectious intermediate, posterior, and panuveitic diseases (https://www.accessdata.fda.gov/drug-satfda_docs/label/2018/125057s410lbl.pdf). The VISUAL I and VISUAL II clinical trials demonstrated that adalimumab significantly prolonged time to treatment failure, reduced the risk of vision loss, and enabled steroid-sparing effects.^[4,5] It has been officially available in Türkiye since 2018, with prescriptions requiring approval by a committee of specialists and periodic renewal every three to six months. Nevertheless, the prolonged nature of biologic therapies gives rise to concerns regarding adherence, safety, and information needs.^[6] In outpatient settings, there is limited time available for patient education, and many individuals therefore turn to publicly accessible sources, most commonly search engines, such as Google.^[7]

Google Trends (GT) is an online tool that provides anonymized, time- and location-based normalized search volume index (SVI) data. Since its launch in 2004, GT has become a valuable resource for infodemiological analyses, allowing the investigation of digital information-seeking behaviors. In recent years, there has been an increasing interest in this field within the context of public health and digital health research, with particular regard to studies in the field of ophthalmology.^[8-11]

The objective of this study is to analyze how individuals in Türkiye seek online information related to adalimumab using GT data, with a focus on thematic patterns, such as drug information, safety, efficacy, usage, pricing, and special situations. The temporal and geographic distribution of these queries will also be examined.

MATERIALS AND METHODS

The present study was designed as an infodemiological analysis based on GT data to assess online information-seeking behaviors regarding adalimumab in the context of uveitis treatment in Türkiye. The primary objective of the present study was to explore the temporal evolution of public interest in adalimumab and to provide a comprehensive mapping of this interest across a range of treatment-related themes.

All data were obtained from the publicly accessible GT platform; no individual data were collected, and therefore, ethical committee approval or informed consent was not required. All data were anonymous, aggregated, and derived from publicly available digital sources. The study was conducted in accordance with the Declaration of Helsinki.

Each keyword group was entered separately into the GT platform, selecting “Web Search” as the search category. The search language was set to Turkish, with the geographical region limited to Türkiye, and the time interval set from January 01,

2016 to July 14, 2025. The selected timeframe is reflective of the clinical introduction and increasing accessibility of adalimumab in Türkiye, in conjunction with evolving public habits regarding online health information. To ensure the relevance of the results to the field of medicine, the “Health” category filter was applied.

Searches were conducted utilizing the “search term” format in GT. To standardize comparisons, the term “adalimumab” was included as a fixed reference keyword in each query. This enabled the relative search volume of other terms to be indexed against adalimumab. In addition to the nomenclature of the molecule, the brand names most frequently employed in Türkiye – Humira (Humira®, AbbVie Inc., North Chicago, IL, USA) and its biosimilar Amgevita (Amgevita®, Amgen Europe B.V., Breda, The Netherlands) – were also included. Following the confirmation that “humira” was the most frequently searched brand name, subsequent queries were adapted to include this term accordingly.

The searches were organized under ten pre-defined thematic groups, each representing a distinct aspect of patient interest in adalimumab: General information, safety and side effects, efficacy and treatment success, mode and duration of administration, cost, comparisons with alternative drugs, special circumstances (e.g. pregnancy, childhood, immunosuppression), impact on vision, patient opinions and concerns, and reimbursement/reporting processes. For each group, 4–5 original Turkish keywords were created in alignment with natural language patterns used by patients. In instances where the SVI yielded a score of zero, alternative colloquial expressions were subjected to empirical investigation.

GT provides normalized weekly average scores ranging from 0 to 100, with 100 representing the peak search volume for a given time period and other terms scored proportionally. In instances where the search volume is found to be exceptionally low, or where there is a possibility of privacy risks being present, GT has been known to assign a score of “0” or to withhold data. Such characteristics were taken into account, and variables without meaningful variation were excluded from statistical analyses. The exported output files were formatted as a CSV file and subsequently organized into thematic groupings. For each file, the relative search scores of keywords were recorded against the reference term (adalimumab). The categories and keywords that were the focus of the investigation are presented in Table 1 (also see Supplementary data for the original Turkish version of the keywords).

