Original Research Article

Is Arabic online patient-centered information about dental extraction trustworthy? An infodemiological study

Ahmad A. Othman[1], Muath S. Alassaf[2] 🆔 , Saad M. Hasubah[3],
Mohammad Aljuhani[4], Ahmad M. Kabli[5] and Mahmoud Alsulaimani[5]

Abstract

Background: Assessment of the Arabic online patient-centered information is understudied. The study aims to assess the quality and readability of the Arabic web-based knowledge about dental extraction.

Methods: The first 100 Arabic websites focusing on dental extraction were gathered using popular terms from Google, Bing, and Yahoo searches. These sites were organized and their quality was assessed using three key standards: the *Journal of the American Medical Association* (*JAMA*) benchmark criteria, the DISCERN instrument, and the inclusion of the Health on the Net Foundation Code of Conduct (HON code) seal. Additionally, the ease of reading of these websites was evaluated through various online readability indexes.

Results: Out of 300 initially reviewed websites on dental extraction in Arabic, 80 met the eligibility criteria. Nonprofit organizations were most common (41.3%), followed by university/medical centers (36.3%), and commercial entities (21.3%). Government organizations were minimally represented (1.3%). All websites were medically oriented, with 60% offering Q&A sections. Quality assessment showed moderate scores on the DISCERN instrument, with no site reaching the highest score. *JAMA* benchmarks were poorly met, and none had the HON code seal. Readability was generally high, with most sites scoring favorably on readability scales.

Conclusions: The rapidly evolving online information about dental extraction lacks readability and quality and can spread misinformation. Creators should focus on clear, unbiased content using simple language for better public understanding.

Keywords

Quality, readability, dental extraction, Arabic knowledge

Background

Dental extraction, or tooth removal, is the most frequent oral surgical procedure performed on patients in dental clinics. Dental caries and periodontal disease are the leading causes of tooth extractions. It is performed for other reasons such as dental trauma, orthodontic treatment, or impacted wisdom teeth.[1]

The reasons for tooth extractions varied greatly geographically and culturally within one country and from one country to another.[2] Teeth extraction is more prevalent in

[1]Department of Oral and Maxillofacial Diagnostic Sciences, Tabiah University, Medina, Saudi Arabia
[2]Department of Oral and Maxillofacial Surgery, King Fahad Hospital, Medina, Saudi Arabia
[3]Department of Dental Education, Taibah University, Medina, Saudi Arabia
[4]Department of Restorative Dentistry, Ohud Hospital, Medina, Saudi Arabia
[5]Department of Preventive Dental Sciences, Taibah University, Medina, Saudi Arabia

Corresponding author:
Muath S. Alassaf, Department of Oral and Maxillofacial Surgery, King Fahad Hospital, Medina, Saudi Arabia
Email: mo3ath345@gmail.com

populations with lower socioeconomic status, and this rate rises with age.[3] Multiple studies published in Arabic-speaking countries such as Saudi Arabia, Kuwait, Egypt, and others have found that caries is the primary reason for tooth extractions.[4,5]

Various postoperative problems can arise after tooth extraction. Depending on the patient, these include varying degrees of discomfort, alveolar osteitis, trismus, hemorrhage, and edema.[6] Tooth loss could cause psychological disturbance in some patients; there is reasonably solid evidence from earlier studies that tooth loss affects the quality of life that is related to oral health. Furthermore, studies show that the degree of oral health-related quality-of-life impairment is influenced by not only the number of missing teeth but also their location and distribution.[7]

Understanding dental extraction's prevalence, etiology, and proper management is crucial for dental professionals and patients. Dental extraction is a well-established dental procedure that has been practiced for centuries. It is performed under local or general anesthesia, depending on the complexity of the extraction and the patient's needs.[8] Proper management after dental extraction plays a vital role in facilitating healing and preventing complications. This includes pain management through the use of analgesics, antibiotics to prevent infection, and postoperative instructions to minimize swelling and promote wound healing.[9] After tooth loss, it must be replaced by an implant or prosthesis to prevent bone loss, maintain an even bite, prevent supereruption of opposing teeth, maintain function, and improve visual appearance.[10,11]

