

AACT Herbal Dietary Supplement Section Abstracts March 2021

1. Clinical Pharmacokinetics of Cannabinoids and Potential Drug-Drug Interactions.

Vázquez M, García-Carnelli C, Maldonado C, Fagiolino P.

Adv Exp Med Biol. 2021;1297:27-42. doi: 10.1007/978-3-030-61663-2_3.

Over the past few years, considerable attention has focused on cannabidiol (CBD) and Δ^9 -tetrahydrocannabinol (THC), the two major constituents of *Cannabis sativa*, mainly due to the promising potential medical uses they have shown. However, more information on the fate of these cannabinoids in human subjects is still needed and there is limited research on the pharmacokinetic drug-drug interactions that can occur in the clinical setting and their prevalence. As the use of cannabinoids is substantially increasing for many indications and they are not the first-line therapy in any treatment, health care professionals must be aware of drug-drug interactions during their use as serious adverse events can happen related with toxic or ineffective outcomes. The present chapter overview summarizes our current knowledge on the pharmacokinetics and metabolic fate of CBD and THC in humans and discusses relevant drug-drug interactions, giving a plausible explanation to facilitate further research in the area.

DOI: 10.1007/978-3-030-61663-2_3

PMID: 33537935 [Indexed for MEDLINE]

2. Cannabidiol Interactions with Medications, Illicit Substances, and Alcohol: a Comprehensive Review. Balachandran P, Elsohly M, Hill KP.

J Gen Intern Med. 2021 Jan 29. doi: 10.1007/s11606-020-06504-8. Online ahead of print.

Cannabidiol, a non-intoxicating phytocannabinoid, has potential therapeutic effects over a broad range of disorders. Recently, there has been increased interest in CBD, as several studies showed promising anticonvulsant efficacy with few side effects. In 2018, a CBD-based oral solution, Epidiolex®, was approved by the FDA to treat two severe forms of pediatric epilepsy, Dravet syndrome, and Lennox-Gastaut syndrome. Although only these two syndromes are recognized indications for CBD, it has been consumed in an unregulated fashion for a variety of indications including chronic pain, muscle stiffness, inflammation, anxiety, smoking cessation, and even cancer. While CBD legislation in the USA is confusing due to the differences in state and federal laws, CBD has proliferated in the US market in several forms such as CBD oil or capsules, hemp oil/extract, and also as an ingredient in several dietary supplements, syrups, teas, and creams. With the ever-increasing use of CBD and its widespread availability to the general public, it is important to examine and report on possible drug-drug interactions between CBD and other therapeutic agents as well as addictive substances such as alcohol and tobacco. A detailed literature search for CBD's possible interactions was conducted using online databases. As expected, CBD has been reported to interact with anti-epileptic drugs, antidepressants, opioid analgesics, and THC, but surprisingly, it interacts with several other common medications, e.g. acetaminophen, and substances including alcohol. This review provides a comprehensive list of interacting drugs. The possible mechanisms for these drug-drug interactions are presented in table format. Given the growing popularity of CBD as a medication and the dearth of available information on CBD drug-drug interactions, it is critical to be aware of current drug-drug interactions and it will be important to investigate the impact of CBD upon concomitant medication use in future randomized, controlled trials.

DOI: 10.1007/s11606-020-06504-8

PMID: 33515191

3. A systematic review of possible interactions for herbal medicines and dietary supplements used concomitantly with disease-modifying or symptom-alleviating multiple sclerosis drugs. Petersen MJ, Bergien SO, Staerk D.

Phytother Res. 2021 Feb 24. doi: 10.1002/ptr.7050. Online ahead of print.