Statistical Analysis

For each keyword within the thematic groups, descriptive statistical analyses were performed to calculate the mean, median, minimum, and maximum SVI values throughout the study

Table 1. Distribution of Google Trends search terms by thematic categories										
Keywords*	General Info	Safety	Efficacy	Administration	Cost	Comparison	Special conditions	Vision-related	Patient experience	Report process
Reference [†]	Adalimumab (ADA) [‡]	ADA	ADA	ADA	ADA	ADA	ADA	ADA	ADA	ADA
K1	Humira [§]	Humira side effects	Is Humira effective?	How to use Humira	Humira price	Humira alternatives	Humira pregnancy	Humira blindness	What kind of drug is Humira	Humira report
K2	Amgevita	Amgevita side effects	Benefits of Humira	Humira dosing schedule	Amgevita price	Humira versus Amgevita	Humira in children	Can Humira restore vision	Humira reviews	Humira report duration
K3	ADA uveitis	ADA side effects	Is Humira effective	Humira injection	Humira SGK	What can be used instead of humira	Humira vaccine	Does humira save eyesight	What users say about Humira	Humira and TBC
K4	Humira uveitis	Is ADA harmful?	When does Humira work?	Humira pen	Humira reimbursement	Humira or corticosteroids	Humira breastfeeding	Humira and glasses	Amgevita user opinions	Humira and cancer
K: Keywords; ADA: Adalimumab; SGK: Sosyal güvenlik kurumu (in Turkish)- social security organization. [†] Keywords were selected based on natural language patterns that patients are likely to use. [‡] Adalimumab was used as the fixed reference term in all GT queries. [§] Searches were conducted using the full name "Adalimumab"; ADA is used here for tabular clarity. [¶] Since "Humira" was the most frequently searched term, other thematic queries were built around it.										

period. The relative distribution of interest across thematic categories was expressed proportionally. To assess temporal trends, annual mean SVI values were analyzed to determine whether changes over time showed statistically significant differences. Given the non-parametric nature of the SVI data distribution, the Kruskal–Wallis test was used for comparisons involving more than two groups, and the Mann–Whitney U test was applied for pairwise analyses. A $p<0.05$ was considered statistically significant.

RESULTS

This study conducted a comprehensive analysis of online information-seeking behaviors related to adalimumab and its brand names using GT data, assessing search volumes over time and by specific keywords. The findings indicate a growing and diversifying public interest in biologic agents.

Among general search queries, the keyword “humira” emerged as the most frequently searched term, reaching a normalized SVI of 100 during most of the study period. In contrast, the generic term “adalimumab” attracted more limited attention (maximum SVI: 24; mean: 10), while “amgevita” appeared only during specific periods (March 2020, December 2021, and March–May 2022). Search queries explicitly related to the indication of uveitis were extremely rare; terms, such as “adalimumab uveitis” and “humira uveitis” showed very low activity over only a few isolated weeks.

Regarding safety concerns, the query “is adalimumab harmful?” demonstrated episodic search interest (maximum SVI: 36), but this pattern was not statistically significant ($p=0.468$, Kruskal–Wallis test). Meanwhile, searches for “adalimumab side effects,” “humira side effects,” and “amgevita side effects” remained at a negligible level (SVI=0).

Queries concerning drug efficacy were also scarce. The term “When does Humira work?” appeared with measurable interest only in December 2019 (SVI: 31), while other efficacy-related terms generated no significant search volume.

Regarding administration, only the term “humira pen” attracted notable attention (mean SVI: 16.6; maximum: 86). Other related queries, such as “humira injection,” “how to use humira,” or “humira dosing schedule,” were rarely searched. The interest in “humira pen” remained stable over time ($p=0.109$, Kruskal–Wallis test).

Cost-related searches were predominantly focused on the term “humira price,” which showed significant fluctuations across the years ($p=0.0002$, Kruskal–Wallis test). Peaks were observed in February 2019, June 2021, and May–July 2022 (maximum SVI: 78). The search term “humira SGK” (referring to reimbursement by the Turkish Social Security Institution) occasionally reflected increased awareness of insurance coverage.

Alternative therapy searches were minimal, with queries, such as “humira or amgevita” (June 2018) and “what can be used instead of humira” (December 2018), appearing in only a few isolated instances (mean SVI: 0.37; maximum: 42).

Searches related to specific clinical scenarios revealed limited public engagement. Terms, such as “humira pregnancy” and “humira vaccine,” were never significantly searched throughout the study period. The term “humira in child” showed a peak only once in January 2025 (SVI: 42), while “humira breastfeeding” drew minimal attention in March 2022 (SVI: 28).