In recent years, the Internet has become an invaluable resource for individuals seeking information and knowledge about various subjects, including general and oral health. The quality of web-based health information is crucial in shaping patient understanding and decision-making, yet ensuring its accuracy, credibility, and accessibility remains a significant challenge due to the diverse sources and standards online. Therefore, this study aims to assess the quality of web-based Arabic health information, acknowledging its profound impact on patient outcomes. Murray et al. discovered that 85% of doctors reported patients bringing internet material before the scheduled appointment,[12] and the patients have to know aspects related to teeth extractions, such as causes, procedures, and postoperative implants. Unfortunately, many strange, useless, dubious, and even false information may be found on the internet. Overall, clinicians, have faced patients who have been misinformed due to browsing websites searching for health information without professional guidance.[13,14] This phenomenon is exacerbated by the pervasive marketing milieu and advertisements that accentuate the attractive attributes of specific healthcare services, including dental extraction, akin to other products or services. Given the high frequency of patient inquiries regarding dental extraction, dental professionals must direct their patients to reputable and easily understandable websites that furnish evidence-based information.[15] Moreover, the disparity in health outcomes associated with lower socioeconomic groups is exacerbated by limited access to reliable health information. Addressing this issue is crucial, as improved access to quality health information has been shown to enhance patient knowledge and contribute to better health outcomes.[1] Inaccurate health-related information may encourage dangerous behaviors such as the use of illegal medications, toxic plants, and incorrect preventative measures. Therefore, it is essential that the information quality on these websites be evaluated.[16,17]

The availability of web-based information in different languages has significantly contributed to the democratization of knowledge, enabling individuals to educate themselves on various topics from the comfort of their homes. However, it is crucial to ensure that the information available online is accurate, reliable, and tailored to specific linguistic and cultural contexts. It is also essential to consider potential biases in online health information. These biases can affect the accuracy and neutrality of the information provided, potentially leading to misinformation and adversely influencing patient decisions.[2] Multiple research studies have been conducted on dental implants, denture hygiene, and periodontal disease,[18–20] but for tooth extraction, the Arabic content has not been evaluated yet. However, this research will undertake a comprehensive assessment of Arabic web-based knowledge on dental extraction. By critically evaluating the credibility, accuracy, and cultural relevance of the available resources, this study will provide a foundation for enhancing the accessibility and quality of dental information in the Arabic language.

Methods

Searching and selecting websites

To find relevant websites related to dental extraction in Arabic, we searched through multiple search engines, including Google, Yahoo, and Bing. These search engines were selected due to their comprehensive coverage, diverse perspectives, and validation of results. All searches were conducted through an anonymous browsing mode on Chrome, and all cookies and browser data were cleared to ensure impartial results. We used the Arabic term "خلع الأسنان" to indicate "dental extraction" to conduct the search process and included the first 100 websites from each search engine to be as comprehensive as possible. Even though most users only look at the first page of Google, we included additional websites beyond the first page. The advanced search features were not utilized, instead opting for the default search settings.[21]

To ensure relevant websites were included, specific exclusion criteria were applied. Firstly, duplicate websites were removed. Next, websites that did not provide

content in Arabic, those that only briefly mentioned dental extraction and those with purely auditory or visual content were excluded. Full-length scientific publications or books, websites with banner ads, sponsored links, discussion forums, and websites blocking direct access were also excluded. According to Ni Riordain and McCreary,[22] all other websites were included and classified based on their affiliation (commercial, nonprofit organization, university/ medical Center, or governmental), specialization of the website categorized as partly or exclusively related to dental extraction, content type as (medical facts, clinical trials, question and answers, and human interest stories) lastly, content presentation (image, audio, and video).[22]

Quality assessment

The quality of websites was assessed using the DISCERN evaluation instrument in conjunction with the *Journal of the American Medical Association* (*JAMA*) benchmarks and the Health On the Net (HON) seal.

DISCERN is a reliable tool that consists of a questionnaire with 16 questions, focusing on the reliability of information, balance of information, and overall quality of the websites. The questions have been broken down into three different portions of the questionnaire. The first section comprises questions 1 to 8 and focuses on assessing the credibility of the publication, aiming to determine whether it can be considered a dependable source of information regarding a particular therapy. The second section's questions (9–15) directly discuss treatment alternatives. The evaluation's overall quality score is represented by question 16. A 5-point Likert scale is used to rate each question, with 1 representing poor quality and 5 representing excellent quality.[23] A dentist with knowledge in the area looked at the consistency of website rankings to ensure consistency in website rating utilizing the DISCERN questionnaire. Two dentists did the evaluation, and the average score was calculated. The lowest and highest possible scores are 16 and 80, respectively. Low (16–32), moderate (3–64), and high scores (> 65) were used to characterize the results.

