

## Research Article

# Evaluating The Readability of Websites Providing Information About Monkeypox Maymun Çiçeği Virüsü Hakkında Bilgi Sunan Web Sitelerinin Okunabilirliğinin Değerlendirilmesi

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### Abstract

**Aim:** The aim of this study is to evaluate the readability, reliability, and quality of the content on websites providing information about the monkeypox virus.

**Material and Method:** The Google search engine (www.google.com.tr) was used with the keyword 'monkeypox,' and websites from the first 15 pages of search results that were English-language websites, which did not require membership and were freely accessible were included in the study, from the first 15 pages of search results were included in the study totaling 44 websites. The websites were categorized into four groups: news sites, professional health organizations, government websites, and others. The readability of the texts on the websites was assessed using the Flesch Reading Ease Score (FRES), Gunning Fog Index (GFI), Coleman-Liau Index (CLI), and Simple Measure of Gobbledygook Index (SMOG). The content quality of the texts was evaluated using the JAMA and DISCERN tools.

**Results:** Of the websites examined, 54.5% were news sites, and only 15.9% were affiliated with professional health organizations. It was found that 56.8% of the websites had a FRES readability level of 'Difficult to read,' 47.7% had a CLI readability level of a 'Fairly difficult,' a 68.2% had a SMOG readability level of 'Undergraduate,' and a 57.8% had a GFI readability level of 'College graduate.' The average JAMA score of the websites was 2.09, and the average DISCERN score was 40.61.

**Conclusion:** The readability level of the information provided on websites regarding monkeypox was moderately difficult, with inadequate quality and weak reliability. Based on these findings, our study underscores the importance of considering the readability, quality, and reliability of websites that provide information about monkeypox, stating that these factors should not be overlooked. Keywords: Monkeypox, internet, readability

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### Öz

**Amac:** Bu çalışmanın amacı, maymun çiçeği virüsü hakkında bilgi sağlayan web sitelerinin okunabilirliğini, güvenilirliğini ve içerik kalitesini değerlendirmektir.

**Gereç ve Yöntem:** Google arama motoru (www.google.com.tr) kullanılarak 'maymun çiçeği' anahtar kelimesiyle arama yapılmıştır. İlk 15 sayfa içerisindeki İngilizce dilinde olan, üyelik gerektirmeyen ve serbest erişilebilen web siteleri çalışmaya dahil edilmiştir. Toplamda 44 web sitesi incelenmiştir. Web siteleri dört gruba ayrılmıştır: haber siteleri, profesyonel sağlık kuruluşları, hükümet web siteleri ve diğerleri. Web sitelerindeki metinlerin okunabilirliği, Flesch Okuma Kolaylığı Puanı (FRES), Gunning Fog İndeksi (GFI), Coleman-Liau İndeksi (CLI) ve Simple Measure of Gobbledygook İndeksi (SMOG) ile değerlendirilmiştir. İçerik kalitesi ise JAMA ve DISCERN araçları kullanılarak değerlendirilmiştir.

**Bulgular:** İncelenen web sitelerinin %54,5'i haber sitelerinden oluşmaktadır ve yalnızca %15,9'u profesyonel sağlık kuruluşlarıyla ilişkilidir. Web sitelerinin %56,8'inin FRES okunabilirlik seviyesi "Okunması Zor" olarak belirlenmiştir. %47,7'si CLI'ye göre "Oldukça Zor," %68,2'si SMOG'a göre "Lisans" ve %57,8'i GFI'ye göre "Üniversite Mezunu" seviyesinde bulunmuştur. Web sitelerinin ortalama JAMA skoru 2,09 ve ortalama DISCERN skoru 40,61 olarak hesaplanmıştır.

**Sonuç:** Maymun çiçeği hakkında bilgi sağlayan web sitelerinin okunabilirlik seviyesi orta derecede zor, içerik kalitesi ise yetersiz ve güvenilirliği zayıf olarak bulunmuştur. Bu bulgulara dayanarak, bu tür web sitelerinin okunabilirlik, kalite ve güvenilirlik unsurlarının göz ardı edilmemesi gerektiği vurgulanmaktadır.

