

# Have the Online Patient Information Materials on Biceps Tendon Disorders Adequate, Quality and Readability?

## Biceps Tendon Bozukluklarına İlişkin Çevrimiçi Hasta Bilgilendirme Materyalleri Yeterli, Kaliteli ve Okunabilir mi?

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### ABSTRACT

**Aim:** The study aimed to analyze the quality, adequacy and readability of websites created for patients with shoulder complaints associated with biceps tendon disorders.

**Methods:** The terms 'shoulder injury', 'biceps tendinitis' and 'biceps tendon rupture' were searched in the most used search engines in United States (Google, Yahoo, and Bing). One hundred forty seven websites designed to inform patients were included in the study. The quality, popularity, adequacy and reliability were measured.

**Results:** Flesch reading ease scores of websites with content creation by health professionals were significantly lower than those without; in contrast, Flesch-Kincaid grade level (FKGL) and Kolemian-Liau index scores were significantly higher ( $p<0.05$ ). Global Quality Score and originality scores were greater in website created by health professionals ( $p<0.05$ ). The Gunning Fog, FKGL, Simple Measure of Gobbledygook, Automated readability index and Linear write formula scores were lower for websites with the HON code than those without the HON code. Also originality score and Alexa Popularity Rank (APR) scores were lower in websites with HONcode than without HON code ( $p<0.05$ ).

**Conclusion:** Websites with HON code and prepared by health-care professionals can provide sufficient and quality information to patients with biceps tendon disorders. The web content available for biceps tendon disorders is above the recommended reading level. Health professionals should be encouraged to increase the readability of the content.

**Key Words:** Health literacy, Musculoskeletal Disorder, Pain, Patient education, Patient information, Shoulder.

### ÖZET

**Amaç:** Çalışma, biceps tendon bozuklukları ile ilişkili omuz şikayetleri olan hastalar için oluşturulan web sitelerinin kalite, yeterlilik ve okunabilirliğini incelemeyi amaçlamıştır.

**Yöntem:** Amerika Birleşik Devletleri'nde en çok kullanılan arama motorlarında (Google, Yahoo ve Bing) 'omuz yaralanması', 'biceps tendiniti' ve 'biceps tendon rüptürü' terimleri arandı. Hastaları bilgilendirmek için tasarlanmış 147 web sitesi çalışmaya dahil edildi. Kalite, popülerlik, yeterlilik ve güvenilirlik ölçüldü.

**Bulgular:** Sağlık profesyonelleri tarafından içerik oluşturulan web sitelerinin Flesch okuma kolaylığı puanları, oluşturmayanlara göre önemli ölçüde düşüktü; aksine, Flesch-Kincaid sınıf düzeyi (FKGL) ve Kolemian-Liau endeksi skorları anlamlı olarak daha yüksekti ( $p<0.05$ ). Sağlık profesyonelleri tarafından oluşturulan web sitesinde global kalite puanları ve özgünlük puanları daha yüksekti ( $p<0.05$ ). Gunning Fog, FKGL, Gobbledygook'un Basit Ölçüsü, Otomatik okunabilirlik endeksi ve doğrusal yazma formülü puanları, HON koduna sahip web sitelerinin HON kodu olmayanlara göre daha düşüktü. Ayrıca özgünlük puanı ve APR puanları, HONcode'lu web sitelerinde HONcode'suz web sitelerine göre daha düşüktü ( $p<0.05$ ).

**Sonuç:** Sağlık profesyonelleri tarafından hazırlanan HON kodlu web siteleri biceps tendon bozukluğu olan hastalara yeterli ve kaliteli bilgi sağlayabilir. Biceps tendon bozuklukları için mevcut olan web içeriği, önerilen okuma seviyesinin üzerindedir. Sağlık profesyonelleri içeriğin okunabilirliğini artırmaya teşvik edilmelidir.