Multiple Sclerosis (MS) is a demyelinating disease affecting the central nervous system, with no curative medicine available. The use of herbal drugs and dietary supplements is increasing among people with MS (PwMS), raising a need for knowledge about potential interactions between conventional MS medicine and herbal drugs/dietary supplements. This systematic review provides information about the safety of simultaneous use of conventional MS-drugs and herbal drugs frequently used by PwMS. The study included 14 selected disease-modifying treatments and drugs frequently used for symptom-alleviation. A total of 129 published papers found via PubMed and Web of Science were reviewed according to defined inclusion- and exclusion criteria. Findings suggested that daily recommended doses of Panax ginseng and Ginkgo biloba should not be exceeded, and herbal preparations differing from standardized products should be avoided, especially when combined with anticoagulants or substrates of certain cytochrome P450 isoforms. Further studies are required regarding ginseng's ability to increase aspirin bioavailability. Combinations between chronic cannabis use and selective serotonin reuptake inhibitors or non-steroidal antiinflammatory drugs should be carefully monitored, whereas no significant evidence for drug-interactions between conventional MS-drugs and ginger, cranberry, vitamin D, fatty acids, turmeric, probiotics or glucosamine was found.

DOI: 10.1002/ptr.7050

PMID: 33624893

4. "Natural" is not synonymous with "Safe": Toxicity of natural products alone and in combination with pharmaceutical agents. Gaston TE, Mendrick DL, Paine MF, Roe AL, Yeung CK.

Regul Toxicol Pharmacol. 2020 Jun;113:104642. doi: 10.1016/j.yrtph.2020.104642. Epub 2020 Mar 18.

During the 25 years since the US Congress passed the Dietary Supplement Health and Education Act (DSHEA), the law that transformed the US Food and Drug Administration's (FDA's) authority to regulate dietary supplements, the dietary supplement market has grown exponentially. Retail sales of herbal products, a subcategory of dietary supplements, have increased 83% from 2008 to 2018 (\$4.8 to \$8.8 billion USD). Although consumers often equate "natural" with "safe", it is well recognized by scientists that constituents in these natural products (NPs) can result in toxicity. Additionally, when NPs are co-consumed with pharmaceutical agents, the precipitant NP can alter drug disposition and drug delivery, thereby enhancing or reducing the therapeutic effect of the object drug(s). With the widespread use of NPs, these effects can be underappreciated. We present a summary of a symposium presented at the Annual Meeting of the Society of Toxicology 2019 (12 March 2019) that discussed potential toxicities of NPs alone and in combination with drugs.

DOI: 10.1016/j.yrtph.2020.104642

PMCID: PMC7211136

PMID: 32197968 [Indexed for MEDLINE]

5. Comparison of eight screening tools to detect interactions between herbal supplements and oncology agents. Shakeel F, Fang F, Kidwell KM, Marcath LA, Hertz DL.

J Oncol Pharm Pract. 2020 Dec;26(8):1843-1849. doi: 10.1177/1078155220905009. Epub 2020 Feb 19.

INTRODUCTION: Patients with cancer are increasingly using herbal supplements, unaware that supplements can interact with oncology treatment. Herb-drug interaction management is critical to ensure optimal treatment outcomes. Several screening tools exist to detect drug-drug interactions, but their performance to detect herb-drug interactions is not known. This study compared the performance of eight drug-drug interaction screening tools to detect herb-drug interaction with anti-cancer agents. **METHODS:** The herb-drug interaction detection performance of four subscription (Micromedex, Lexicomp, PEPID, Facts & Comparisons) and free (Drugs.com, Medscape, WebMD, RxList) drug-drug interaction tools was assessed. Clinical relevance of each herb-drug interaction was determined using Natural Medicine and each drug-drug interaction tool. Descriptive statistics were used to calculate sensitivity, specificity, positive predictive value, and negative predictive value. Linear regression was used to compare performance between subscription and free tools. **RESULTS:** All tools had poor sensitivity (<0.20) for detecting herb-drug interaction. Lexicomp had the highest positive predictive value (0.98) and best overall performance score (0.54), while Medscape was the best performing free tool (0.52). The worst subscription tools were as good as or better than the best free tools, and as a group subscription tools outperformed free tools on all metrics. Using an average subscription tool would detect one additional herb-drug interaction for every 10 herb-drug interactions screened by a free tool. **CONCLUSION:** Lexicomp is the best available tool for screening herb-drug interaction, and Medscape is the best free alternative; however, the sensitivity and performance for detecting herb-drug interaction was far lower than for drug-drug interactions, and overall quite poor. Further research is needed to improve herb-drug interaction screening performance.