**Anahtar Kelimeler:** Maymun çiçeği, internet, okunabilirlik

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## INTRODUCTION

Human monkeypox (MPX) is a disease caused by the monkeypox virus (MPXV), a member of the Orthopoxvirus family, and is primarily confined to a few endemic countries in Central and West Africa (1). Monkeypox was first identified in African monkey colonies in 1958, and the first human case was reported in 1970 in the Democratic Republic of the Congo (2). The modes of transmission of monkeypox include direct contact with infected skin and mucocutaneous lesions, respiratory droplets, or through contaminated objects, all of which can facilitate human-to-human transmission. Although monkeypox is not classified as a sexually transmitted infection, it has been observed that the majority of cases are associated with men who engage in unprotected sex. Monkeypox presents symptoms similar to those of chickenpox. After an incubation period of 10-14 days in infected individuals, symptoms such as malaise, fever, chills, and reactive lymphadenopathy emerge, followed by the appearance of rashes, 1-3 days later. The maculopapular rash typically begins on the torso and, as it intensifies, spreads to other parts of the body. Between the 2nd and 4th weeks, lesions evolve from papules to vesicles and then pustules. Infectiousness persists for up to two weeks after the appearance of the rash (3). Human monkeypox cases have been on the rise since the 1970s, with outbreaks occasionally occurring outside Africa due to importations and travel-related spread since 2003 (4). In May 2022, the UK and the European Centre for Disease Prevention and Control, along with the Centers for Disease Control and Prevention in the United States, reported an increase in the number of monkeypox cases in several countries across Europe and the Americas (5).

The internet hosts a vast array of medical resources aimed at informing both patients and healthcare professionals (6). A national survey conducted by the Pew Internet & American Life Project found that 80% of internet users in the United States search for health-related information online (7). Individuals with serious health conditions or limited access to healthcare often turn to the internet for medical information (8). Online medical resources can assist healthcare professionals in educating the public and helping individuals access essential information to protect and improve their health. However, significant deficiencies exist in users' ability to find, understand, and utilize medical information available online, and the quality of such information often lacks standardization (9). The essential criteria for evaluating health-related information sources on the internet are defined in the Journal of the American Medical Association (JAMA) evaluation tool, which includes authorship, attribution, disclosure, and currency (6).

Another widely used tool for assessing online medical resources is the DISCERN scale, which consists of 16 questions that evaluate the quality of written information regarding health issues and treatments (10).

Readability is defined as the ease with which a text can be read and understood (11). It is a fundamental requirement for ensuring that information is useful and of high quality. Poor readability of online health information may result in misinformation and adversely affect individuals' health (12). Studies evaluating the readability of medical information on the internet have revealed significant variations in the readability levels (13, 14). To assess the readability of online texts, various measurement tools are used, including the Flesch Reading

Ease Score (FRES), Gunning Fog Index (GFI), Coleman-Liau Index (CLI), and the Simple Measure of Gobbledygook (SMOG) Index (15).

People who have not fully recovered from the residual effects of the COVID-19 pandemic express serious concerns about the potential emergence of a monkeypox pandemic on a global scale (16). In this context, literature includes studies evaluating the readability (17, 18) and content quality of information (19) available on the internet regarding the COVID-19 pandemic. The aim of our study is to analyze the readability, reliability, and quality of the content on websites providing information about the monkeypox virus.

## MATERIALS AND METHODS

This study did not require ethical approval as it utilized publicly available information from websites. The research was conducted in accordance with the principles of the Helsinki Declaration of Human Rights (3, 20). On August 19, 2024, Google Trends was used to identify the primary keyword for the study. The terms “monkeypox virus,” “monkeypox disease,” and “monkeypox virus disease” were searched globally using the web search option over the past seven days, across all categories. The selection of the past seven days as the timeframe was based on the dynamic nature of public health concerns and internet search trends. Previous studies analyzing rapidly evolving health topics have demonstrated that search trends fluctuate significantly over short periods. By selecting a recent and relevant timeframe, our study aimed to capture the most up-to-date public interest and search behavior, reducing the risk of outdated data skewing the results (21). The search revealed that the term “monkeypox virus” was most frequently used. The keyword was subsequently entered into the Google search engine ([www.google.com.tr](http://www.google.com.tr), Google LLC, Mountain View, California, USA), with the “past seven days” filter applied, and the first 15 pages of results were reviewed. To

ensure the reliability of the results, the researcher logged out of their personal Google account and cleared the browser cache and cookies.

