



ELSEVIER

Contents lists available at ScienceDirect

## Integrative Medicine Research

journal homepage: [www.elsevier.com/locate/imr](http://www.elsevier.com/locate/imr)

Original Article

## Dietary and herbal supplements for fatigue: A quality assessment of online consumer health information

Jeremy Y Ng\*, Catherine Jiayi Zhang, Saad Ahmed

Department of Health Research Methods, Evidence, and Impact, Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada

## ARTICLE INFO

## Article history:

Received 17 November 2020

Revised 23 April 2021

Accepted 3 May 2021

Available online 26 May 2021

## Keywords:

Consumer health information  
Dietary and herbal supplements  
DISCERN  
Fatigue  
Quality of information

## ABSTRACT

**Background:** The Internet is increasingly utilized by patients to acquire information about dietary and herbal supplements (DHSs). Previously published studies assessing the quality of websites providing consumer health information about DHSs have been found to contain inaccuracies and misinformation that may compromise patient safety. The present study assessed the quality of online DHSs consumer health information for fatigue.

**Methods:** Six unique search terms were searched on Google, each relating to fatigue and DHSs, across four countries. Across 480 websites identified, 48 were deemed eligible and were quality assessed using the DISCERN instrument, a standardized index of the quality of consumer health information.

**Results:** Across 48 eligible websites, the mean summed score was 47.64 (SD = 10.38) and the mean overall rating was 3.06 (SD = 0.90). Commercial sites were the most numerous in quantity, but contained information of the poorest quality. In general, websites lacked discussion surrounding uncertainty of information, describing what would happen if no treatment was used, and how treatment choices affect overall quality of life.

**Conclusion:** Physicians and other healthcare professionals should be aware of the high variability in the quality of online information regarding the use of DHSs for fatigue and facilitate open communication with patients to guide them towards reliable online sources.

© 2021 Published by Elsevier B.V. on behalf of Korea Institute of Oriental Medicine.

This is an open access article under the CC BY-NC-ND license

[\(http://creativecommons.org/licenses/by-nc-nd/4.0/\)](http://creativecommons.org/licenses/by-nc-nd/4.0/)

## 1. Introduction

Fatigue is a condition with physical, mental, and behavioural components, and is associated with numerous chronic physical and psychiatric disorders such as multiple sclerosis, cancer, and depression<sup>1</sup>. Nonpathological fatigue is defined as being shorter than 3 months in duration, has an identifiable cause, and resolves spontaneously or through treatment of the underlying condition<sup>1</sup>. In contrast, pathological fatigue causes functional impairments and can be categorized as prolonged (1–5 months in duration) or chronic ( $\geq 6$ -month duration)<sup>1</sup>. Chronic fatigue, when combined with at least 4 of 8 specified symptoms and the lack of an adequate medical explanation, is diagnosed as chronic fatigue syndrome (CFS)<sup>2</sup>.

\* Corresponding author at: Department of Health Research Methods, Evidence, and Impact, Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada.

E-mail address: [ngjy2@mcmaster.ca](mailto:ngjy2@mcmaster.ca) (J.Y. Ng).

In a population-based study in Nijmegen, Gelderland in the Netherlands, one-third of adults self-reported fatigue symptoms while 1% of adults self-reported CFS symptoms<sup>3</sup>. Other studies have shown consistent CFS rates of prevalence at 1–3% across various countries, including the United States, the United Kingdom, Australia, Brazil, and Nigeria<sup>4</sup>.

The etiology and pathophysiology of fatigue are multifactorial and poorly understood, making its treatment especially challenging<sup>1</sup>. Many patients with fatigue often turn to dietary and herbal supplements (DHSs) for symptom relief<sup>5</sup>. DHSs are defined as “products containing naturally occurring substances intended to supplement the diet, and restore or maintain good health,” encompassing vitamins and minerals, herbal remedies, homeopathic medicines, traditional medicines, probiotics, and other products such as amino acids, essential fatty acids, enzymes, organ tissues, and metabolites<sup>6,7,29</sup>. They are often over-the-counter products which can typically be purchased without a prescription in pharmacies, health food stores, as well as through online retail-

ers<sup>8</sup>. One study found that 86% of patients with CFS have used vitamin supplements, while another study reported that 89% of female patients with CFS consumed vitamin and mineral supplements at dosages that were 100–200% of the recommended daily allowance<sup>5</sup>. Despite the prevalence of DHS usage among patients, evidence supporting the effectiveness of DHSs for fatigue is very limited. One systematic review of randomized controlled trials tested supplements for CFS and reported beneficial effects for nicotinamide adenine dinucleotide and magnesium<sup>9</sup>. For most other supplements, evidence of effectiveness is absent or inconclusive, and little is known about potential adverse events<sup>9</sup>. Patients with fatigue should be aware of such uncertainties when considering DHSs as a treatment option.

Information about DHSs for the treatment or management of fatigue is readily accessible online; the Internet itself has become a common and increasingly predominant source of health information for the general public<sup>10</sup>. While online consumer health information may enable patients to be more involved in their health care and make more informed treatment choices<sup>10</sup>, both disease-specific and broad evaluations of websites about DHSs have generally revealed quality issues relating to information provided about safety and effectiveness, especially when originating from retail/commercial sources<sup>11–12</sup>. Unreliable online sources, however, may influence patients to consume products that are ineffective or even unsafe<sup>10</sup>. Past research has evaluated websites providing information about cancer-related fatigue and treatments for CFS, and, for both, the quality of information was reported to be inconsistent<sup>13–14</sup>. The quality of online information on DHSs for fatigue accessible to the typical consumer have yet to be assessed, thus the purpose of this study is to assess the quality of online DHSs consumer health information for the treatment and/or management of fatigue. This findings from this study may be of benefit to both healthcare providers and researchers, as it offers them a better understanding of the types of information patients with fatigue may be access in the absence of a healthcare provider.

## 2. Methods

### 2.1. Search Strategy and Screening

JYN designed a search strategy to capture websites that contained DHSs consumer health information for the treatment and/or management of fatigue. CJZ ran searches on Google; this was the only search engine used, as it comprised >90% of the global search engine market share as of April 2020 and reflected the typical information-seeking behaviour of a given patient<sup>15</sup>. Additionally, searches were conducted across four English-speaking countries to obtain a more internationally representative selection of commonly visited websites. Six searches each were conducted across four countries— Australia (Google.com.au), Canada (Google.ca), the United Kingdom (Google.co.uk), and the United States (Google.com)—using the search terms, “dietary supplements for fatigue”, “herbal medicine for fatigue”, “herbs for fatigue”, “natural health products for fatigue”, “natural products for fatigue”, and “supplements for fatigue”, which are reflective of terms synonymous to DHS used across different jurisdictions<sup>8,16</sup>. All searches were conducted using the Google Chrome browser in incognito mode to prevent the results from being influenced by past search histories. Searches were conducted on the same day (May 15, 2020) to minimize influence from variation in time. Websites captured by the first two Google search result pages (i.e., 20 websites) generated by each search term were reviewed; this decision was made based on the fact that Google search results listed on the first page yield 92% of all traffic from an average search, which drops by 95% when moving to the second page<sup>17</sup>.

### 2.2. Eligibility Criteria

CJZ and SA reviewed the search results, and all duplicate sites were excluded. Websites were screened for eligibility and included if they contained at least one webpage that contained DHSs consumer health information for the treatment and/or management of fatigue. Given that to our knowledge no prior research employing a similar methodology has been conducted at the intersection of these topics, we did not differentiate between different types of fatigue (i.e. transient versus cumulative, cancer- vs. non-cancer-related); we, therefore, included all types regardless of known or unknown co-morbidity. Furthermore, invalid addresses, Wikipedia, forums, eBooks, peer-reviewed articles, webpages with only videos (i.e. YouTube), news websites, websites written in non-English languages, websites requiring subscriptions, and websites that did not contain consumer health information (e.g., HowStuffWorks and Amazon) were excluded.