**Anahtar Kelimeler:** Sağlık okuryazarlığı, Kas-iskelet sistemi bozukluğu, Ağrı, Hasta eğitimi, Hasta bilgilendirme, Omuz.

Received Date: 03.11.2022 / Accepted Date: 24.02.2023 / Published (Online) Date: 21.06.2023

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To cited: Gültekin MZ, Dinçel YM, Doğar F, Arslan S. Have the online patient information materials on biceps tendon disorders adequate, quality and readability? Acta Med. Alanya 2023;7(1): 46-52 doi: 10.30565/medalanya.1198923



## Introduction

Health literacy is terminologically defined as “the degree to which individuals can obtain, process, and understand basic health information and services in order to make appropriate health decisions”[1]. Lower health literacy has generally been found to be associated with higher complication rates, more hospitalizations, higher health care expenditures, and poor health care [2].

Advances in information technologies have changed health literacy habits and sources of information. Today, patients use social media, websites, etc. internet-based platforms more in order to have information about any health-related issue [3]. However, it is reported that most of the content on websites claiming to provide health information is not written by health professionals and is not supervised by any governing body or is not bound by any ethical regulation [4]. It is also reported that the quality of websites contents is questionable. For these reasons, the internet can also be a source of inaccurate or inadequate health information [5].

Inaccurate or inadequate information has a negative impact on people’s ability to make decisions about health problems. Patients may ignore their serious medical problems or suffer permanent harm because of inaccurate or inadequate health information [6]. The reason for inaccurate or inadequate health information may be that the referenced source does not have sufficient content, its quality is not at the desired level and its readability is low [7].

There are studies investigating the quality and readability of internet content related to different branches of medicine [8]. In addition, the quality and readability of internet content related to different orthopedic diseases such as ankle problems, clavicle fractures, carpometacarpal joint arthritis, hip dysplasia, subacromial impingement were examined [9-11]. However, to the best of our knowledge, there is no study investigating the quality and readability of internet content related to biceps tendonitis and biceps rupture. Therefore the present study aimed to analyze the quality, adequacy and readability of websites created for patients with shoulder complaints associated with biceps tendon disorders.

## Material And Methods

Data were scanned on December 16, 2020, using the three preferred search engines in the United States, consisting of Google, Yahoo, and Bing, for diagnosis of 3 common orthopedic conditions, including shoulder injury, biceps tendinitis, and biceps tendon rupture, that were included in the “Patient Information Materials” section of the up-to-date website. All three search engines captured the top 25 websites that contained text for all three patient terms,

and only one of the recurring websites was included in the study. Networks that targeted physicians or health professionals, were not in English, contained only videos and newspaper news, presentations at conferences or academic training, and were restricted by subscriptions or fees were excluded. A total of 147 websites were evaluated for quality, adequacy and readability by 3 orthopedist. This type of study no ethics review and approval are required.

**Quality:** The webpages were reviewed for quality. The educational value for each website was rated using a 5-point global score modified from that of Singh et al. and recorded as Global Quality Score (GQS). These two scoring systems provide nonspecific assessment of the health-related websites [12]. The websites studied were also evaluated as those with and without “Health on the Net Foundation (HON)” code. Websites that meet the criteria for this code are allowed to include a logo on their site showing that it complies with the code. Websites that meet the 8 criteria set by HON are allowed to include a logo on their site showing that it complies with the code. The criteria required to obtain the HON logo are: authority, complementarily, confidentiality, attribution, justifiability, transparency of authorship, financial disclosure, and advertising policy [13].

**Popularity:** The popularity and visibility of websites were evaluated with “Alexa Popularity Rank”. The Alexa Popularity Rank is indicated that how often a website is frequented relative to all other sites on the web over the past 3 months [14].