The study included English-language, publicly accessible websites that provide information about monkeypox virus and which do not require membership for access. The exclusion criteria were as follows: non-English websites, academic articles, chat and forum sites, websites not intended to provide informational content, commercial and advertising sites, duplicate websites, sites that require membership or acceptance of cookie settings, websites offering only video and/or visual content, social media-based sites, and websites that do not provide information about monkeypox virus. Based on their content, the websites included in the study were categorized into four groups: news sites, professional health organizations, government websites, and other sources.

### Readability Measurement

Four validated readability tools were used in the study: Flesch Reading Ease Score (FRES), Gunning Fog Index (GFI), Coleman-Liau Index (CLI), and Simple Measure of Gobbledygook Index (SMOG) (Table 1). The data for these tools were obtained through publicly accessible online applications. Specifically, the FRES (<https://charactercalculator.com/flesch-reading-ease/>) and CLI (<https://www.readabilit.com/readability/coleman-liau-index>) data were collected by one researcher (E.T.A.), the GFI (<https://charactercalculator.com/gunning-fog-index/>) data by another researcher (H.Y.), and the SMOG (<https://charactercalculator.com/smog-readability/>) data by a third researcher (E.G.).

### Content Evaluation

The study used the DISCERN Scale and the JAMA Score to evaluate the reliability and quality of the information. The DISCERN Scale, developed by Charnock et al. (10), is designed to evaluate the adequacy and quality of written information regarding treatment options. This scale includes 16 questions: eight on reliability and independence, seven on treatment adequacy, and one on overall content quality. Each question is rated on a scale from 1 to 5, where 1 represents “definitely no” and 5 represents “definitely yes.” The total score on the scale is classified into five categories: 63-75 (excellent), 51-62 (good), 39-50 (fair), 28-38 (poor), and 15-27 (very poor).

### JAMA Score

The JAMA Score is a globally recognized tool for evaluating the quality, reliability, and usability of online

medical information. (22) This scoring system is based on four key criteria, scored as either “present = 1” or “absent = 0”. The total score ranges from 0 to 4, with scores  $\geq 3$  indicating “high reliability” and scores  $\leq 2$  indicating “low reliability.” The criteria are as follows:

- Author Information: Details about the authors, contributors, their affiliations, and expertise.
- Citations: References and copyright information included within the content.
- Transparency: Disclosure of site ownership, sponsorship, advertising, and funding.
- Timeliness: Indication of publication and update dates.

The websites included in the study were evaluated using the DISCERN Scale by researcher E.G. and the JAMA Score by researcher E.T.A. The readability analyses, along with the data obtained from the DISCERN Scale and JAMA Score, were transferred to Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA) for further analysis.

**Table 1:** Readability tool

READABILITY TOOLS	FEATURES		
FRES	Index Score	Grade	Summary
	90-100	5th Grade	Very Easy
	80-90	6th Grade	Easy
	70-80	7th Grade	Fairly Easy
	60-70	8-9th Grade	Plain English
	50-60	10-12th Grade	Fairly Difficult
	30-50	College	Difficult
	10-30	College Graduate	Very Difficult
	0-10	Professional	Extremely Difficult
CLI	Index Score	School Level	Comprehension
	5&Below	5th Grade and below	Very Easy
	6	6th Grade	Easy
	7	7th Grade	Fairly Easy
	7-10	8th,9th,10th Grade	Conversational English
	11-12	11th,12th Grade	Fairly Difficult
	13-16	College	Difficult
	17+	Professional	Extremely Difficult
GFI	Fox Index	Grade	
	6	Sixth Grade	
	7	Seventh Grade	
	8	Eighth Grade	
	9	High School Freshman	
	10	High School Sophomore	
	11	High School Junior	
	12	High School Senior	
	13	College Freshman	
	14	College Sophomore	
SMOG	15	College Junior	
	16	College Senior	
	17	College Graduate	
	Score	Education Level	
	4.9 or lower	Elementary School	
	5-8.9	Middle School	
	9-12.9	High School	
	13-16.9	Undergraduate	
	17 or higher	Graduate	