### 2.3. Data Extraction and Website Quality Assessment

CJZ and SA extracted the following data: website URL, website type, types of DHSs discussed, types of non-DHSs therapies discussed, and whether the website appeared in searches made using different search terms and/or from different geographical locations. Different webpages of the same website yielded by searches were collapsed into a single entity, thus, quality assessments were conducted for individual websites rather than webpages. All eligible websites were assessed using the DISCERN instrument<sup>18</sup>, a standardized index of the quality of written consumer health information. The index is composed of 15 quality criteria (i.e., characteristics of good quality publication about treatment choices), which evaluate the publication’s reliability and comprehensiveness in discussing specific details of treatment choices, in addition to one overall quality rating. For each criterion, the websites were scored on a Likert scale from 1 (no) to 5 (yes). Prior to conducting data extraction and quality assessing eligible websites using the DISCERN instrument, JYN, CJZ, and SA partook in a pilot test to standardize these steps, by independently evaluating three separate websites. All three authors then met to discuss data extractions, as well as resolve DISCERN instrument item discrepancies. CJZ and SA then independently completed all data extractions and DISCERN instrument assessments in duplicate across all eligible websites. Following this, all three authors met again to discuss and resolve any discrepancies through discussion. The score for each quality criterion and the overall quality rating for each eligible website was calculated by taking the average of both assessors’ final ratings. . Lastly, the total mean scores and total standard deviations for each quality criterion, the overall quality rating, the standard deviation of the overall quality rating, and sum of the 15 quality criteria were calculated for all eligible websites.

## 3. Results

### 3.1. Search Results

A total of 480 webpages were retrieved across all Google searches, 393 of which were duplicates and excluded. Of the 87 remaining webpages, 39 were excluded upon further review as they did not provide any consumer health information (n = 18), were a webpage from the same website (n = 7), did not contain any information about DHSs for fatigue (n = 5), were peer-reviewed articles (n = 5), were news websites (n = 2), had an invalid URL (n = 1), and require a subscription (n = 1). After different webpages from the same website were collapsed into a single item, the 48 websites that remained were deemed eligible, and were data

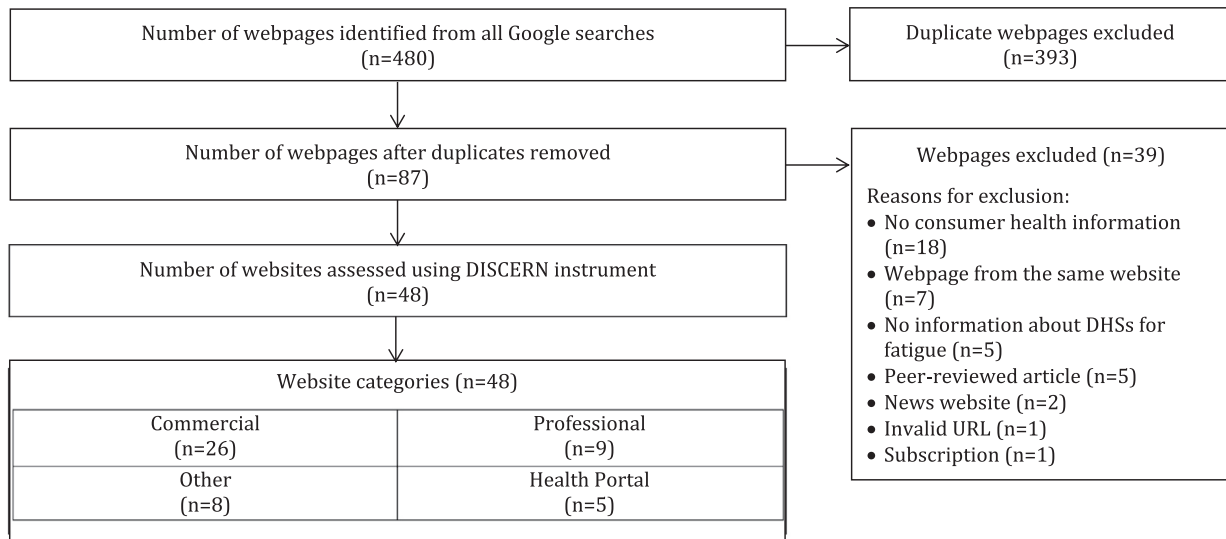


Fig. 1. Web Information Search Strategy and Assessment Flowchart

extracted and assessed with the DISCERN instrument. This process is depicted in Fig. 1.

### 3.2. General Characteristics of Eligible Websites

Of the 48 eligible websites, we categorized 26 as “commercial” sites (websites that marketed products and services to consumers online), 9 as “professional” sites (websites owned and operated by health professionals and professional organizations), 8 as “other” (websites that did not fit into any of our other defined categories), and 5 as “health portals” (websites with a search function that contains health information on a variety of health topics). The types of DHSs covered by eligible websites were extensive. Herbal remedies were discussed by the largest portion of the websites at 68.75% (33 out of 48), followed by vitamins and/or minerals at 62.50% (30 out of 48); coenzyme Q10 was one of the most commonly discussed stand-alone DHS at 35.42% (17 out of 48). To accommodate for the multifactorial nature of fatigue, the websites recommended a wide variety of herbs, with specific herbs targeting specific aspects of the disease. A couple of the predominantly discussed herbs were ginseng and ashwagandha, which were mentioned by 43.75% (21 out of 48) and 25.00% (12 out of 48) of the websites, respectively. In addition to DHSs, 27.08% (13 out of 48) of the websites provided information about non-DHS therapies such as pharmaceutical therapies and non-DHS complementary medicine, of which acupuncture was the most discussed treatment. Notably, the vast majority—79.17% (38 out of 48)—of websites appeared in multiple searches found using different search terms and/or countries. Table 1 provides details about the characteristics of all eligible websites.

### 3.3. Types of Fatigue Discussed

Twenty-five out of the 48 eligible websites discussed more than one type of fatigue. Specifically, commercial websites did not address the multifactorial nature of fatigue, and often presented it instead as generalized exhaustion/tiredness. Of these 25 websites, the following types of fatigue were specifically discussed: fatigue secondary to diseases and sleep disorders (n = 17), CFS (n = 13), adrenal fatigue (n = 9), chronic fatigue (n = 7), general fatigue (n = 4), pregnancy-related fatigue (n = 4), and medication-related fatigue (n = 1).

### 3.4. DISCERN Instrument Ratings

Across all websites, the mean score for the sum of all 15 DISCERN instrument items (Question 1–15) was 47.64 (SD = 10.38) and the mean score for the overall rating (Question 16) was 3.06 (SD = 0.90). The 3 highest scoring websites were Verywell Health (71.00), Mayo Clinic (67.50), and WebMD (66.00), while the 3 lowest scoring websites were Nick Dale Naturopath (32.50), Nourished Essentials (31.50), and Bulk Powders (31.50). Ten out of the 12 highest scoring websites were professional sites and health portals, incorporating all 5 websites within the latter typology. These websites took special demographics into account, thoroughly discussed the benefits and risks of DHSs, and acknowledged alternative treatment options. Conversely, 10 out of the 12 lowest scoring websites were commercial sites. Perhaps motivated by financial gain, they often portrayed DHSs as the only viable treatment option. All of the DISCERN scores for each individual question and website are provided in Table 2.

### 3.5. Trends Identified Across Resources Assessed

#### 3.5.1. Aims of Website

Question 1 of the DISCERN instrument assesses whether the aims of the website had been clearly stated, while Question 2 assesses whether the aims have been achieved. The mean scores for Questions 1 and 2 were 4.69 (SD = 0.53) and 4.55 (SD = 0.74), respectively. Websites typically presented their aims in an “About” page or section. Websites generally stated aims that accurately described their topics of discussion; it is here where most websites identified their target audience and what kind of information users could expect to find within the resource.

#### 3.5.2. Uncertainty Regarding Treatment Options

Question 8 of the DISCERN instrument assesses whether a website acknowledged the lack of, or conflicting evidence associated with the effectiveness of any treatment. The mean score for this question was 2.22 (SD = 1.61), with 22 (45.83%) websites receiving a score of 1. For the websites that chose to discuss uncertainties, the limitations in existing research were often mentioned in the form of vague statements as opposed to detailed explanations.