The *Journal of the American Association* has published the *JAMA* benchmarks, which include four criteria: authorship (the website identified the authors of the medical content, along with their affiliations and pertinent credentials), attribution (sources of its information, including any references or studies), currency (clearly indicating when the medical content was posted or updated), and disclosure (ownership and disclosure of any conflicts of interest).[24] The HON Foundation evaluated the websites for their openness and the caliber of their web-based health data. It's crucial to remember that while HON concentrates on evaluating transparency and quality, it does not examine how accurate web-based health information is. Eight criteria, namely attribution, authority, complementarity,

confidentiality, justifiability, financial disclosure, openness, and advertising policy included in HON. Utilizing a browser plugin from their official website, an HON code examination was carried out.[25]

Readability assessment

The Simplified Measure of Gobbledygook (SMOG), the Flesch Reading Ease (FRE) scale, and the Flesch-Kincaid Grade Level (FKGL) scale were used to measure readability. With the presence of other readability tests, these are the applicable tests for Arabic language. FKGL ranges from 0 to 18, with 18 being the hardest text to read. The harder it is to understand the material, the higher the SMOG score. The FRE score, on the other hand, can vary from 0 to 100, with a higher number indicating a text that is easier to read. Through the website (www.readabilityformulas. com), the automated formula was used for all readability assessments. Based on multiple studies done to evaluate Arabic language contents, it was recommended to set the acceptable level as less than 7 for FKGL and SMOG, and 80 or above for FRE.[26–28]

Data analysis

SPSS version 25 was used to analyze statistical data. The analysis results were displayed in tables, which included the mean value and its standard deviation for quantitative data and suitable parametric and nonparametric tests were used to compare the means of different variables. For qualitative data, it was presented as frequencies and percentages. To determine statistical significance in comparative tests, a P-value set as ≤ 0.05.

Results

Available websites

The searched term resulted in 6,450,000 from Google, 143,000 from Bing, and 350,000 from Yahoo, during September 2023. The first 100 websites were included and filtered based on the set eligibility criteria, as shown in Figure 1. Eventually, eighty websites were included.

Based on their affiliation, nonprofit organizations are the most prevalent, making up 41.3% of the total, followed by university or medical centers at 36.3% and commercial entities at 21.3%. Governmental organizations are the least represented, constituting only 1.3% of the organizations. All of the websites were partially related to dental extraction. The content type was medical fact in all websites; however, 48 (60%) also provided questions and answers. The contents included images and videos in 20 (25%), and 10 (12.5%), respectively. Table 1 summarizes the categorization of the included websites.
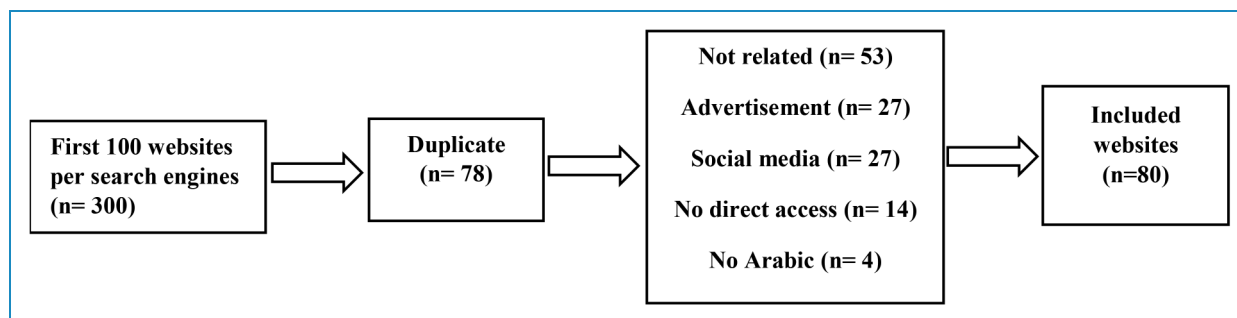
Figure 1. Flow chart of the searching strategy.

Table 1. Description of websites based on affiliation, specialization, content type, and presentation (n = 80).

Category	Criteria	n (%)
Affiliation	Commercial	17 (21.25)
	Nonprofit organization	33 (41.25)
	University/medical center	29 (36.25)
	Governmental	1 (1.25)
Specialization	Exclusively related	0 (0)
	Partly related	80 (100)
Content type	Medical facts	80 (100)
	Clinical trials	2 (2.5)
	Human interest stories	0 (0)
	Question and answer	48 (60)
Content presentation	Image	20 (25)
	Video	10 (12.5)
	Audio	0 (0)

Quality assessment

Based on the DISCERN instrument, the overall mean is 42.8 (±8.1) with none of the websites achieving the highest score of 80 but the maximum score was 62. The lowest achieved score was 23. The mean of the reliability section (questions 1–8) was 23.2 (±3.8) which is higher than the mean of the treatment evaluation section (questions 9–15) with a mean of 16.6 (±4.2). The poorest scores were related to the fourth and seventh questions concerned about the resources with mean of 1.32 (±0.8) and 1.64 (±0.7), respectively. None of the websites had a high score level but most of them 70 (87.5%) were at a moderate level

and only 10 (12.5%) websites were at low level. In Table 2, the summary of DISCERN analysis in shown.