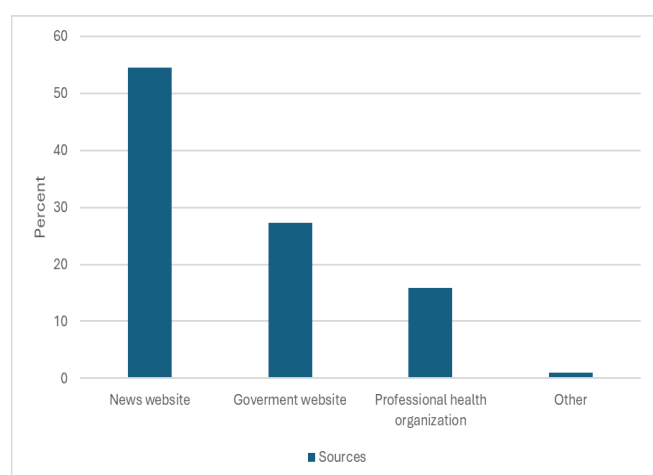
## Statistical Analysis

All statistical analyses were performed using IBM SPSS 22 (SPSS Inc., Chicago, IL, USA). The websites were categorized by source and described using frequency and percentage distributions. For website text data metrics such as characters, words, sentences, syllables, FRES Index Score, GFI Fog Index, CLI Index Score, and others, appropriate software must be used for accurate analysis.

The SMOG Score was analyzed for mean, standard deviation, minimum, and maximum values. The readability levels for the FRES and CLI, SMOG, and GFI were reported using frequency and percentage distributions. The JAMA and DISCERN scores were analyzed for mean, standard deviation, minimum, and maximum values.

## RESULTS

A total of 150 websites from the first 15 pages of Google (Google LLC, Mountain View, California, USA) for the keyword “monkeypox virus” was evaluated. Based on the inclusion criteria, 44 websites were included in the study. When examining the sources of these websites, it was found that 54.5% (n=24) were news websites, 27.3% (n=12) were government websites, 15.9% (n=7) were professional health organizations, and 2.3% (n=1) fell into the “other” category (Figure 1).



**Figure 1:** Distribution of websites by source type

The readability data for the included websites are presented in Table 2. The average readability scores were as follows: FRES = 38.29, CLI = 12.66, GFI = 18.23, and SMOG = 15.75.

**Table 2:** Readability data of the websites

	Minimum	Maximum	Mean	Standard Deviation
Characters	547	37028	6823,75	6810,50
Words	80	5543	1088,84	1055,62
Sentences	3	241	43,32	45,64
Syllables	156	10042	1822,68	1837,66
FRES	1,41	65,60	38,29	15,20
GFI	9,80	32,15	18,23	4,63
CLI	8,66	17,10	12,66	1,84
SMOG	11,36	22,24	15,75	2,73

\*FRES: Flesch Reading Ease Score, GFI: Gunning Fog Index, CLI: Coleman-Liau Index, SMOG: Simple Measure of Gobbledygook Index

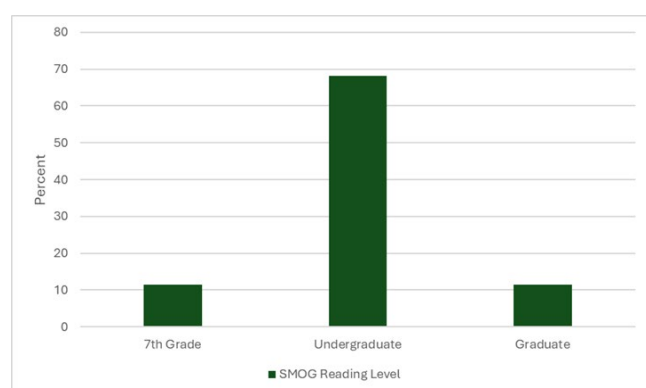
Table 3 presents the readability levels of the texts on the websites based on FRES and CLI according to FRES, the majority (56.8%) of texts were categorized as 'College/Difficult to read', while according to CLI, the largest proportion (47.7%) fell into the '11-12<sup>th</sup> Grade/Fairly difficult to read' category.