**Adequacy:** It was assessed whether the content of the websites studied included a disease definition, the importance, symptoms, signs and treatment of the disease, and the mechanism of the disease occurrence. These six items were identified as the most highlighted six basic contents in texts disseminated for the diseases investigated in our study on the websites of the recognized academic association such as AAOS (American Academy of Orthopedic Surgeons), EFORT( European Federation of National Associations of Orthopedics and Traumatology) and SICOT (International Society of Orthopedic Surgery and Traumatology). Prior to analysis, text from each website was copied into a word processing document and converted to the same font (Times New Roman), text size, and monospaced [15]. Website identifiers, links, sponsors, advertisements, videos, unnecessary images, and author names were removed prior to evaluation to allow for blind scoring.

**Readability:** All text from the articles was copied and pasted into separate Microsoft Word documents (Microsoft). Authors, advertisements, links, images, copyright notices, disclaimers, acknowledgments, citations, and videos, were excluded. The degree of readability was evalu-

ated using FRES (Flesch reading ease), Gunning Fog, FKGL (Flesch-Kincaid grade level), CLI (Koleman-Liau index), SMOG (Simple Measure of Gobbledygook), ARI (Automated readability index), and LWF (Linear write formula), which are recommended and most commonly used by AAOS for readability [15, 16]. To analyze the readability of this online health information released to patients, used the index scores which are reported by "National Institutes of Health, US National Library of Medicine, and Medicare and Medicaid Centers"[17].

**Statistical Analysis:** Research data were uploaded to the computer and analyzed using "SPSS (Statistical Package for Social Sciences) for Windows 22.0 (SPSS Inc, Chicago, IL)." Descriptive statistics were presented as median (interquartile range), frequency distribution, and percentage. The data of websites with content prepared by healthcare professionals and websites with content prepared by people other than healthcare professionals were compared. Also the data of the websites with and without HON-code were grouped and compared. The chi-square test and Fisher's Exact Test were used to assess associations between categorical variables. Suitability of variables for normal distribution was assessed using visual (histogram and probability plots) and analytical methods (Kolmogorov-Smirnov test/ Shapiro Wilk test). For variables that did not fit the normal distribution, the Mann-Whitney U

test was applied to reveal statistical significance between two independent groups, while the Kruskal Wallis test was performed between three independent groups. The relationship between variables was assessed using Spearman correlation test. The correlation coefficient was interpreted as at "weak level" between 0-0.25, "medium level" between 0.26-0.50, "strong level" between 0.51-0.75 and at "very strong level" between 0.76-1.00. The statistical significance level was taken as  $p < 0.05$ .

## Results

The GQS median and APR median were 5 (IQR: 2 - 5) and 69821 (IQR: 5781 - 712202), respectively; furthermore, the APR score was below 25000 for 33.3% of the websites, between 25000 and 250000 for 31.3%, and above 250000 for 35.4%. Of the 147 websites studied, 78.2% had content created by health professionals and 29.3% had a HON code. While 42.9% of the websites studied cited a reference as the content source, 74.1% were enriched with illustrations and images (Table 1).

In assessing the adequacy of the content of the websites studied, 94.6%, 89.1%, 83.0%, 83.0%, 76.2%, and finally 75.5% of the websites included the importance, symptoms, treatment, signs of the disease, and mechanism of the disease occurrence, respectively.

**Table 1.** Parameters evaluating the quality of websites included in the research

Quality	
Global Quality Score (GQS), median (IQR)	5 (2 - 5)
Alexa Popularity Rank (APR), median (IQR)	69821 (5781 - 712202)
APR groups, n (%)	
<25000	49 (33.3)
25000-250000	46 (31.3)
>250000	52 (35.4)
Characteristics by the source of upload, n (%)	
Health professionals	115 (78.2)
Non-health professionals	32 (21.8)
HON Code, n (%)	
Yes	43 (29.3)
No	104 (70.7)
Originality, n (%)	
Citing reference	63 (42.9)
Not citing reference at all	84 (57.1)
Illustrations and images, n (%)	
Yes	109 (74.1)
No	38 (25.9)

n: number of sites; %: Column percentage; IQR: Interquartile range (25% - 75%)

The median FRES score of the websites included in the study was 47.8 (IQR: 39.2 - 54.6), the median Gunning FOG score was 12.5 (IQR: 11 - 14), the median FKGL score was 11.0 (IQR: 9.7 - 12.8), CLI median 12 (IQR: 10 - 13), SMOG median 9.9 (IQR: 8.9 - 11.3), ARI median 11.0 (IQR: 9.5 - 13.0) and LWF median was 11.9 (IQR: 9.3 - 14.1).