Queries reflecting concerns about vision outcomes, such as “humira blindness,” “Can Humira restore vision,” and “does humira save eyesight,” did not yield any meaningful search activity. However, the term “humira and glasses” appeared during three distinct periods: August 2017 (SVI: 44), November 2019 (SVI: 57), and November 2023 (SVI: 33). Despite these spikes, year-by-year comparison revealed no statistically significant differences ($p=0.265$, Kruskal–Wallis test).

In the theme of patient experiences and satisfaction, only the phrase “are you satisfied with humira?” generated measurable search interest. This query peaked in February 2016, February 2018, and March 2021 (SVI range: 36–40), while remaining minimal at other times ($p=0.998$, Kruskal–Wallis test).

Regarding administrative and procedural queries, searches related to “humira report” and “how long does humira report last” were minimal. Queries involving tuberculosis and malignancy within the scope of pre-treatment reporting were also rare; only “humira and cancer” was searched during a limited period (September 2016, SVI: 52).

The analysis of the keywords indexed relative to “adalimumab” revealed a cumulative increase in SVI over time (Fig. 1). A comparison of the two time periods – 2016–2020 versus 2021–

2025 – revealed a statistically significant increase in search interest in biologic treatments after 2021 ($p<0.001$, Mann–Whitney U test).

According to the findings of the analysis, presented in Table 2, the search terms that demonstrated the most significant increase in GT data between the periods 2016–2020 and 2021–2025, along with their comparative descriptives, are outlined.

The time-dependent comparison revealed statistically and clinically meaningful increases in the relative search volumes for several keywords between the two periods (2016–2020 vs. 2021–2025). Notably, the phrase “Humira pen” showed the most pronounced increase (mean SVI: 3.60 → 30.78), suggesting a rising public interest in understanding the mode of administration. Similarly, “Humira price” and the general term “Humira” demonstrated a significant increase of 22.48 and 24.20 points, respectively. Furthermore, certain keywords that were previously not searched – such as “Humira in child,” “Humira breastfeeding,” and “Humira SGK” – began to appear in the latter time period, indicating an emerging public curiosity about special clinical conditions related to adalimumab use.

The geographic distribution of search terms across Turkish provinces was also analyzed based on GT data. “Adalimumab” was searched widely across the country, with the highest SVI values noted in İzmir, Antalya, and Bursa. “Humira” had an even broader geographic reach, being highly searched in Adana, Konya, and Gaziantep, among others. In contrast, interest in the term “Amgevita” was limited to a few provinces, with the highest search volumes observed in İstanbul, Eskişehir, and İzmir.

DISCUSSION

This study aimed to evaluate the online information-seeking behaviors related to adalimumab and its biosimilars in Türkiye, analyzing variations by time, thematic content, and geographic distribution. The findings provide insights into patients’ awareness, concerns, and information needs regarding treatment with biologic agents. GT data revealed a significant temporal shift in search behavior, potentially influenced by contextual, regional, and sociocultural dynamics.

A notable increase in search interest related to adalimumab was observed following 2021. This phenomenon can be attributed to the increasing utilization and awareness of the drug. It has been demonstrated by literature that there is a high degree of correlation between the data from the GT and the public’s awareness of recently introduced medications.^[12] Moreover, the post-2020 period coincides with the emergence of the global Coronavirus Disease 2019 pandemic. During this period, there was a notable surge in the number of individuals seeking digital health information, as patients increasingly

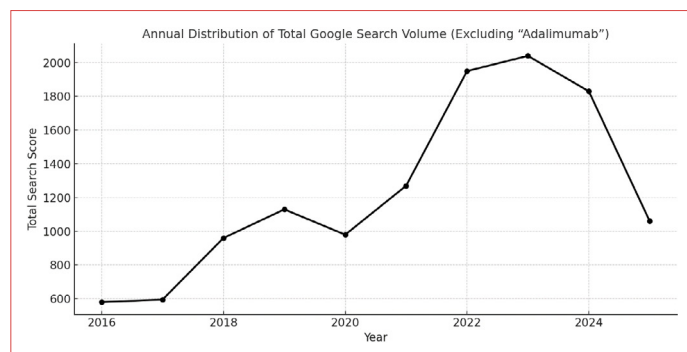


Figure 1. Cumulative annual search volume scores based on Google Trends data from 2016 to 2025, excluding the keyword “adalimumab”.