DOI: 10.1177/1078155220905009

PMID: 32075508 [Indexed for MEDLINE]

6. Drug adulteration of sexual enhancement supplements: a worldwide insidious public health threat. Yelehe-Okouma M, Pape E, Humbertjean L, Evrard M, El Osta R, Petitpain N, Gillet P, El Balkhi S, Scala-Bertola J.

Fundam Clin Pharmacol. 2021 Jan 22. doi: 10.1111/fcp.12653. Online ahead of print.

Worldwide, the consumption of dietary supplements for the enhancement of sexual performance is common. Consumers are generally fond of these products because they often want to avoid drugs, preferring "natural" than "chemical" solutions. This is challenging, as many of these supplements labelled "herbal" or "natural" are actually adulterated with drugs, mainly phosphodiesterase-5 inhibitors. This phenomenon is facilitated by fewer demanding regulations for marketing supplements. Thus, consumers may be widely exposed to serious adverse events, such as acute liver injury, kidney failure, pulmonary embolism, stroke or even death. We aim to warn physicians about this issue. This multidisciplinary review simultaneously deals with clinical consequences of this phenomenon, analytical toxicology, and regulation. Indeed, after outlining this worldwide issue and highlighting that a drug-adulterated dietary supplement is actually a falsified drug, we discuss its main contributing factors. Then, we describe some examples of adverse events of which a case of sildenafil-tadalafil-induced ischaemic stroke that benefited medical care in our hospital. Furthermore, we present some means to avoid adulteration and discuss their limitations that may be explained by the

heterogeneity of the regulation of dietary supplements between countries. Doing so, we point out the requirement of a global harmonization of this regulation for an efficient eradication of this public health threat. Meanwhile, dietary supplements should be considered adulterated until proven otherwise. Thus, we encourage physicians to investigate these products in the drug histories of their patients, especially when clinical conditions cannot be explained by classical aetiologies.

DOI: 10.1111/fcp.12653
PMID: 33484004

7. High dose vitamin C induced methemoglobinemia and hemolytic anemia in glucose-6-phosphate dehydrogenase deficiency. Lo YH, Mok KL.

Am J Emerg Med. 2020 Nov;38(11):2488.e3-2488.e5. doi: 10.1016/j.ajem.2020.05.099. Epub 2020 Jun 1.

Investigational use of intravenous vitamin C has been on the rise, but its side effects may be underreported. A 75-year-old woman presented with acute onset of jaundice, dark urine and shortness of breath after receiving 30 g of vitamin C infusion as an unconventional therapy for her hemifacial spasm. Diagnosis of methemoglobinemia and hemolytic anemia was made clinically and confirmed on laboratory tests. She recovered with supportive treatment and packed cell transfusion. Her previously unrecognized underlying condition of glucose-6-phosphate dehydrogenase (G6PD) deficiency was confirmed months after the initial presentation. This is the first reported case of methemoglobinemia and hemolytic anemia induced by high dose vitamin C in a female patient with G6PD deficiency. The dosage of vitamin C administered was also relatively low compared with previous adult reports. When administered at physiological dose, vitamin C can be used as an alternative to methylene blue in treatment of methemoglobinemia in patients with G6PD deficiency. However at supraphysiological dose vitamin C can paradoxically lead to hemolytic anemia in the same group of patients. Physicians should be alert of these potential complications of high dose vitamin C.

DOI: 10.1016/j.ajem.2020.05.099
PMID: 32561141 [Indexed for MEDLINE]

8. [Severe Vitamin D intoxication]. [Article in German]. Frischknecht L, von Rappard J.