FRES scores of websites with content creation by health professionals were significantly lower than those without; in contrast, FKGL and CLI scores were significantly higher ( $p < 0.05$ ). GQS scores and originality scores were greater in website created by health professionals. In addition, the percentage of websites with reference citations and addressing the importance, symptoms, treatment, signs and mechanism of the disease was significantly higher in websites with content creation by health professionals than in those without ( $p < 0.05$ ) (Table 2).

The Gunning FOG, FKGL, SMOG, ARI and LWF scores were lower for websites with the HON code than those without

the HON code. Also originality score and APR scores were lower in websites with HONcode than without HON code ( $p < 0.05$ ). Other quality and readability scores were similar ( $p > 0.05$ ) (Table 3).

## Discussion

The present study aimed to analyze the quality, adequacy and readability of websites created for patients with shoulder complaints associated with biceps tendon injuries. Websites with and without the HON code had similar adequacy in the content they presented about the disease. Websites without HON code were more original and preferred than websites with HON code. However, the readability of websites with HON code was better than those without HON code. Websites prepared by health professionals offer adequate and quality content about the disease compared to those not prepared by health

**Table 2.** Distribution of the readability, quality and adequacy of information parameters on websites studied according to the status of uploading content by health professionals

Health Professionals (n = 115)	Characteristics according to the source of upload		p
	Non-health Professionals (n = 32)		
<b>Readability, median (IQR)</b>			
FRES	46.8 (35.9 - 52.5)	54.0 (45.2 - 60.1)	0.002 <sup>a**</sup>
Gunning Fog	12.5 (11.0 - 14.1)	12.6 (10.9 - 13.8)	0.683 <sup>a</sup>
FKGL	11.2 (9.9 - 12.9)	10.3 (8.8 - 12.1)	0.019 <sup>a*</sup>
CLI	12.0 (11.0 - 13.0)	11.0 (10.0 - 12.0)	0.015 <sup>a*</sup>
SMOG	10.1 (9.0 - 11.6)	9.6 (8.4 - 10.5)	0.058 <sup>a</sup>
ARI	11.3 (9.7 - 13.4)	10.7 (9.0 - 12.2)	0.120 <sup>a</sup>
LWF	12.0 (9.4 - 14.6)	11.0 (8.6 - 13.2)	0.149 <sup>a</sup>
<b>Quality</b>			
GQS, median (IQR)	5 (4 - 6)	2 (1 - 3)	<0.001 <sup>a**</sup>
APR, median (IQR)	66943 (7169 - 664215)	157777.5 (450 - 994832.5)	0.996 <sup>a</sup>
HON code, n (%)	35 (30.4)	8 (25.0)	0.550 <sup>b</sup>
Originality, n (%)	58 (50.4)	5 (15.6)	<0.001 <sup>b**</sup>
Illustrations and images, n (%)	83 (72.2)	26 (81.3)	0.300 <sup>b</sup>
<b>Adequacy of information, n (%)</b>			
Definition of the disease	109 (94.8)	30 (93.8)	0.685 <sup>c</sup>
Importance of the disease	107 (93.0)	24 (75.0)	0.008 <sup>c**</sup>
Symptoms of the disease	102 (88.7)	20 (62.5)	<0.001 <sup>b**</sup>
Treatment of the disease	104 (90.4)	18 (56.3)	<0.001 <sup>b**</sup>
Signs of the disease	99 (86.1)	13 (40.6)	<0.001 <sup>b**</sup>
Mechanism of the disease occurrence	97 (84.3)	14 (43.8)	<0.001 <sup>b**</sup>