Table 2. Mean SVI values of selected search terms in two distinct time intervals and interpretive remarks

Search term	Mean SVI (2016–2020)	Mean SVI (2021–2025)	Comment
Humira pen administration	3.6	30.8	Substantial rise in interest toward the route of
Humira	55.2	79.4	Increased general awareness and public interest
Humira price	3.1	25.6	Growing concern over economic implications
Amgevita	0.2	6.5	Increased attention to biosimilar alternatives
Humira in child	0.0	0.76	Emerging interest in pediatric indications
Humira SSI	0.0	0.71	Awareness of reimbursement and accessibility issues
Is adalimumab harmful	0.0	0.65	Rising safety concerns over the therapy
Humira injection	0.0	0.53	Seeking information on practical administration
Humira breastfeeding	0.0	0.51	Inquiries related to use during lactation
Humira reviews	0.0	0.09	Demand for patient experience and feedback

SSI: Social Security Institution; SVI: Search Volume Index.

turned to online resources to satisfy their informational needs. Nevertheless, this transition carries with it the potential for the dissemination of misinformation, which may intensify patient anxiety and result in diminished treatment adherence.^[13,14] It is therefore imperative for healthcare providers to counsel patients on the reliability of online information sources.

In general search patterns, the brand name “Humira” generated significantly higher interest than the generic term “adalimumab,” reaching the maximum normalized SVI during most of the study period. This finding reflects the dominance of brand-based recognition over the active ingredient and highlights public familiarity with commercially promoted content. Similar observations have been made in studies investigating infliximab (Remicade vs. biosimilars).^[15] In Türkiye, the relatively lower awareness of “adalimumab” may stem from prescription practices or pharmacist-driven brand recommendations. Meanwhile, interest in the term “Amgevita” – another commercial product – has shown a modest increase but remains geographically limited, likely influenced by market approval timelines and its inclusion in reimbursement schemes (active access in Türkiye began post-2020). Searches for biosimilar alternatives were largely limited to “Humira or Amgevita?,” emphasizing the critical role of patient education in treatment transitions involving biosimilars.^[16]

The geographical analysis demonstrated that the search term “Amgevita” was predominantly utilized in major metropolitan areas, including Istanbul, Izmir, and Eskişehir. Conversely, “Humira” exhibited a more extensive nationwide interest. This may indicate that recognition of biosimilars is still limited and tends to be concentrated in regions with better healthcare infrastructure. The presence of university hospitals and private

clinics, improved access to information, and a more proactive patient population are characteristics of these urban centers. Furthermore, searches for “adalimumab” exhibited a concentration in relatively more socioeconomically developed cities, such as Antalya, Bursa, and Izmir. This finding suggests that users who employ generic search terms may possess a higher level of health literacy and engagement with formal medical terminology.^[17]

With regard to the volume of keyword searches, public information-seeking behavior appears to be predominantly focused on cost and safety concerns. However, it was notable that queries related to drug efficacy or pharmacological mechanisms were absent. This finding suggests a lack of pharmacological literacy among the general population. This finding is consistent with the results of previous studies, which indicated that levels of health literacy in Türkiye are limited.^[18]

The high search frequency of terms, such as “Humira price” and “Humira SGK” (Social Security Institution) suggests public concern over treatment accessibility. Search peaks in 2019, 2021, and 2022 corresponded to major currency fluctuations and pharmaceutical pricing adjustments in Türkiye. Notably, these periods aligned with public discourse on reimbursement restrictions and policy changes. The temporal overlap implies a public sensitivity to economic access, consistent with previous evidence showing a correlation between online search interest and the cost of anti-cancer drugs,^[19] and supports earlier findings that economic factors significantly influence patients’ treatment decisions in Türkiye.^[20]

Searches related to patient experience, such as “Humira reviews,” highlight an increasing demand for patient-centered

care and reflect the public's interest in individual experiences with biologic treatments. Prior literature emphasizes that in chronic conditions requiring biologics, patient experiences and peer feedback can meaningfully influence therapeutic decision-making, independent of clinical evidence.^[21-23]

This study has several limitations that should be considered when interpreting the results. First, the analysis was conducted using GT data, which provides normalized SVI on a scale of 0–100, rather than absolute search counts. As a result, search terms with very low volume may appear as “0,” potentially under-representing niche but clinically relevant queries. This limitation may particularly affect rare or technical terms related to off-label uses, pediatric applications, or disease-specific concerns. In addition, GT does not disclose demographic information, such as users' age, gender, education, or socioeconomic background, limiting the ability to draw conclusions about specific user groups. The intent behind search queries cannot be definitively determined – some may originate from healthcare professionals, caregivers, or students rather than patients. Moreover, the analysis was restricted to Turkish-language searches, which may not capture the behavior of bilingual or non-Turkish-speaking users in Türkiye. Finally, this study does not incorporate data from other digital platforms, such as YouTube, Twitter, or specialized medical forums, which may also significantly contribute to health-related information-seeking behavior.