The 4 items of *JAMA* benchmarks were not all present in any of the websites and 3 items were achieved together in 5 (6.3%) websites. In contrast, 18 (22.5) websites had none of the items achieved. In terms of each item interpretation, disclosure was not present in all websites, currency was the most present item in 55 (86.8%) followed by authorship in 39 (48.8%) websites. Lastly, attribution was achieved on only 7 (8.8%) websites. As shown in Table 3, the distribution of DISCERN and *JAMA* based on affiliation had a statistically significant difference in terms of many achieved *JAMA* items and DISCERN categories. It also showed significant differences regarding the authorship and currency between affiliations. None of the websites had the HON seal.

Readability assessment

The analysis of included websites revealed a range of scores on different readability scales. On the FRE scale, sites scored between 45.9 and 100, with an average of 94.3 (±12.9). The FKGL score ranged from 0.7 to 25.5, with a mean of 6.8 (±4.9). The SMOG rating varied from 1.8 to 4.7, with an average of 2.01 (± 0.4). Notably, 49 (61.3%) of the websites achieved a score of 80 or higher on the FRE scale, and 72 (90%) scored 7 or less on the FKGL. It is worth mentioning that all websites received a score of 7 or less on the SMOG rating. Table 4 shows the comparison of the means for numerical variables. The overall mean scoring (DISCERN) showed statistically significant differences across the whole cohort websites, and the significance was between commercial and nonprofit organizations' websites (Figure 2). Also, the studied means of readability tests according to websites' affiliation showed a statistically significant difference between commercial and health centers in the terms of number of words.

Discussion

Telemedicine may provide better healthcare accessibility through the Internet, but it comes with the potential dangers

Table 2. DISCERN evaluation for the included websites.

Domain	DISCERN question	Mean (SD)	Maximum	Minimum
Reliability	Q1. Explicit aims	3.80 (0.75)	5	2
	Q2. Aims achieved	3.93 (0.78)	5	1.5
	Q3. Relevance	4.03 (0.84)	5	1.5
	Q4. Explicit sources	1.32 (0.76)	5	1
	Q5. Explicit date	2.33 (1.26)	5	1
	Q6. Balanced and unbiased	3.29 (0.78)	5	1.5
	Q7. Additional sources	1.64 (0.68)	5	1
	Q8. Areas of uncertainty	2.85 (0.67)	4	1.5
Treatment options	Q9. How treatment works	2.86 (0.98)	4.5	1
	Q10. Benefits of treatment	2.7 (0.96)	4.5	1
	Q11. Risk of treatment	2.38 (0.68)	4.5	1
	Q12. Effects of no treatment	2.26 (0.60)	4.5	1
	Q13. Effects on quality of life	2.32 (0.60)	4.5	1
	Q14. All alternatives described	2.16 (0.92)	5	1
	Q15. Shared decision	1.88 (0.54)	3.5	1
Overall rating	Q16. Overall quality rating	3.02 (0.82)	4.5	1

of providing incomplete information and inaccurate knowledge. Online health information provides specific disease information, support, and management. Although there are no other studies of health literacy on this specific topic, other studies found that online pictorial delivery of information increases the retention of information. Many people today refer to this time as the "age of false information." This misinformation, whether intentionally or unintentionally created, spreads quickly and impacts various aspects of life. Health is one area that is particularly affected, as it can cause delays or even prevent effective care, putting people's lives at risk.[9,29,30] Moreover, scoring differences in assessment tools reflect variations in content priorities among different creators. Health/medical communications professionals may prioritize clarity and patient engagement, leading to higher scores on readability-focused tools. Conversely, university academics/clinicians prioritize evidence-based information, resulting in higher scores on tools assessing comprehensiveness and scientific rigor. Commercial teams may prioritize marketing, leading to lower scores on objectivity-focused tools.[31]

Dental extraction is a dental procedure that involves the removal of a tooth from its socket in the jawbones. This procedure has been in practice for centuries and can be performed for various reasons including tooth decay, periodontal diseases, and orthodontic purposes. It can be performed under local or general anesthesia, depending on the complexity of the extraction and the patient's condition. Postoperatively, proper management is essential to prevent complications and promote healing. Pain management is achieved using analgesics, and antibiotics are used to prevent infection. Postoperative instructions are also essential in minimizing swelling and promoting wound healing. Usually, patients are advised to avoid smoking and maintain good oral hygiene.[8,9]

Content types and presentation

After filtering the screened websites for Google, Bing, and Yahoo, only 80 websites were included, with the most common reason for exclusion being that the website is not related. During the evaluation, it was discovered that

Table 3. Quality and readability of the included websites based on their affiliation reported as frequency and percentage (n = 80).