n: Number of websites ; %: Column percentage; IQR: Interquartile range (25%-75%); <sup>a</sup>Mann-Whitney U Test; <sup>b</sup>Pearson Chi-squared test ; <sup>c</sup>Fisher's Exact Test; \* $p < 0.05$ ; \*\* $p < 0.01$ , FRES: Flesch reading ease, FKGL: Flesch-Kincaid grade level, CLI: Kolemian-Liau index, SMOG: Simple Measure of Gobbledygook, ARI: Automated readability index, LWF: Linear write formula, GQS: Global Quality Score, APR: Alexa Popularity Rank

**Table 3.** Distribution of the readability, quality and adequacy of information parameters on the websites included in the study according to quality and accreditation status

Yes (n = 43)	<b>HON Code</b>		<b>P</b>
	No (n = 104)		
<b>Readability, median (IQR)</b>			
FRES	48.8 (44.5 - 57.8)	47.2 (34.1 - 54.5)	0.078 <sup>a</sup>
Gunning Fog	11.7 (10.5 - 13.4)	12.8 (11.3 - 14.4)	<b>0.018<sup>a*</sup></b>
FKGL	10.4 (9.3 - 12.0)	11.3 (9.9 - 13.6)	<b>0.024<sup>a*</sup></b>
CLI	11 (11 - 12)	12 (10 - 13)	0.506
SMOG	9.4 (8.5 - 10.8)	10.1 (9.1 - 11.7)	<b>0.020<sup>a*</sup></b>
ARI	10.0 (9.1 - 12.3)	11.5 (9.7 - 13.4)	<b>0.029<sup>a*</sup></b>
LWF	10.7 (8.2 - 13.8)	12.3 (10.7 - 14.9)	<b>0.007<sup>a**</sup></b>
<b>Quality</b>			
GQS, median (IQR)	5 (2 - 5)	4 (3 - 5)	0.850 <sup>a</sup>
APR, median (IQR)	5634 (423 - 29939)	164927.5 (32260.0 - 1070407.2)	<0.001 <sup>a**</sup>
Uploading content by health professional n (%)	35 (81.4)	80 (76.9)	0.550 <sup>b</sup>
Originality, n (%)	25 (58.1)	38 (36.5)	0.016 <sup>b*</sup>
Illustration and images, n (%)	31 (72.1)	78 (75.0)	0.714 <sup>b</sup>
<b>Adequacy of information, n (%)</b>			
Definition of the disease	41 (95.3)	98 (94.2)	1.000 <sup>c</sup>
Importance of the disease	37 (86.0)	94 (90.4)	0.561 <sup>c</sup>
Symptoms of the disease	38 (88.4)	84 (80.8)	0.264 <sup>b</sup>
Treatment of the disease	37 (86.0)	85 (81.7)	0.526 <sup>c</sup>
Signs of the disease	33 (76.7)	79 (76.0)	0.919 <sup>b</sup>
Mechanism of the disease occurrence	33 (76.7)	78 (75.0)	0.823 <sup>b</sup>

n: Number of websites ; %: Column percentage; IQR: Interquartile range (25%-75%); <sup>a</sup>Mann-Whitney U Test; <sup>b</sup>Pearson Chi-squared test ; <sup>c</sup>Fisher's Exact Test; \*p<0.05; \*\*p<0.01, FRES: Flesch reading ease, FKGL: Flesch-Kincaid grade level, CLI: Kolemian-Liau index, SMOG: Simple Measure of Gobbledygook, ARI: Automated readability index, LWF: Linear write formula, GQS: Global Quality Score, APR: Alexa Popularity Rank

professionals. However, the readability of the content presented by health professionals was lower than those not prepared by health professionals.