CONCLUSION

The cumulative findings of this study indicate that public interest in online information about adalimumab and other biologic agents in Türkiye has significantly increased over the years. Searches for the generic name “adalimumab” were more frequent in socioeconomically developed provinces, suggesting that users in these regions may be more familiar with clinical terminology and digital health literacy. In contrast, the more widespread interest in “Humira” illustrates the dominant role of brand awareness in public perception. The emphasis on pricing and patient experience in online searches indicates that patients' decisions are shaped not only by clinical considerations but also by economic and psychosocial factors. The relatively limited public interest in biosimilars further underscores the need for enhanced patient education and awareness campaigns in this area.

DECLARATIONS

Ethics Committee Approval: All data were obtained from the publicly available GT platform; no individual data were collected and therefore no ethics committee approval was required.

Informed Consent: All data was obtained from the publicly available GT platform; no individual data was collected and therefore informed consent was not required.

Conflict of Interest: The authors declare that there is no conflict of interest.

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Use of AI for Writing Assistance: This study involved generative artificial intelligence (AI)-based language models (ChatGPT, OpenAI) in assisting with the English language editing and academic phrasing of the manuscript text. All data analysis, interpretation, and conclusions were solely conducted and verified by the authors. The AI tool was not used for generating scientific content, nor for performing data analysis.

Authorship Contributions: Concept – BYO; Design – BYO; Supervision – BYO; Fundings – BYO; Materials – BYO, GO; Data collection &/or processing – BYO, GO; Analysis and/or interpretation – BYO; Literature search – BYO, GO; Writing – BYO; Critical review – BYO, GO.

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Supplementary Data										
Anahtar kelimeler*	Genel bilgi	Güvenlik	Etkinlik	Uygulama	Ücret	Karşılaştırma	Özel durumlar	Görme üzerine	Hasta memnuniyeti	Rapor prosedürü
Referans†	Adalimumab (ADA)‡	ADA	ADA	ADA	ADA	ADA	ADA	ADA	ADA	ADA
A1	Humira§	Humira yan etki	Humira işe yarıyor mu	Humira nasıl kullanılır;	Humira fiyat	Humira alternatif	Humira gebelik	Humira körlük	Humira nasıl bir ilaç	Humira raporu
A2	Amgevita	Amgevita yan etki	Humira faydası	Humira kaç günde bir yapılır	Amgevita fiyat	Humira mı amgevita mı	Humira çocuk	Humira görme düzelir mi	Humira yorumlar	Humira rapor kaç ay
A3	ADA üveit	ADA yan etki	Humira etkili mi	Humira enjeksiyon	Humira SGK	Humira yerine ne kullanılır	Humira aşı	Humira göz kurtulur mu	Humira kullananlar ne diyor:	Humira verem
A4	Humira üveit	ADA zararlı mı	Humira ne zaman etki eder	Humira pen	Humira geri ödeme	Humira mı kortizon mu	Humira emzirme	Humira gözlük	Amgevita kullannalar ne diyor	Humira kanser
A: Anahtar kelime; ADA: Adalimumab; SGK: Sosyal güvenlik kurumu. *Anahtar kelimeler denenenek halk dilinde en olası söz öbekleri seçilerek belirlenmiştir. †Kıyaslama sağlamak için “Adalimumab” sabit tutulmuştur. ‡Arama yapılırken “Adalimumab” şeklinde açık hali yazılmıştır. ADA kısaltması grafik için yapılmıştır. §En sık aranan terim “Humira” olduğu için diğer gruplarda terim olarak “Humira” tercih edilmiştir.										

A: Anahtar kelime; ADA: Adalimumab; SGK: Sosyal güvenlik kurumu. *Anahtar kelimeler denenecek halk dilinde en olası söz öbekleri seçilerek belirlenmiştir. [†]Kıyaslama sağlamak için "Adalimumab" sabit tutulmuştur. [‡]Arama yapılırken "Adalimumab" şeklinde açık hali yazılmıştır. ADA kısaltması grafik için yapılmıştır. [§]En sık aranan terim "Humira" olduğu için diğer gruplarda terim olarak "Humira" tercih edilmiştir.