**Table 3:** FRES and CLI readability levels and categories of the texts on the websites

FRES			CLI		
Grade	Summary	N	School Level	Comprehension	N
5th Grade	Very Easy	0	5th Grade and below	Very Easy	0
6th Grade	Easy	0	6th Grade	Easy	0
7th Grade	Fairly Easy	0	7th Grade	Fairly Easy	0
8-9th Grade	Plain English	2	8-10th Grade	Conversational English	4
10-12th Grade	Fairly Difficult	8	11-12th Grade	Fairly Difficult	21
College	Difficult	25	College	Difficult	16
College Graduate	Very Difficult	7	Professional	Extremely Difficult	3
Professional	Extremely Difficult	2			

\*N: Number, FRES: Flesch Reading Ease Score, CLI: Coleman-Liau Index

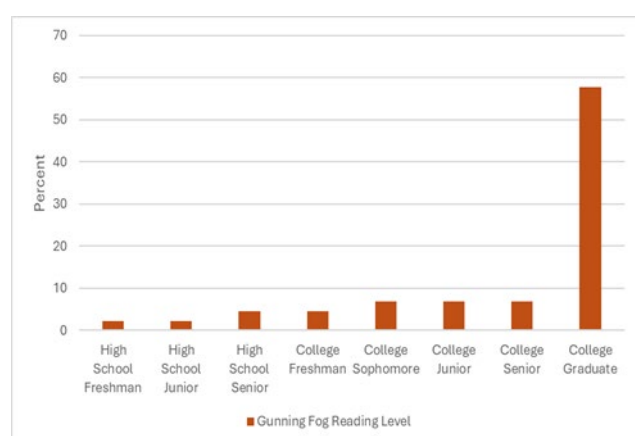
The SMOG readability levels of the texts on the websites are shown in Figure 2. It was found that 68.2% (n=30) of the websites' texts were classified as 'Undergraduate' level, 20.5% (n=9) as 'Graduate' level, and 11.4% (n=5) as '7<sup>th</sup> Grade' level.



**Figure 2:** SMOG readability levels of the texts on the websites

The GFI readability levels of the websites texts revealed the following distribution: 57.8% (n=26) were at the 'College graduate', 15.9% (n=7) at the 'College Senior', 6.8% (n=3) at the 'College Junior', 6.8% (n=3) at the 'College Sophomore', 4.5% (n=2) at the 'High School Senior', 4.5% (n=2) at the 'College Freshman', 2.3% (n=1) at the 'High School Junior', and 2.3% (n=1) at the 'High Scholl Freshman'.

The GFI readability levels are shown in Figure 3.



**Figure 3:** GFI readability levels of the texts on the websites

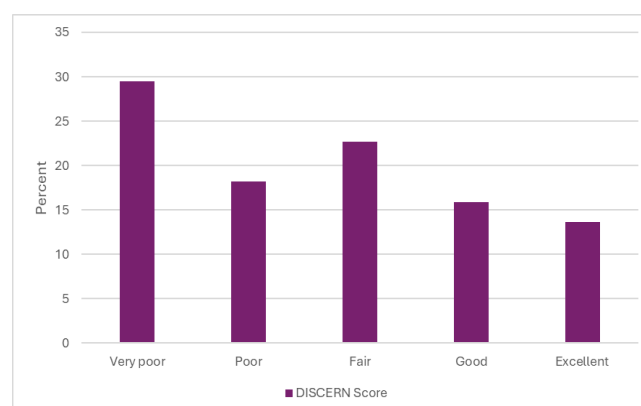
The JAMA and DISCERN scores of the evaluated websites are presented in Table 4. The average JAMA score of the websites was found to be 2.09, while the average DISCERN score was 40.61.