Variable	Commercial (n = 17)	Dental center (n = 29)	Governmental (n = 1)	Nonprofit organization (n = 33)	Total (n = 80)	P-value
Number of achieved *JAMA* items per website						
None	6 (7.5%)	9 (11.3%)	1 (1.3%)	2 (2.5%)	18 (22.5%)	0.001*
One	4 (5.0%)	16 (20.0%)	0	8 (10.0%)	28 (35.0%)	
Two	7 (8.8%)	4 (5.0%)	0	18 (22.5%)	29 (36.3%)	
Three	0	0	0	5 (6.3%)	5 (6.3%)	
Four	0	0	0	0	0	
JAMA items						
Authorship	8 (10%)	8 (10%)	0	23 (28.7%)	39 (48.8%)	0.008*
Attribution	0	2 (2.5%)	0	5 (6.3%)	7 (8.8%)	0.315
Disclosure	0	0	0	0	0	
Currency	10 (12.5%)	14 (17.5%)	0	31 (38.8%)	55 (86.8%)	0.001
DISCERN						
Low	3 (3.8%)	3 (3.8%)	1 (1.3%)	3 (3.8%)	10 (12.5%)	0.048*
Medium	14 (17.5%)	26 (32.5%)	0	30 (37.5%)	70 (87.5%)	
High	0	0	0	0	0	
FRES						
Readable	11 (13.8%)	18 (22.5%)	1 (1.3%)	19 (23.8%)	49 (61.3%)	0.822
Difficult	6 (7.5%)	11 (13.8%)	0	14 (17.5%)	31 (38.8%)	
FKGL						
Readable	15 (18.8%)	27 (33.8%)	1 (1.3%)	29 (36.3%)	72 (90.0%)	0.886
Difficult	2 (2.5%)	2 (2.5%)	0	4 (5.0%)	8 (10.0%)	

*Significant at a level of 0.05 or less.
FKGL: Flesch-Kincaid Grade Level; FRES: Flesch Reading Ease scale; *JAMA*: *Journal of the American Medical Association.*

the websites were partially related to dental extraction. Most of the provided information consisted of medical facts, including questions and answers. Some of the websites also contained images and video content. To ensure a comprehensive evaluation, the number of screened websites was expanded.

Based on website affiliations, most websites belonged to nonprofit organizations, followed by universities or medical centers, followed by commercial websites. This is more or less consistent with the other studies.[28] Noteworthy, governmental websites were the least affiliated. Patient information on governmental websites was evaluated and it was complicated for the general population.[32] Over 90% of the websites in this study were partly related, regarding website specialization which is also consistent with the other studies.[31,32] In similar studies, the content type was

Table 4. Comparison between means according to websites' affiliation (n = 80).

Variable	Commercial	Dental center	Nonprofit organization	Governmental	P-value
DISCERN					
Overall	39.1 (±5.9)	42.8 (±8.6)	45.2 (±8.2)	29.5	0.014*
Reliability	21.6 (±2.4)	22.2 (±2.9)	25.1 (±4.3)	18.5	0.001**
Treatment	14.8 (±3.1)	17.6 (±4.9)	16.833 (±3.5)	9.0	0.055
Readability					
FRES	93.3 (±15.1)	95.6 (±11.9)	93.5 (±12.9)	97.5	0.928
FKGL	7.2 (±5.6)	6.3 (±4.6)	7.1 (±4.9)	5.7	0.916
SMOG	1.9 (±0.3)	1.9 (±0.6)	2.052 (±0.4)	1.8	0.635
Words	637.7 (±352.1)	931.2 (±444.1)	790.64 (±329.9)	122	0.045***
Sentences	28.5 (±21.8)	43.1 (±28.7)	33.36 (±19.1)	5	0.087

* Significant between commercial and nonprofit organizations' websites.
** Significant between commercial and nonprofit organizations' websites, as well as between dental centers and nonprofit organizations' websites.
*** Significant between commercial and dental centers' websites.
FKGL: Flesch-Kincaid Grade Level; FRES: Flesch Reading Ease scale; SMOG: Simplified Measure of Gobbledygook.

mostly medical facts, and this was true even for nonteeth extraction-related topics.[29,30] In our studies, websites containing questions and answers were more than half of the websites compared to only 10% in the study about tooth extraction. This is likely due to the difference in the number of evaluated websites. The content presentation affects perception and understanding, and videos were found to be more effective.[28] In this study, about a quarter of the websites included images, and 12.5% contained videos.