#### 3.5.3. No Treatment Option

Question 12 of the DISCERN instrument assesses whether a website clearly described any consequence of not using/receiving

**Table 1**  
General Characteristics of Eligible Websites

Website Name	URL	Website Category	Types of Fatigue Discussed	Types of DHSs Discussed	Types of Non-DHSS Therapies Discussed	Appeared in More than One Search?
AcuMedic	<a href="https://clinic.acumedic.com/">https://clinic.acumedic.com/</a>	Commercial	Chronic fatigue, chronic fatigue syndrome	Traditional Chinese herbal medicine	Acupuncture, and lifestyle changes (refers to detailed lifestyle advice on topics including diet, exercise, relaxation techniques, rest and sleep).	Yes
Amy Myers MD	<a href="https://www.amymyersmd.com/">https://www.amymyersmd.com/</a>	Commercial	Unspecific	Vitamins, essential fatty acid, and multivitamin (refers to DHSs with multiple ingredients, including nutrients such as antioxidants, probiotics, herbal extracts, and/or other chemical elements in addition to vitamins and minerals).	Lifestyle changes	No
Bulk Powders	<a href="https://www.bulkpowders.co.uk/">https://www.bulkpowders.co.uk/</a>	Commercial	Unspecific	Vitamins and minerals, essential amino acid, and multivitamin	None	Yes
Care/of	<a href="https://takecareof.com/">https://takecareof.com/</a>	Commercial	Unspecific	Vitamin and minerals, CoQ10, and traditional herbal medicine in Eastern Europe and Asia (including <i>Rhodiola rosea</i> , and ashwagandha)	Lifestyle changes	Yes
Cleveland Clinic	<a href="https://health.clevelandclinic.org/">https://health.clevelandclinic.org/</a>	Professional	General fatigue, chronic fatigue syndrome, fatigue secondary to diseases and sleep disorders	Vitamins and minerals, and traditional Chinese herbal medicine	Pharmaceutical medication, and therapy	Yes
Consumer Lab	<a href="https://www.consumerlab.com/">https://www.consumerlab.com/</a>	Other	Unspecific	Vitamins and minerals, CoQ10, hormone (including melatonin), herbal remedies (including curcumin from turmeric, ashwagandha, cocoa flavanols, ginseng, <i>Rhodiola rosea</i> and maca) and carnitine	None	Yes
Dr. Axe	<a href="https://draxe.com/">https://draxe.com/</a>	Commercial	Chronic fatigue syndrome, adrenal fatigue	Vitamins and minerals	Lifestyle changes	Yes
Dr. Cobi	<a href="https://www.drcobi.com/">https://www.drcobi.com/</a>	Commercial	Chronic fatigue syndrome, adrenal fatigue	Vitamin, amino acid, hormones (including melatonin, and DHEA), adrenal cortical and thymus extracts, herbal remedies (including Siberian ginseng, licorice root, borage, ashwagandha, <i>Astragalus</i> , wild indigo, <i>Echinacea</i> , poke root, pau d'arco, cleavers, cat's claw, milk thistle, garlic, oregano, thyme, peppermint, dandelion root, milk thistle, burdock root, red clover, barberry, Turkey rhubarb, marshmallow root, comfrey root, plantain, goldenseal, slippery elm, nettles, and turmeric), fatty acids, enzymes, probiotics, and another chemical compounds	Pharmaceutical medication, and lifestyle changes	No
Dr. Weil	<a href="https://www.drweil.com/">https://www.drweil.com/</a>	Commercial	Chronic fatigue syndrome, adrenal fatigue	Vitamins, CoQ10, and herbal remedies (including Siberian ginseng, garlic, and <i>Astragalus</i> root)	Cognitive-behavioural therapy, and lifestyle changes	Yes

(continued on next page)

Table 1 (continued)

Website Name	URL	Website Category	Types of Fatigue Discussed	Types of DHSs Discussed	Types of Non-DHSS Therapies Discussed	Appeared in More than One Search?
Eu Yan Sang	<a href="https://www.euysang.com.sg/">https://www.euysang.com.sg/</a>	Commercial		Vitamins and mineral, and traditional Chinese herbal medicine	Acupuncture, and lifestyle changes	No
Everyday Health	<a href="https://www.everydayhealth.com/">https://www.everydayhealth.com/</a>	Health portal	Chronic fatigue syndrome, fatigue secondary to diseases and sleep disorders	Vitamin, and ribose	Graded exercise therapy, and lifestyle changes	Yes
Fisher-Titus Medical Center	<a href="https://www.fishertitus.org/">https://www.fishertitus.org/</a>	Professional	Unspecific	Essential oils (including peppermint and rosemary)	Lifestyle changes	Yes
Fusion Health	<a href="https://www.fusionhealth.com.au/">https://www.fusionhealth.com.au/</a>	Commercial	Unspecific	Vitamins and minerals, traditional Chinese herbal medicine, and multivitamins	None	Yes
Gaia Herbs	<a href="https://www.gaiaherbs.com/">https://www.gaiaherbs.com/</a>	Commercial	Adrenal fatigue	Herbal remedies (including ashwagandha, <i>Rhodiola rosea</i> , holy basil, Siberian ginseng, and <i>Schisandra</i> )	None	Yes
Global Healing	<a href="https://globalhealing.com/">https://globalhealing.com/</a>	Commercial	Chronic fatigue syndrome, adrenal fatigue, pregnancy-related fatigue	Mineral, and CoQ10	Graded exercise therapy, cognitive behavioural therapy, acupuncture, massage, and lifestyle changes	Yes
Harvard Health Publishing	<a href="https://www.health.harvard.edu/">https://www.health.harvard.edu/</a>	Other	Chronic fatigue syndrome, fatigue secondary to diseases and sleep disorders	Vitamins and minerals	None	Yes
Health Rising	<a href="https://www.healthrising.org/">https://www.healthrising.org/</a>	Other	Chronic fatigue syndrome	Herbal remedies (including ashwagandha, cocoa, ginger, lemon balm, mistletoe, turmeric, cayenne pepper, garlic, ginkgo, horse chestnut, CoQ10 from grapeseed oil, chamomile, red bush, skullcap, St. John's wort, valerian, vervain, and caraway seed)	Pharmaceutical medication, therapies, and lifestyle changes	Yes
Healthline	<a href="https://www.healthline.com/">https://www.healthline.com/</a>	Health portal	Chronic fatigue syndrome, pregnancy-related fatigue, fatigue secondary to diseases and sleep disorders	Vitamin and mineral, CoQ10, amino acids, hormone (including melatonin), herbal remedies (including ashwagandha, <i>Rhodiola rosea</i> , and beetroot), creatine, and caffeine	Lifestyle changes	Yes
Holland and Barrett	<a href="https://www.hollandandbarrett.com/">https://www.hollandandbarrett.com/</a>	Commercial	Unspecific	Vitamins and minerals	Lifestyle changes	Yes
Inessa Wellness	<a href="https://www.inessawellness.com/">https://www.inessawellness.com/</a>	Commercial	Unspecific	Vitamins, CoQ10, and iodine	Lifestyle changes	Yes
Mayo Clinic	<a href="https://www.mayoclinic.org/">https://www.mayoclinic.org/</a>	Professional	Chronic fatigue syndrome, fatigue secondary to diseases and sleep disorders	Mineral, CoQ10, hormone (including melatonin), NADH, and ribose	Pharmaceutical medication, cognitive training, and graded exercise	Yes
Medical News Today	<a href="https://www.medicalnewstoday.com/">https://www.medicalnewstoday.com/</a>	Health portal	Chronic fatigue syndrome, fatigue secondary to diseases and sleep disorders	Vitamins and mineral, CoQ10, amino acid, herbal remedy (including ashwagandha), and creatine	None	Yes
Mind Body Green	<a href="https://www.mindbodygreen.com/">https://www.mindbodygreen.com/</a>	Other	Unspecific	Vitamins and mineral, CoQ10, and amino acids	None	Yes

(continued on next page)

Table 1 (continued)