**Table 4.** JAMA and DISCERN scores on the websites

	Minimum	Maximum	Mean	Std. Deviation
JAMA	1	4	2,09	0,96
DISCERN	20	66	40,61	15,63

When the websites were grouped based on their average

DISCERN scores, it was observed that 29.5% (n=13) were classified as "very poor," 22.7% (n=10) as "fair," 18.2% (n=8) as "poor," 15.9% (n=7) as "good," and 13.6% (n=6) as "excellent."



**Figure 4:** DISCERN score groups of the websites

## DISCUSSION

Human monkeypox is a zoonotic disease caused by the monkeypox virus, which emerged as a multinational outbreak in 2022, spreading rapidly among young men who have sex with men. It is a significant health concern due to its clinical symptoms, including classical vesicular-pustular rashes and associated signs (1). Over the past decade, significant technological advancements have been made in the field of information technology have made the internet a ubiquitous phenomenon. A study in the literature evaluates the readability of information provided on websites about the monkeypox virus (3). However, there is no study that concurrently evaluates the readability, reliability, and quality of information on websites about the monkeypox virus. The aim of our study is to analyze the readability, reliability, and quality of the content found on websites about the monkeypox virus. It is the first comprehensive and systematic evaluation of the information available on websites about the monkeypox virus.

The internet offers an accessible and flexible platform, encouraging patients to seek information about their health issues due to its ease and practicality (23). Advances in communication technologies are transforming how individuals access health information, understand their health conditions, and make healthcare decisions. Research shows that the internet is an effective platform for sharing health information with a wide audience, including those with lower income and education levels (13). Health literacy, closely linked to general literacy, refers to the ability and motivation to acquire, understand, and evaluate health information, helping individuals access healthcare services, prevent diseases, and make informed decisions in daily life (22).

Frost and Baldwin (3) emphasize the importance of health literacy in effectively disseminating information about infectious diseases. In their study, they evaluated the readability of 50 English-language websites containing patient education materials related to monkeypox. Among the readability scales used in the study—FRES, GFI, and CLI—no website met the target readability score. However, the FKGL and SMOG tools identified one (2%) and two (4%) websites, respectively, that met the target level. According to FRES, approximately 56.8% of the websites were categorized as ‘College/Difficult to read’, while 47.7% were classified, based on CLI, as ‘11-12<sup>th</sup> Grade/Fairly difficult to read’. For SMOG readability levels, 68.2% (n=30) of the websites were at the ‘Undergraduate’ level, 20.5% (n=9) at the ‘Graduate’ level, and 11.4% (n=5) at the ‘7<sup>th</sup> Grade’ level. Regarding GFI readability levels, 57.8% (n=26) of the websites were at the ‘College graduate’ level.

In May 2022, the initial reporting of monkeypox cases led to a significant increase in internet searches related to the disease (24, 25). The primary sources of information about the Mpox virus infection included the internet, social media, radio, and television (26). Studies on medical and pharmacy students (27, 28) revealed that these students primarily relied on social media and the internet for their information about monkeypox. This highlights the importance of the quality of information available on social media and the internet, as individuals increasingly turn to these platforms for health-related information.

Numerous studies have examined the content of YouTube videos and social media posts related to monkeypox. Studies evaluating YouTube videos about monkeypox found that most of the videos analyzed were from news channels (16, 29). In alignment with these findings, our study determined that 54.5% of websites providing information about monkeypox were news sites. A study found that 20% of YouTube videos about monkeypox contained misleading information (29). Similarly, in a study assessing the content quality of TikTok videos on monkeypox using the DISCERN and JAMA tools, the quality of the videos was found to be low (30). In contrast, Yapıcı et al. reported that all the YouTube videos they analyzed related to monkeypox were deemed useful (31). Videos uploaded by healthcare professionals on YouTube and TikTok had a higher quality of content compared to other sources (31, 32).

In our study, the low DISCERN and JAMA scores of the texts on the websites we examined may be attributed to the fact that only 15.9% of these websites were affiliated with professional health organizations. The higher content quality of information shared by health professionals highlights the need for users to consider the source of health information when evaluating online content.

## CONCLUSION

In our study, it was concluded that the information provided on websites related to monkeypox was written above the recommended reading level, and the quality and reliability of the content on these sites were found to be insufficient. This study demonstrates the need for information presented on websites about monkeypox to be written in clear and simple language that is accessible to all.

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