Quality assessment

The DISCERN questionnaire offers a reliable approach to assess the quality of written information concerning various therapies for specific health conditions. DISCERN evaluates two aspects, namely, the reliability of the information and the quality of content about the treatment. Among the 16 questions, the poorest scores were related to the references. The mean score for question 4 was 1.32 (±0.76), lower than the studies in different fields.[14,15,28] In a recent study carried out by Alakhali,[33] the mean overall rating was 2.23 (1.6) out of 5 and the median overall rating was 1 (1–3) based on DISCERN.[33]

The overall quality mean in this study was 47.7 (±17.52) and was considered similar to multiple studies. The total mean score for DISCERN was higher than in commercial websites with statistical differences (P = 0.041). The DISCERN tool's primary challenges are the absence or insufficient availability of information sources and a lack of information about how treatment works, risks, supplementary therapies, and potential alternatives in the context of teeth extraction. Nonprofit organizations show a higher mean regarding the reliability section. The section on treatment information showed no significant difference between different websites. Therefore, the quality of commercial and nonprofit organization websites is comparable; however, nonprofit organizations' websites are more reliable. For the DISCERN categories, moderate scores websites were the most common, and high scores were mostly on universities' or medical centers' websites. These findings are consistent with other studies.[28,34]

JAMA evaluation showed findings similar to those of other studies in terms of the number of achieved items per website, with most websites not achieving any item. Our data showed a statistically significant difference in attribution among different affiliations, with nonprofit organizations being higher in including sources of information.

The HON Foundation evaluated the websites for their openness and their web-based health data caliber. It's crucial to remember that while HON concentrates on evaluating transparency and quality, it does not examine how accurate web-based health information is. Eight criteria, namely attribution, authority, complementarity, confidentiality, justifiability, financial disclosure, openness, and advertising policy, are included in HON. Websites that adhere to the HON code are expected to provide accurate, transparent, and up-to-date information, protect user
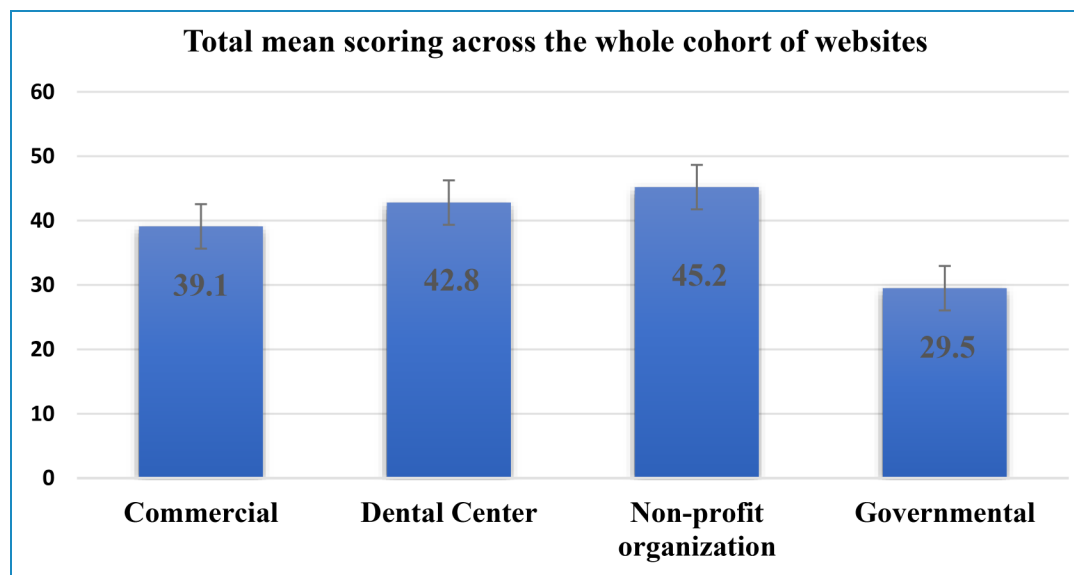
Figure 2. The distribution of the overall mean scoring according to the websites (n = 80).

privacy, and disclose the source and qualifications of the content creators.[25] Similar studies about the number of websites with HON seal ranges from 4 to 12 websites.[31,34,35] In this study, none of the websites has HON seal. Information to patients should be presented on websites that have a HON code, which will be easy for the general population to use when looking for health-related information.

Readability assessment

Low health literacy has been found to hurt health and quality of life. Research has shown that older adults with low health literacy are more likely to experience chronic health conditions and impose a high risk of mortality.[36] An integral part of the physician–patient relationship is patient education, as it empowers patients to make informed decisions about their health, fosters collaboration between patients and healthcare providers, enhances patient satisfaction, and improves health outcomes.[37] However, the majority of the population has limited health literacy.[38] Health-related information targeting the general population should be presented in a simple and noncomplicated term so that nonmedical individuals can understand the information. Readability tests use the number of difficult words and the length of a sentence using multiple tests to calculate the readability of a text. Previous studies used five tests to compare the readability of different websites based on different variable tests. The standard readability tests include FRES, FKGL, and SMOG.[21] According to our study, we found various affiliation websites that have comparable outcomes for readability tests. However, the data indicates that 60% of websites achieved high scores on the FRE scale.