Website Name	URL	Website Category	Types of Fatigue Discussed	Types of DHSs Discussed	Types of Non-DHSs Therapies Discussed	Appeared in More than One Search?
Mother Earth Living	<a href="https://www.motherearthliving.com/">https://www.motherearthliving.com/</a>	Commercial	Chronic fatigue, adrenal fatigue, pregnancy-related fatigue, fatigue secondary to diseases and sleep disorders	Herbal remedies (including Siberian ginseng, <i>Astragalus</i> , and vervain)	None	No
Myprotein	<a href="https://www.myprotein.com/">https://www.myprotein.com/</a>	Commercial	Unspecific	Vitamins and minerals, CoQ10, herbal remedies (including ginseng, and green tea), caffeine, and creatine	None	Yes
National Institute of Medical Herbalists	<a href="https://nimh.org.uk/">https://nimh.org.uk/</a>	Professional	Unspecific	Herbal remedies	None	No
Naturally Savvy	<a href="https://naturallysavvy.com/">https://naturallysavvy.com/</a>	Other	Adrenal fatigue, pregnancy-related fatigue, medication-related fatigue, fatigue secondary to diseases and sleep disorders	Herbal remedies (including Siberian ginseng, licorice root, gotu kola, <i>Ginkgo biloba</i> , and sea kelp)	None	Yes
Nick Dale Naturopath	<a href="https://nickdale-naturopath.co.uk/">https://nickdale-naturopath.co.uk/</a>	Commercial	General fatigue, chronic fatigue, fatigue secondary to diseases and sleep disorders	Supplements, herbal remedies, and homeopathic medicine	Lifestyle changes	No
Nourished Essentials	<a href="https://nourishedessentials.com/">https://nourishedessentials.com/</a>	Commercial	Fatigue secondary to diseases and sleep disorders	CoQ10, and herbal remedies (including ginseng, artichoke root, <i>Schisandra</i> , valerian, green supplements, licorice extract, and <i>Ginkgo biloba</i> )	Lifestyle changes	Yes
Nutra Life	<a href="https://www.nutralife.com.au/">https://www.nutralife.com.au/</a>	Commercial	Unspecific	Vitamins, herbal remedy (including ginseng), and multivitamins	None	No
One Medical	<a href="https://www.onemedical.com/">https://www.onemedical.com/</a>	Professional	Fatigue secondary to diseases and sleep disorders	Traditional herbal Chinese medicine (including ginseng root, and sweet wormwood)	Acupuncture, qigong, and lifestyle changes	Yes
PennState Health	<a href="http://pennstatehershey.adam.com/">http://pennstatehershey.adam.com/</a>	Professional		Vitamins and mineral, essential fatty acids, amino acid, hormones (including melatonin, and DHEA), beta-carotene, herbal remedies (including ginseng, and <i>Echinacea</i> ), essential oils (jasmine, peppermint, and rosemary), homeopathic medicine, and NADH	Pharmaceutical medication, acupuncture, chiropractic, physical therapies, and lifestyle changes	Yes
Progressive Nutraceutical	<a href="https://www.progressivenutraceutical.com/">https://www.progressivenutraceutical.com/</a>	Commercial	Chronic fatigue syndrome, adrenal fatigue	Herbal remedies (including licorice root, <i>Rhodiola</i> , <i>Schisandra</i> , and ashwagandha), and adrenal glandular extracts	Lifestyle changes	Yes
St. Luke's Hospital	<a href="https://www.stlukes-stl.com/">https://www.stlukes-stl.com/</a>	Professional	Medication-related fatigue, fatigue secondary to diseases and sleep disorders	Vitamins and mineral, essential fatty acids, amino acid, hormones (including melatonin, and DHEA), beta-carotene, herbal remedies (including ginseng, and <i>Echinacea</i> ), essential oils (jasmine, peppermint, and rosemary), homeopathic medicine, and NADH	Pharmaceutical medication, acupuncture, chiropractic, physical therapies, and lifestyle changes	Yes
The British Dietetic Association	<a href="https://www.bda.uk.com/">https://www.bda.uk.com/</a>	Professional	Unspecific	Vitamins and mineral, essential fatty acids, CoQ10, and carnitine	Lifestyle changes	Yes

(continued on next page)

Table 1 (continued)

Website Name	URL	Website Category	Types of Fatigue Discussed	Types of DHSs Discussed	Types of Non-DHSs Therapies Discussed	Appeared in More than One Search?
The Herbal Academy	<a href="https://theherbalacademy.com/">https://theherbalacademy.com/</a>	Commercial	Unspecific	Herbal remedies (including <i>Hibiscus</i> , lemon balm, mint, tulsi/holy basil, ginger, peach, lavender, and rose)	None	Yes
The Herbal Resource	<a href="https://www.herbal-supplement-resource.com/">https://www.herbal-supplement-resource.com/</a>	Other	Chronic fatigue, adrenal fatigue	Herbal remedies (including ashwagandha, Siberian ginseng, <i>Ephedra</i> , Asian ginseng, licorice root, gotu kola, bladderwrack, <i>Ginkgo biloba</i> , <i>Astragalus</i> , reishi, stinging nettle, shilajit, ginger, St. John's wort, dandelion, skullcap, borage, <i>Schisandra</i> , maca, <i>Cordyceps</i> , <i>Rhodiola rosea</i> , holy basil, <i>Moringa</i> , <i>Sumac</i> , and <i>Gynostemma</i> )	None	Yes
Theta Health	<a href="http://www.thetahealth.co.za/">http://www.thetahealth.co.za/</a>	Commercial	Unspecific	Vitamins and minerals, hormone (including HGH), homeopathic medicine, herbal remedies, and multivitamins	None	No
Thompson's	<a href="https://www.thompsons.co.nz/">https://www.thompsons.co.nz/</a>	Commercial	Fatigue secondary to diseases and sleep disorders	Vitamins and minerals, CoQ10, herbal remedies (including Korean ginseng, Siberian ginseng, and <i>Rhodiola</i> ), multivitamins, and spirulina	Lifestyle changes	Yes
Tonic Natural Health	<a href="https://tonicnaturalhealth.com.au/">https://tonicnaturalhealth.com.au/</a>	Commercial	Adrenal fatigue, fatigue secondary to diseases and sleep disorders	Vitamins and mineral, and fatty acids	Lifestyle changes	Yes
Upper Cervical Awareness	<a href="https://uppercervicalawareness.com/">https://uppercervicalawareness.com/</a>	Commercial	General fatigue, chronic fatigue, chronic fatigue syndrome	CoQ10, fatty acids, hormone (including melatonin), and herbal remedies (including valerian root, licorice extract, Siberian ginseng, green supplements, and ginkgo)	Chiropractic	Yes
Urban Moonshine	<a href="https://www.urbanmoonshine.com/">https://www.urbanmoonshine.com/</a>	Commercial	Unspecific	Herbal remedies (including maca, cacao, <i>Schisandra</i> , nettles, tulsi, ashwagandha and reishi)	Lifestyle changes	Yes
VAGA	<a href="https://www.vaga.org/">https://www.vaga.org/</a>	Other	Unspecific	Vitamins, hormone (including melatonin), amino acids, herbal remedies (including <i>Rhodiola rosea</i> , and ashwagandha), and caffeine	None	Yes
Verywell Health	<a href="https://www.verywellhealth.com/">https://www.verywellhealth.com/</a>	Health portal	General fatigue, chronic fatigue, fatigue secondary to diseases and sleep disorders	Vitamins, essential fatty acids, amino acid, CoQ10, hormone (including DHEA), D-ribose, NADH, and traditional Chinese herbal medicine (including ginseng)	Pharmaceutical medication, acupuncture, qigong, moxibustion, acupoint application, mind-body therapies, and lifestyle changes	Yes
Vive Health	<a href="https://www.vivehealth.com.au/">https://www.vivehealth.com.au/</a>	Commercial	Unspecific	CoQ10, herbal remedies (including ginseng, and green supplements), and multivitamins	Lifestyle changes	No
WebMD	<a href="https://www.webmd.com/">https://www.webmd.com/</a>	Health portal	Fatigue secondary to diseases and sleep disorders	Vitamin and mineral, amino acid, taurine, chlorella, blue-green algae, herbal remedies (including pepper, lavender, panax ginseng, <i>Rhodiola</i> , and rosemary), astaxanthin, creatine, and sulbutiamine	Pharmaceutical medication, mind-body therapy, talk therapy, physical therapy, and lifestyle changes	Yes

(continued on next page)

**Table 1** (continued)

Website Name	URL	Website Category	Types of Fatigue Discussed	Types of DHSs Discussed	Types of Non-DHSs Therapies Discussed	Appeared in More than One Search?
Willis-Knighton Health System	<a href="https://www.wkhs.com/">https://www.wkhs.com/</a>	Professional	Unspecific	Herbs and supplements, probiotics, and NADH	Acupuncture, exercise therapy, moxibustion, qigong, body awareness interventions, and mindfulness	No
Woman's Day	<a href="https://www.womansday.com/">https://www.womansday.com/</a>	Other	Fatigue secondary to diseases and sleep disorders	Vitamins and mineral	None	Yes

Abbreviations: coenzyme Q10 (CoQ10); dehydroepiandrosterone (DHEA); human growth hormone (HGH); nicotinamide adenine dinucleotide (NADH)

treatment. The mean score for this question was 1.45 (SD = 0.88). Twenty-nine (60.42%) websites received a rating of 1, and only a single website scored a 5. Across all websites, information provided relating to opting for no treatment option for various diseases was either anecdotal or very brief and lacking detail. The consequence of not using treatment for fatigue specifically was never discussed.