The quality and readability of online materials related to diseases about different medical fields were investigated. Most of these studies reported that online patient education materials were insufficient in terms of quality and were above the reading level of the society [8]. As in other fields of medicine, there are online contents prepared for orthopedic diseases, but the quantity of these contents is not sufficient [18, 19].

Online patient education materials prepared for orthopedic diseases provide advantages in terms of time and cost compared to other education tools. However, there are serious problems with the adequacy and quality of online content [20]. In their review, Cassidy JT et al reported that the quality of the websites prepared for information on orthopedic diseases is poor [21]. A study of 10 common or-

thopaedic sports diagnoses, such as reconstruction of the anterior cruciate ligament, medial collateral ligament tear, posterior cruciate ligament tear, rotator cuff tear, meniscal tear, labral tear, tennis elbow, acromioclavicular joint separation, patellofemoral syndrome, and osteochondral defects revealed that the quality of information was generally higher for website with HON code than without HON code. Garcia GH et al reported that web content accessed for shoulder instability often contains false information [18]. According to the results of the current study, the rate of websites with HON code about the importance, symptoms, signs and injury mechanism of biceps tendon pathologies is higher than those without HON code. According to the current study results; the number of websites with HON code giving adequate information about the importance, symptoms, signs and mechanism of injury of biceps tendon pathologies was higher than those without HON code. Therefore, it can be said that websites



with HON code provide adequate information about biceps tendon pathologies compared to those without HON code. However, as a result of the study, it was seen that websites without HON code have more original content and have higher popularity. Also in the results of study; it has been seen that the websites prepared by health professionals offer more adequate and higher quality content for biceps tendon disorders than those prepared by non health professional.

Only 12% of general patient informative texts are prepared below the 8th grade level recommended for society [22]. This is also a problem for online content that concerns the orthopedic patient population. Although online content prepared for orthopedic diseases is useful for young, highly educated and internet-savvy patients, it is not suitable for the entire orthopedic patient population [20]. One of the reasons for this is the low readability of the contents of the websites prepared to inform orthopedic patients [23]. Kiapour AM et al reported that online content available for femoroacetabular impingement syndrome was prepared above the recommended level [24]. Akinleye SD et al reported that the online content available for patients with arthroscopic injuries exceeded the average reading ability of adults [25]. According to the current study results, the readability of sites with HON code was higher than the recommended level for the general public, but better than those without HON code. However, another remarkable result of the study was that the readability of websites with content prepared by health professionals was lower than those prepared by non health professional.

The result of the current study that has not been emphasized in the literature before; the content of the websites accessed as a result of the online search for bicep tendon disorders is variable. Websites with HON code and/or prepared by healthcare professionals are more successful in presenting sufficient and quality information to patients. However, the readability of websites prepared by healthcare professionals for biceps tendon disorders is low. With these results, it can be thought that the study will contribute to the literature.

There were some limitations in our study. The first is that non-sponsored websites or websites that do not want to pay fees refuse to obtain a HON code certificate because it has become chargeable in recent years, whereas HON Code can be purchased upfront as a free foundation service. Although the FKGL rating system is well formulated, descriptive audio/visual data (video, sound recording, etc.), in addition to photo and illustration, which do not accompany the rating but support the written text, can increase text comprehension. The number of syllables in words and words in sentences affects computation in this

formula and the FRES formula. Besides, although comprehension in this formula can be calculated as good, abbreviations of medical terms that the patient may not understand can also be misleading (e.g., lupus and physis).

**Conclusion:** Websites with HON code and prepared by healthcare professionals can provide sufficient and quality information to patients with biceps tendon disorders. The web content available for biceps tendon disorders is above the recommended reading level for patients. Health professionals should be encouraged to increase the readability of the content.

**Conflict of Interest:** The author declares no conflict of interest related to this article.

**Funding sources:** The author declares that this study has received no financial support

**Ethics Committee Approval:** Publicly available YouTube videos were used in this study. No ethics review and approval are required for this type of study.

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**Peer-review:** Externally peer reviewed.

**Acknowledgement:** No acknowledgement

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