The difference between our findings and those described in the literature is significant,[21,30–34] with our study indicating easily readable and comprehensible material for the general population, contrasting with the findings of other studies. Furthermore, concerning affiliation, the predominant websites identified in previous studies were affiliated with medical centers, yet these websites were found to present lower-quality information.

Limitations

This study has a few important limitations. We only searched three search engines to retrieve information. In addition, we only included 80 websites with one search phrase. A significant limitation arises from the use of a single search phrase, potentially limiting the representativeness of the findings to what patients might access or find. The scope of this study is focused on the Arabic-speaking population. Websites were excluded if they were non-Arabic. Therefore, the result may not apply to the non-Arabic-speaking population. It is worth mentioning that the results obtained may differ based on the location of the Internet server. Thus, it is challenging to obtain a conclusive statement about the overall patient population. Another important limitation is that readability tests utilized in this study were originally used to assess the readability of the English text using US grade levels. This cross-sectional study only represents a snapshot from a single location and may not reflect the experiences of all patients across all websites. Finally, the generalizability of the study may be constrained to the region under study, as there are numerous Arabic-speaking countries where search results could vary significantly.

Conclusion

Information on the internet is growing and changing, therefore, information gathered at different time frames may differ. In addition, the level of patients' educational information available online is difficult to read and comprehend. This can lead to the spread of misinformation and unrealistic treatment expectations. A recommended method to establish a readability level is to use shorter sentences with simple language, which will improve general population comprehension. As a result, website creators need to provide high-quality information about teeth extraction and the process of healing following that; such websites should be presented in an easily understandable way and free from commercial bias. Finally, it is recommended to develop standardized evaluation criteria specifically tailored for assessing the quality of Arabic health information online, and to conduct regular and systematic data collection to capture changes in online content over time.

ORCID iD: Muath S. Alassaf [ID] https://orcid.org/0009-0001-5958-1685

References

1. Alesia K and Khalil HS. Reasons for and patterns relating to the extraction of permanent teeth in a subset of the Saudi population. *Clin Cosmet Investig Dent* 2013; 5: 51–56.
2. Chestnutt IG, Binnie VI and Taylor MM. Reasons for tooth extraction in Scotland. *J Dent* 2000; 28: 295–297.
3. Barbato PR, Nagano HCM, Zanchet FN, et al. Perdas dentárias e fatores sociais, demográficos e de serviços associados em adultos brasileiros: uma análise dos dados do Estudo Epidemiológico Nacional (Projeto SB Brasil 2002-2003). *Cad Saúde Pública* 2007; 23: 1803–1814.
4. Aljafar A, Alibrahim H, Alahmed A, et al. Reasons for permanent teeth extractions and related factors among adult patients in the Eastern Province of Saudi Arabia. *Scientific World J* 2021; 2021: –7.
5. Al-Shammari KF, Al-Ansari JM, Al-Melh MA, et al. Reasons for tooth extraction in Kuwait. *Med Princ Pract* 2006; 15: 417–422.
6. Vettori E, Costantinides F, Nicolin V, et al. Factors influencing the onset of intra- and post-operative complications following tooth exodontia: retrospective survey on 1701 patients. *Antibiotics* 2019; 8: 264.
7. Gerritsen AE, Allen PF, Witter DJ, et al. Tooth loss and oral health-related quality of life: a systematic review and meta-analysis. *Health Qual Life Outcomes* 2010; 8: 126.
8. Ruggiero S, Gralow J, Marx RE, et al. Practical guidelines for the prevention, diagnosis, and treatment of osteonecrosis of the jaw in patients with cancer. *J Oncol Practice* 2006; 2: 7–14.
9. Shenoi RS, Rajguru JG, Parate SR, et al. Compliance of post-operative instructions following the surgical extraction of impacted lower third molars. *Indian J Dent Res* 2021; 32: 87–91.
10. Bodic F, Hamel L, Lerouxel E, et al. Bone loss and teeth. *Joint Bone Spine* 2005; 72: 215–221.
11. Craddock HL, Youngson CC, Manogue M, et al. Occlusal changes following posterior tooth loss in adults. Part 2. Clinical parameters associated with movement of teeth adjacent to the site of posterior tooth loss. *J Prosthodont* 2007; 16: 495–501.
12. Murray E, Lo B, Pollack L, et al. The impact of health information on the internet on health care and the physician-patient relationship: national U.S. Survey among 1.050 U.S. Physicians. *J Med Internet Res* 2003; 5: 17.
13. Ho A, McGrath C and Mattheos N. Social media patient testimonials in implant dentistry: information or misinformation? *Clin Oral Implants Res* 2017; 28: 791–800.
14. Wang Y, McKee M, Torbica A, et al. Systematic literature review on the spread of health-related misinformation on social media. *Soc Sci Med* 2019; 240: 112552.
15. Jayaratne YSN, Anderson NK and Zwahlen RA. Readability of websites containing information on dental implants. *Clin Oral Implants Res* 2014; 25: 1319–1324.
16. Hasan L and Abuelrub E. Assessing the quality of web sites. *Appl Comp Inform* 2011; 9: 11–29.
17. Kortum P, Edwards C and Richards-Kortum R. The impact of inaccurate internet health information in a secondary school learning environment. *J Med Internet Res* 2008; 10: e17.
18. Aboalshamat K. Quality and readability of web-based information on dental caries in Arabic: an infodemiological study. *BMC Oral Health* 2023; 23: 797.
19. Halboub E, Al-Ak'hali MS, Alqahtani AS, et al. Quality of web-based Arabic health information on dental implants: an infodemiological study. *BMC Oral Health* 2023; 23: 232. PMID: 37081436; PMCID: PMC10116105.
20. Alhajj MN, Mashyakhy M, Ariffin Z, et al. Quality and readability of web-based Arabic health information on denture