### 3.5.6. Effect on Overall Quality of Life

Question 13 of the DISCERN instrument asks the assessor to consider how the treatment choices affect overall quality of life. The mean score for this question was 1.51 (SD = 0.88). Twenty-three out of 48 (47.92%) eligible websites scored a 1, and only two websites received a full score of 5. Twenty-seven (56.25%) websites discussed lifestyle factors such as diet, exercise, relaxation, and sleep. However, such factors were commonly identified by websites as alternatives to using DHSs or having an irreplaceable role in the treatment of fatigue and thus, we considered these treatment options as opposed to effects on overall quality of life.

### 3.7. Recommended Websites for Patients and Consumers

Given the substandard quality of information found on a large number of eligible websites found following assessment with the DISCERN instrument, healthcare practitioners are advised to guide their patients in navigating online resources. Table 3 lists five websites that received the highest summed DISCERN scores and provided information of relevance to the general public, less biased coverage of treatment options, and regular updates to maintain the accuracy of their content.

## 4. Discussion

The purpose of the present study was to review the quality of online DHSs consumer health information for the treatment and/or management of fatigue. Eligible websites were assessed using the DISCERN instrument and were found to be contain variable quality of information. All websites discussed the use of DHSs for at least one, if not more types of fatigue (i.e. chronic fatigue syndrome, cancer-related fatigue). The fact that different types of fatigue were discussed across the subset of websites surveyed is unsurprising, given that the etiology and pathophysiology of fatigue are multifactorial. In general, the websites were most successful in stating and achieving their aims and most lacking in discussing topics including uncertainties regarding treatment options, what would happen if no treatment was used, and how treatments affect overall quality of life. Highest scoring websites were primarily categorized as professional and health portals, whereas lowest scoring websites were primarily commercial.

Similarly published studies have used the DISCERN instrument to assess websites that provided health information about other

conditions, including back pain<sup>19,20</sup>, anxiety disorders<sup>21</sup>, chronic pain<sup>22</sup>, arthritis<sup>23</sup>, gastrointestinal diseases<sup>24</sup>, and postherpetic neuralgia<sup>25</sup>. One study specifically used the DISCERN instrument to assess the quality of websites that provided information about DHSs for cancer<sup>11</sup>. Across all of these aforementioned studies, the quality of consumer health information provided by each subset of websites assessed were found to be poor to moderate, with commercial sites being the most numerous in quantity, but poorest in quality. Websites of commercial nature, in particular, are known to have provided poor quality or inaccurate information with respect to different DHSs such as St. John's wort<sup>26</sup>, kratom<sup>27</sup>, and ephedra<sup>28</sup>. Collectively, these identified trends are shared by the present study.

As the main medium for information delivery has transitioned from print and in-person to digital, it is important that patients are provided with the necessary education enabling them to discern reliable online health information and use them to make informed decisions about the treatments they choose. When approaching the topic of DHSs for the treatment and/or management of fatigue, healthcare providers should be aware of the variability that exists with respect to the quality of online health information and guide their patients towards high quality websites. Open communication is key to maintaining positive patient-provider relationships, as a provider's dismissal of a patient's online findings may result in the patient's loss of trust and/or increased reluctance to use health care services<sup>10</sup>.

### 4.1. Strengths and Limitations

One strength included conducting searches on Google across four different English-speaking countries (Australia, Canada, the United Kingdom, and the United States), which yielded a more internationally-representative sample of websites. Another strength included the use of the DISCERN instrument, which has been found to be both reliable and valid in evaluating the quality of consumer health information. Additional strengths include the fact that we piloted data extractions and the application of the DISCERN instrument; both steps were completed independently and in duplicate during the pilot and full assessments, prior to all authors meeting to discuss and resolve discrepancies. With respect to limitations, our search only captured a cross-sectional snapshot of website information, however, because the internet is a dynamic source of information that is subject to change, the results of this study may differ if replicated across future searches. Furthermore, because the study's search strategy only included the first 20 websites returned for each search term, less popular websites were not evaluated for quality. Additionally, if different search terms were used, variable results could have been obtained. Another limitation includes the fact that we conducted all searches in English and excluded all



**Table 2**  
DISCERN Instrument Ratings

Section	SECTION 1 Is the publication reliable?										SECTION 2 How good is the quality of information on treatment choices?						SECTION 3 Overall Rating of the Publication		
	DISCERN Question	1. Are the aims clear?	2. Does it achieve its aims?	3. Is it relevant?	4. Is it clear what sources of information were used to compile the publication (other than the author or producer)?	5. Is it clear when the information reported in the publication was produced?	6. Is it balanced and unbiased?	7. Does it provide details of additional sources of support and information?	8. Does it refer to areas of uncertainty?	9. Does it describe each treatment works?	10. Does it describe the benefits of each treatment?	11. Does it describe the risks of each treatment?	12. Does it describe what would happen if no treatment is used?	13. Does it describe how the treatment choices affect overall quality of life?	14. Is it clear that there may be more than one possible treatment choice?	15. Does it provide support for decision-making?	16. Based on the answers to all of the above questions, rate the overall quality of the publication as a source of information about treatment choices	Standard Deviation of Overall Score (Q16)	DISCERN Score of Overall (Sum of Q1-Q15)
Verywell Health	<a href="https://www.verywellhealth.com/">https://www.verywellhealth.com/</a>	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	2.00	5.00	5.00	5.00	5.00	0.00	71.00
Mayo Clinic	<a href="https://www.mayoclinic.org/">https://www.mayoclinic.org/</a>	5.00	5.00	5.00	3.00	5.00	5.00	5.00	5.00	4.00	5.00	4.00	4.00	2.50	5.00	5.00	5.00	0.00	67.50
WebMD	<a href="https://www.webmd.com/">https://www.webmd.com/</a>	5.00	5.00	5.00	3.00	5.00	5.00	5.00	5.00	3.50	5.00	5.00	1.50	3.00	5.00	5.00	3.50	0.71	66.00
Willis-Knighton Health System	<a href="https://www.wkhs.com/">https://www.wkhs.com/</a>	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.50	5.00	5.00	1.50	1.00	5.00	5.00	4.50	0.71	66.00
Healthline	<a href="https://www.healthline.com/">https://www.healthline.com/</a>	5.00	5.00	5.00	4.00	5.00	4.50	4.50	5.00	4.50	5.00	3.50	1.50	3.00	5.00	5.00	5.00	0.00	65.50
PennState Health	<a href="http://pennstatehershey.adam.com/">http://pennstatehershey.adam.com/</a>	4.50	5.00	4.00	3.00	5.00	5.00	5.00	5.00	3.00	5.00	5.00	1.50	1.00	5.00	5.00	4.00	0.00	62.00
Medical News Today	<a href="https://www.medicalnewstoday.com/">https://www.medicalnewstoday.com/</a>	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.00	2.50	5.00	4.50	1.50	1.00	4.50	5.00	4.50	0.71	62.00
St. Luke's Hospital	<a href="https://www.stlukes-stl.com/">https://www.stlukes-stl.com/</a>	5.00	5.00	4.00	2.50	5.00	5.00	5.00	2.00	3.00	5.00	5.00	3.00	1.00	5.00	5.00	4.00	0.00	60.50
Everyday Health	<a href="https://www.everydayhealth.com/">https://www.everydayhealth.com/</a>	5.00	5.00	5.00	3.00	3.00	5.00	5.00	1.50	3.50	5.00	3.50	1.00	1.50	5.00	5.00	4.00	0.00	57.00
Fisher-Titus Medical Center	<a href="https://www.fishertitus.org/">https://www.fishertitus.org/</a>	5.00	5.00	4.50	3.00	4.50	3.50	2.50	5.00	2.50	4.50	3.00	1.50	1.50	5.00	5.00	3.50	0.71	56.00
The Herbal Resource	<a href="https://www.herbal-supplement-resource.com/">https://www.herbal-supplement-resource.com/</a>	5.00	5.00	4.50	3.50	3.00	3.00	5.00	3.00	3.50	5.00	4.50	1.00	2.50	2.00	4.50	3.50	0.71	55.00
Dr. Weil Care/of	<a href="https://www.drweil.com/">https://www.drweil.com/</a>	3.50	5.00	5.00	3.00	3.00	3.50	5.00	2.50	2.50	5.00	3.50	1.00	1.00	4.50	4.50	4.00	0.00	52.50
Dr. Axe	<a href="https://takecareof.com/">https://takecareof.com/</a>	5.00	5.00	5.00	3.50	3.00	2.50	5.00	5.00	2.50	5.00	1.00	1.00	1.50	2.00	4.50	4.00	0.00	51.50
Gaia Herbs	<a href="https://draxe.com/">https://draxe.com/</a>	4.50	5.00	4.50	3.00	3.00	3.50	3.50	1.50	4.50	5.00	1.50	5.00	1.00	1.50	4.50	3.00	0.00	51.50
Health Rising	<a href="https://www.gaiaherbs.com/">https://www.gaiaherbs.com/</a>	5.00	5.00	5.00	3.00	4.50	2.50	5.00	1.50	2.50	4.50	1.50	1.00	1.50	4.50	4.00	2.50	0.71	51.00
Holland and Barrett	<a href="https://www.healthrising.org/">https://www.healthrising.org/</a>	5.00	3.00	2.50	1.50	4.50	2.50	3.00	5.00	2.50	4.50	1.50	4.00	1.50	5.00	5.00	3.50	0.71	51.00
Myprotein	<a href="https://www.hollandandbarrett.com/">https://www.hollandandbarrett.com/</a>	5.00	5.00	4.50	3.00	4.00	3.00	4.00	1.50	4.00	5.00	3.00	1.00	1.00	2.50	4.50	2.50	0.71	51.00
Cleveland Clinic	<a href="https://www.myprotein.com/">https://www.myprotein.com/</a>	4.50	5.00	4.50	4.50	4.50	3.50	5.00	1.00	1.50	5.00	2.00	1.00	1.50	2.50	4.50	3.00	0.00	50.50
	<a href="https://health.clevelandclinic.org/">https://health.clevelandclinic.org/</a>	5.00	5.00	5.00	1.00	2.50	3.50	1.50	1.50	2.50	5.00	4.50	1.50	1.50	5.00	5.00	3.00	0.00	50.00