hygiene: an infodemiology study. *J Contemp Dent Pract* 2020; 21: 956–960.

21. Edmunds MR, Barry RJ and Denniston AK. Readability assessment of online ophthalmic patient information. *JAMA Ophthalmol* 2013; 131: 1610–1616.

22. Ni Riordain R and McCreary C. Head and neck cancer information on the internet: type, accuracy and content. *Oral Oncol* 2009; 45: 675–677.

23. Charnock D, Shepperd S, Needham G, et al. DISCERN: an instrument for judging the quality of written consumer health information on treatment choices. *J Epidemiol Community Health* 1999; 53: 105–111.

24. Fox S and Rainie L. The online health care revolution: how the web helps Americans take better care of themselves. *Pew Research Center* 1999; 11/30.

25. Boyer C, Baujard V and Geissbuhler A. Evolution of health web certification through the HONcode experience. *Stud Health Technol Inform* 2011; 169: 53–57.

26. Halboub E, MS A-A, Al-Mekhlafi HM, et al. Quality and readability of web-based Arabic health information on COVID-19: an infodemiological study. *BMC Public Health* 2021; 21: 151.

27. Al-Ak'hali MS, Fageeh HN, Halboub E, et al. Quality and readability of web-based Arabic health information on periodontal disease. *BMC Med Inform Decis Mak* 2021; 21: 41.

28. Halboub E, Al-Ak'hali MS, Alqahtani AS, et al. Quality of web-based Arabic health information on dental implants: an infodemiological study. *BMC Oral Health* 2023; 23: 232.

29. Chisolm DJ, Hardin DS, McCoy KS, et al. Health literacy and willingness to use online health information by teens with asthma and diabetes. *Telemed J E Health* 2011; 17: 676–682.

30. Alassaf MS, Hammudah HA, Almuzaini ES, et al. Is online patient-centered information about implant bone graft valid? *Cureus* 2023; 15: e46263.

31. Fan KS, Ghani SA, Machairas N, et al. COVID-19 prevention and treatment information on the internet: a systematic analysis and quality assessment. *BMJ Open* 2020; 10: e040487.

32. Leira-Feijoo Y, Ledesma-Ludi Y, Seoane-Romero JM, et al. Available web-based dental implants information for patients. How good is it? *Clin Oral Implants Res* 2015; 26: 1276–1280.

33. Alakhali MS. Quality assessment of information on oral cancer provided at Arabic speaking websites. *Asian Pac J Cancer Prev* 2020; 21: 961–966. PMID: 32334456; PMCID: PMC7445971.

34. Leira Y, Castelo-Baz P, Pérez-Sayáns M, et al. Available patient-centered Internet information on peri-implantitis. Can our patients understand it? *Clin Oral Investig* 2019; 23: 1569–1574.

35. Abdouh I, Porter S, Fedele S, et al. Web-based information on the treatment of the mouth in systemic sclerosis. *BMC Rheumatol* 2020; 4: 61.

36. Lu J, Sun S, Gu Y, et al. Health literacy and health outcomes among older patients suffering from chronic diseases: a moderated mediation model. *Front Public Health* 2023; 10: 1069174.

37. DeWalt DA, Berkman ND, Sheridan S, et al. Literacy and health outcomes: a systematic review of the literature. *J Gen Intern Med* 2004; 19: 1228–1239.

38. Kutner M, Greenberg E, Jin Y, et al. The Health Literacy of America's Adults: Results from the 2003 National Assessment of Adult Literacy. 2003.