(continued on next page)

Table 2 (continued)

Section	SECTION 1 Is the publication reliable?															SECTION 2 How good is the quality of information on treatment choices?					SECTION 3 Overall Rating of the Publication			
	1. Are the aims clear?	2. Does it achieve its aims?	3. Is it relevant?	4. Is it clear what sources of information were used to compile the publication (other than the author or producer)?	5. Is it clear when the information used or reported in the publication was produced?	6. Is it balanced and unbiased?	7. Does it provide details of additional sources of support and information?	8. Does it refer to areas of uncertainty?	9. Does it describe how each treatment works?	10. Does it describe the benefits of each treatment?	11. Does it describe the risks of each treatment?	12. Does it describe what would happen if no treatment is used?	13. Does it describe how the treatment choices affect overall quality of life?	14. Is it clear that there may be more than one possible treatment choice?	15. Does it provide shared decision-making?	16. Based on the answers to all of the above questions, rate the overall quality of the publication as a source of information about treatment choices	Standard Deviation of Overall Score (Q16)	DISCERN Score (Sum of Q1-Q15)						
Global Healing Consumer Lab	<a href="https://globalhealing.com/">https://globalhealing.com/</a>	5.00	5.00	4.50	3.00	5.00	3.00	5.00	1.50	2.50	5.00	1.00	1.50	1.00	2.50	4.50	3.50	0.71	50.00					
	<a href="https://www.consumerlab.com/">https://www.consumerlab.com/</a>	5.00	5.00	3.50	1.00	2.50	3.50	1.00	4.50	3.00	5.00	4.50	1.00	1.50	4.50	4.50	3.50	0.71	50.00					
The Herbal Academy	<a href="https://theherbalacademy.com/">https://theherbalacademy.com/</a>	5.00	5.00	3.00	5.00	5.00	3.00	5.00	1.00	3.00	5.00	1.50	1.00	1.50	2.50	3.00	3.00	0.00	49.50					
Amy Myers MD	<a href="https://www.amymyersmd.com/">https://www.amymyersmd.com/</a>	5.00	5.00	4.50	3.50	3.00	3.00	3.00	1.50	2.50	5.00	1.50	1.00	1.50	3.50	4.50	3.50	0.71	48.00					
Inessa Wellness	<a href="https://www.inessawellness.com/">https://www.inessawellness.com/</a>	5.00	5.00	4.50	5.00	3.00	3.00	5.00	1.00	2.50	5.00	1.50	1.00	1.00	2.00	2.50	3.00	0.00	47.00					
Harvard Health Publishing	<a href="https://www.health.harvard.edu/">https://www.health.harvard.edu/</a>	4.50	5.00	3.50	1.00	2.50	3.50	1.00	3.00	3.00	5.00	3.00	1.00	1.00	5.00	4.50	2.50	0.71	46.50					
The British Dietetic Association	<a href="https://www.bda.uk.com/">https://www.bda.uk.com/</a>	3.50	4.50	5.00	3.00	5.00	2.50	5.00	1.00	1.50	5.00	1.00	1.00	1.00	2.50	4.50	3.00	0.00	46.00					
Naturally Savvy	<a href="https://naturallysavvy.com/">https://naturallysavvy.com/</a>	5.00	4.50	3.50	3.00	3.00	3.00	5.00	1.00	3.00	5.00	1.00	1.00	1.00	2.50	3.00	3.00	0.00	44.50					
One Medical	<a href="https://www.onemedical.com/">https://www.onemedical.com/</a>	4.50	3.00	3.00	1.00	2.50	1.50	1.00	5.00	3.00	5.00	3.00	1.50	1.50	4.00	5.00	2.50	0.71	44.50					
Vive Health	<a href="https://www.vivehealth.com.au/">https://www.vivehealth.com.au/</a>	5.00	4.50	2.50	3.00	5.00	3.00	5.00	1.00	2.50	5.00	1.50	1.00	1.50	1.00	3.00	3.00	0.00	44.50					
Eu Yan Sang	<a href="https://www.euyansang.com.sg/">https://www.euyansang.com.sg/</a>	5.00	5.00	3.00	3.50	2.50	3.00	5.00	1.00	2.00	5.00	1.50	1.00	1.50	2.00	3.00	3.00	0.00	44.00					
Mind Body Green	<a href="https://www.mindbodygreen.com/">https://www.mindbodygreen.com/</a>	4.50	4.50	4.50	3.00	3.00	1.50	2.50	1.50	3.00	5.00	1.50	1.00	1.00	2.50	4.50	3.00	0.00	43.50					
Woman's Day	<a href="https://www.womansday.com/">https://www.womansday.com/</a>	4.50	4.50	3.00	2.50	3.00	1.50	2.50	1.00	3.00	5.00	1.50	1.00	5.00	2.50	2.50	2.50	0.71	43.00					
Fusion Health	<a href="https://www.fusionhealth.com.au/">https://www.fusionhealth.com.au/</a>	5.00	5.00	3.50	1.50	1.50	1.50	3.00	1.00	4.50	5.00	1.50	1.00	1.50	2.00	4.50	3.00	0.00	42.00					
AcuMedic	<a href="https://clinic.acumedic.com/">https://clinic.acumedic.com/</a>	5.00	5.00	3.50	1.50	1.00	1.50	1.00	1.00	5.00	5.00	1.00	1.00	1.00	5.00	4.50	3.00	0.00	42.00					
Upper Cervical Awareness	<a href="https://uppercervicalawareness.com/">https://uppercervicalawareness.com/</a>	4.50	5.00	2.00	1.50	3.00	1.50	5.00	1.00	3.00	5.00	1.50	1.50	1.50	1.50	4.50	2.50	0.71	42.00					
Progressive Nutracare	<a href="https://www.progressivenutracare.com/">https://www.progressivenutracare.com/</a>	5.00	3.00	2.00	3.00	2.50	3.00	2.00	1.00	2.50	4.50	1.50	1.00	1.50	2.50	5.00	2.50	0.71	40.00					
Dr. Cobi	<a href="https://www.drcobi.com/">https://www.drcobi.com/</a>	5.00	5.00	4.50	1.00	2.50	2.00	1.50	1.00	2.50	5.00	1.00	1.50	1.50	3.00	2.50	3.00	0.00	39.50					

(continued on next page)

Table 2 (continued)

Section	SECTION 1 Is the publication reliable?															SECTION 2 How good is the quality of information on treatment choices?					SECTION 3 Overall Rating of the Publication		
	1. Are the aims clear?	2. Does it achieve its aims?	3. Is it relevant?	4. Is it clear what sources of information were used to compile the publication (other than the author or producer)?	5. Is it clear when the information used or reported in the publication was produced?	6. Is it balanced and unbiased?	7. Does it provide details of additional sources of support and information?	8. Does it refer to areas of uncertainty?	9. Does it describe how each treatment works?	10. Does it describe the benefits of each treatment?	11. Does it describe the risks of each treatment?	12. Does it describe what would happen if no treatment is used?	13. Does it describe how the treatment choices affect overall quality of life?	14. Is it clear that there may be more than one possible treatment choice?	15. Does it provide support for decision-making?	16. Based on the answers to all of the above questions, rate the overall quality of the publication as a source of information about treatment choices	Standard Deviation of Overall Score (Q16)	DISCERN Score of Overall (Sum of Q1-Q15)					
Nutra Life Urban Moonshine	<a href="https://www.nutralife.com.au/">https://www.nutralife.com.au/</a>	4.50	4.50	2.50	3.00	2.50	2.50	5.00	1.00	1.50	5.00	1.50	1.00	1.00	2.50	1.50	2.50	0.71	39.50				
VAGA	<a href="https://www.vaga.org/">https://www.vaga.org/</a>	5.00	3.00	5.00	1.50	5.00	1.50	1.00	1.00	3.00	4.50	1.00	1.00	1.00	2.50	3.00	2.50	0.71	39.00				
Tonic Natural Health	<a href="https://www.vaga.org/">https://www.vaga.org/</a>	4.50	3.00	2.50	1.00	1.50	2.50	1.00	3.00	2.50	5.00	3.50	1.50	1.00	2.50	3.00	2.50	0.71	38.00				
Thompson's National Institute of Medical Herbalists	<a href="https://tonicnaturalhealth.com.au/">https://tonicnaturalhealth.com.au/</a>	5.00	4.50	4.50	3.00	3.00	2.50	1.50	1.00	2.50	4.50	1.00	1.00	1.50	1.00	1.00	2.50	0.71	37.50				
Theta Health	<a href="https://www.thompsons.co.nz/">https://www.thompsons.co.nz/</a>	4.50	2.50	4.50	1.00	1.50	1.00	1.00	1.00	2.50	5.00	1.50	1.00	1.00	2.50	3.50	2.00	0.00	34.00				
Mother Earth Living	<a href="https://nimh.org.uk/">https://nimh.org.uk/</a>	4.50	3.50	2.50	1.00	1.50	1.50	1.00	1.00	1.00	5.00	1.50	1.00	1.00	3.00	4.00	1.50	0.71	33.00				
Nick Dale Naturopath	<a href="http://www.thetahealth.co.za/">http://www.thetahealth.co.za/</a>	4.50	3.50	5.00	1.00	1.50	1.00	1.00	1.00	2.00	5.00	1.50	1.50	1.00	2.00	1.50	1.50	0.71	33.00				
Nourished Essentials	<a href="https://www.motherearthliving.com/">https://www.motherearthliving.com/</a>	3.00	4.50	4.50	1.50	2.50	1.50	1.50	1.00	2.00	5.00	1.50	1.00	1.00	1.50	1.00	1.50	0.71	32.50				
Bulk Powders	<a href="https://nickdale-naturopath.co.uk/">https://nickdale-naturopath.co.uk/</a>	5.00	3.50	2.50	1.00	1.50	1.50	1.00	1.00	1.00	5.00	1.00	3.00	1.00	2.50	2.00	1.50	0.71	32.50				
TOTAL Means	<a href="https://nourishedessentials.com/">https://nourishedessentials.com/</a>	3.50	4.50	2.50	1.00	1.00	1.00	1.00	1.00	2.50	5.00	1.50	1.00	1.00	1.50	3.50	2.00	0.00	31.50				
TOTAL Standard Deviations	<a href="https://www.bulkpowders.co.uk/">https://www.bulkpowders.co.uk/</a>	3.00	5.00	2.50	1.00	1.50	1.00	1.00	1.50	3.00	5.00	1.50	1.00	1.50	1.50	1.50	2.00	0.00	31.50				
TOTAL Means		4.69	4.55	3.96	2.59	3.29	2.86	3.30	2.22	2.82	4.94	2.38	1.45	1.51	3.19	3.89	3.06	0.35	47.64				
TOTAL Standard Deviations		0.53	0.74	1.01	1.29	1.34	1.27	1.76	1.61	0.87	0.17	1.42	0.88	0.88	1.38	1.23	0.90	0.36	10.38				

ii

**Table 3**  
Recommended Websites for Patients and Consumers

Website Name	URL	DISCERN Score (Sum)	Website Category	Target Audience	Frequency of Updates
Verywell Health	<a href="https://www.verywellhealth.com/">https://www.verywellhealth.com/</a>	71.00	Health portal	Physicians and the general public (including patients and caregivers)	Website states that content is routinely evaluated and updated to reflect the most current information. The precise frequency of updates is unavailable.
Mayo Clinic	<a href="https://www.mayoclinic.org/">https://www.mayoclinic.org/</a>	67.50	Professional	Medical professionals and patients/the general public	Website states that content is updated both routinely and whenever necessary to reflect new or revised information. The precise frequency of updates is unavailable.
WebMD	<a href="https://www.webmd.com/">https://www.webmd.com/</a>	66.00	Health portal	Patients/the general public	Website states that content is corrected and updated promptly. The "News" section is updated daily.
Willis-Knighton Health System	<a href="https://www.wkhs.com/">https://www.wkhs.com/</a>	66.00	Professional	Medical professionals and patients/the general public (including kids, teens and parents)	Content of the "Health Library" section is provided by EBSCO Information Services, which states that information is routinely evaluated and updated. The precise frequency of updates is unavailable.
Healthline	<a href="https://www.healthline.com/">https://www.healthline.com/</a>	65.50	Health portal	Patients/the general public	Website states that content is updated both routinely and whenever necessary. The "Health News" section is updated daily.

non-English language websites. There have been few studies on the quality of non-English online consumer health information, therefore, it is unclear whether our findings apply to non-English websites and the patient populations who access and read them. Lastly, while the DISCERN instrument is intended to evaluate the reliability of a publication as a source of information about treatment choices, it cannot be used to assess the accuracy of the evidence on which a website is based.

**5. Conclusion**

This study assessed the quality of online DHSs consumer health information for the treatment and/or management of fatigue. The DISCERN instrument was used to assess the quality of all eligible websites, and was found to be variable. The present study's findings align with trends identified by published comparative literature assessing the quality of consumer health information with respect to related topics, which notably include a high quantity of commercial websites containing poor quality information. Healthcare providers should be aware of the information that their patients may encounter outside of the clinical setting, so that they can better assist them in identifying and discerning high-quality, publicly available information online.

**Author Contributions**

JYN: Conceptualization, Methodology, Investigation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing.  
CJZ: Investigation, Formal analysis, Writing – Original Draft.  
SA: Investigation, Formal analysis, Writing – Review & Editing.

**Conflict of interest**

The authors declare that they have no competing interests.

**Funding**

JYN was awarded a Research Scholarship and an Entrance Scholarship from the Department of Health Research Methods, Evidence and Impact, Faculty of Health Sciences at [McMaster University](#).

**Ethical statement**

This study involved a search and review of publicly available online information only; it did not require ethics approval or consent to participate.

**Data availability**

All relevant data are included within this manuscript.

**References**

- Jason LA, Evans M, Brown M, Porter N. What is fatigue? pathological and non-pathological fatigue. *PM&R*. 2010;2(5):327–331 May 31. doi:10.1016/j.pmrj.2010.03.028.
- Landmark-Høyvik H, Reinertsen KV, Loge JH, Kristensen VN, Dumeaux V, Fosså SD, et al. The genetics and epigenetics of fatigue. *PM&R*. 2010 May 31;2(5):456–465. doi:10.1016/j.pmrj.2010.04.003.
- van't Leven M, Zielhuis GA, van der Meer JW, Verbeek AL, Bleijenberg G. Fatigue and chronic fatigue syndrome-like complaints in the general population. *Eur J Public Health*. 2009;20(3):251–257 Aug 18. doi:10.1093/eurpub/ckp113.
- Clauw DJ. Perspectives on fatigue from the study of chronic fatigue syndrome and related conditions. *PM&R*. 2010;2(5):414–430 May 31. doi:10.1016/j.pmrj.2010.04.010.
- Brouwers FM, Van Der Werf S, Bleijenberg G, Van Der Zee L, Van Der Meer JWM. The effect of a polynutrient supplement on fatigue and physical activity of patients with chronic fatigue syndrome: a double-blind randomized controlled trial. *QJM*. 2002;95(10):677–683 Oct 1. doi:10.1093/qjmed/95.10.677.
- Canada.ca [Internet]. Ottawa: Government of Canada; 2020 May 6. About Natural Health Products; 2016 Mar 14 [cited 2020 May 6]; [about 3 screens]. Available from: <https://www.canada.ca/en/health-canada/services/drugs-health-products/natural-non-prescription/regulation/about-products.html>
- U.S. Food and Drug Administration [Internet]. White Oak MD: FDA; 2020. questions and answers on dietary supplements; 2019 Jul 22 [cited 2020 Aug 26]; [about 1 screen]. Available from: <https://www.fda.gov/food/information-consumers-using-dietary-supplements/questions-and-answers-dietary-supplements#:~:text=A%20dietary%20supplement%20is%20a,tissues%2C%20glandular%2C%20and%20metabolites>
- Canada.ca [Internet]. Ottawa: Government of Canada; 2020 May 11. natural health products; 2020 May 9 [cited 2020 May 11]; [about 2 screens]. Available from: <https://www.canada.ca/en/health-canada/services/drugs-health-products/natural-non-prescription.html>
- Alraek T, Lee MS, Choi TY, Cao H, Liu J. Complementary and alternative medicine for patients with chronic fatigue syndrome: a systematic review. *BMC Complement Altern Med*. 2011;11:87 Oct 7. doi:10.1186/1472-6882-11-87.
- El Sherif R, Pluye P, Thoër C, Rodriguez C. Reducing negative outcomes of online consumer health information: qualitative interpretive study with clinicians, librarians, and consumers. *J Med Internet Res*. 2018;20(5):e169 May 4. doi:10.2196/jmir.9326.

11. Molassiotis A, Xu M. Quality and safety issues of web-based information about herbal medicines in the treatment of cancer. *Complement Ther Med*. 2005;12(4):217–227 Jan 11. doi:10.1016/j.ctim.2004.09.005.
12. Owens C, Baergen R, Puckett D. Online sources of herbal product information. *Am J Med*. 2014;127(2):109–115 Feb 1. doi:10.1016/j.amjmed.2013.09.016.
13. D'Silva S, van Kessel K. An evaluation of the quality and content of web sites on cancer related fatigue. *J Consum Health Internet*. 2014;18(4):313–336 Nov 4. doi:10.1080/15398285.2014.952997.
14. Kisely SR. Treatments for chronic fatigue syndrome and the Internet: a systematic survey of what your patients are reading. *Aust N Z J Psychiatry*. 2002;36(2):240–245 Apr 1. doi:10.1046/j.1440-1614.2002.01017.x.
15. StatCounter Global Stats [Internet]. [place unknown]: Statcounter; c1999-2020. Search Engine Market Share Worldwide; 2020 Apr [cited 2020 May 8]; [1 screen]. Available from: <https://gs.statcounter.com/search-engine-market-share#monthly-201712-201812-bar>
16. U.S. Department of Health & Human Services [Internet]. Washington: NIH Office of Dietary Supplements; [date unknown]. dietary supplements: what you need to know; 2020 Apr 7 [cited 2020 May 11]; [1 screen]. Available from: [https://ods.od.nih.gov/HealthInformation/DS\\_WhatYouNeedToKnow.aspx](https://ods.od.nih.gov/HealthInformation/DS_WhatYouNeedToKnow.aspx)
17. Chitika, Inc. Chitika insights: the value of google result positioning [Internet]. Westborough: Chitika, Inc.; 2013 [cited 2020 May 11]. 10 p. Available from: <http://info.chitika.com/uploads/4/9/2/1/49215843/chitikainsights-valueofgoogleresultspositioning.pdf>
18. DISCERN [Internet]. DISCERN. [cited 2020 Sep 21]. Available from: <http://www.discrim.org.uk/index.php>
19. Li L, Irvin E, Guzmán J., Bombardier C. Surfing for back pain patients: the nature and quality of back pain information on the Internet. *Spine (Phila Pa 1976)*. 2001 Mar 1;26(5):545–57. 10.1097/00007632-200103010-00020
20. Ng JY, Gilotra K. Web-information surrounding complementary and alternative medicine for low back pain: a cross-sectional survey and quality assessment. *Integr Med Res*. 2021;10(3) Sep 1. doi:10.1016/j.imr.2020.100692.
21. Ipser J.C., Dewing S., Stein D.J. A systematic review of the quality of information on the treatment of anxiety disorders on the internet. *Curr Psychiatry Rep*. 2007 Aug 1;9(4):303–9. 10.1007/s11920-007-0037-3
22. Kaicker J, Debono VB, Dang W, Buckley N, Thabane L. Assessment of the quality and variability of health information on chronic pain websites using the DISCERN instrument. *BMC Med*. 2010;8(1):59 Dec 1. doi:10.1186/1741-7015-8-59.
23. Ng JY, Vacca A, Jain T. The quality of online consumer health information at the intersection of complementary and alternative medicine and arthritis. *Adv Rheumatol*. 2021;61. doi:10.1186/s42358-021-00162-y.
24. Tangri V, Chande N. Quality of Internet-based information on gastrointestinal diseases. *Can J Gastroenterol*. 2011;25(2):93–96 Feb. doi:10.1155/2011/345076.
25. Hallingbye T, Serafini M. Assessment of the quality of postherpetic neuralgia treatment information on the Internet. *J Pain*. 2011;12(11):1149–1154 Nov 1. doi:10.1016/j.jpain.2011.05.005.
26. Thakor V., Leach M.J., Gillham D., Esterman A. The quality of information on websites selling St. John's wort. *Complementary therapies in medicine*. 2011 Jun 1;19(3):155–60. 10.1016/j.ctim.2011.05.005
27. Ng J.Y., Ans M., Marwaha A. Assessing the quality of information provided on websites selling Kratom (*Mitragyna speciosa*) to consumers in Canada. *Substance Abuse Treatment, Prevention, and Policy*. 2021 Dec;16(1):1–5. 10.1186/s13011-021-00361-2
28. Ng J.Y., Marwaha A., Ans M. The quality of information available about Ephedra Sinica on online vendor websites: the Canadian consumer experience. *complementary therapies in medicine*. 2021 Mar 1;57:102674. 10.1016/j.ctim.2021.102674
29. Ng JY, Luong M. Evaluation of the Canadian natural health product regulatory framework in academic research: A scoping review. *European Journal of Integrative Medicine*. 2020;37. doi:10.1016/j.eujim.2020.101159.