MMW Fortschr Med. 2020 Nov;162(20):54-57. doi: 10.1007/s15006-020-4412-x.

DOI: 10.1007/s15006-020-4412-x
PMID: 33219972 [Indexed for MEDLINE]

9. Bodybuilding supplements leading to copper toxicity, encephalopathy, fulminant hepatic failure and rhabdomyolysis. Richards JR, Scheerlinck PH, Owen KP, Colby DK.

Am J Emerg Med. 2020 Nov;38(11):2487.e1-2487.e5. doi: 10.1016/j.ajem.2020.05.096. Epub 2020 Jun 2.

Millions of people worldwide use nutritional and dietary supplements, such as vitamins and minerals. These and other performance-enhancing substances are also used by high school, college, and professional athletes, bodybuilders, and amateur sports enthusiasts. The constituents of these supplements and their metabolites may be harmful and not listed on the product label. We present a case report of a 32-year-old bodybuilder using myriad nutritional,

performance-enhancing, and weight-loss supplements with life-threatening encephalopathy, hepatic failure, rhabdomyolysis, and copper toxicity mimicking Wilson's disease. Emergency physicians and nurses should be aware of these potential deleterious effects and inquire about supplement use by patients with unexplained multiorgan failure. Family, friends, or acquaintances should be asked to bring the actual products to the hospital for analysis.

DOI: 10.1016/j.ajem.2020.05.096
PMID: 32532617 [Indexed for MEDLINE]

10. A rare case of turmeric-induced hepatotoxicity. Chand S, Hair C, Beswick L.

Intern Med J. 2020 Feb;50(2):258-259. doi: 10.1111/imj.14727.

DOI: 10.1111/imj.14727
PMID: 32037709 [Indexed for MEDLINE]

11. An Unusual Culprit of Drug-Induced Pancreatitis. Weissman S, Lo A, Patel R, Mehta TI, Singh V, Aziz M, Belyayeva A, Cherian J, Amrutiya V, Atoot A, Hassan A, Sotiriadis J, Atoot A, Tabibian JH.

Dig Dis Sci. 2020 May;65(5):1549-1552. doi: 10.1007/s10620-019-05864-4. Epub 2019 Sep 30.

Black elderberry (*Sambucus mexicana*)

DOI: 10.1007/s10620-019-05864-4
PMID: 31571105 [Indexed for MEDLINE]

12. Acute Liver Injury After Long-Term Herbal "Liver Cleansing" and "Sleep Aid" Supplement Use. Koenig G, Callipari C, Smereck JA.

J Emerg Med. 2021 Feb 9:S0736-4679(21)00004-4. doi: 10.1016/j.jemermed.2021.01.004. Online ahead of print.

BACKGROUND: Acute liver injury is reported in association with toxins, pharmaceuticals, and viral infections. Increasingly prevalent are cases of herbal- and dietary supplement-related hepatotoxicity. Early recognition of this potentially life-threatening complication by emergency care providers leads to more appropriate management and disposition. **CASE REPORT:** A 53-year-old woman presented to the emergency department with a 3-day history of jaundice and increased abdominal girth after a month-long use of a combination herbal "liver-cleansing" compound and a nightly herbal "sleep aid." The "Liver Detoxifier and Regenerator" listed multiple constituents, including concentrated scute root and turmeric root; "Restful Sleep" listed multiple constituents, including valerian. Emergency department evaluation revealed marked hyperbilirubinemia with liver enzyme elevations indicative of cholestatic jaundice. Imaging studies, including ultrasound and abdominal magnetic resonance imaging, revealed hepatomegaly and steatosis without biliary dilatation; a biopsy specimen was obtained, and the results were consistent with drug-induced liver injury. The patient's liver function abnormalities gradually improved with discontinuation of the products as well as a tapered course of corticosteroid therapy. **WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?:** A significant proportion of the U.S. adult population uses herbal and dietary supplements. Most patients do not discuss nonprescription medication use with their providers and many physicians will not specifically ask about herbal supplements. It is important for emergency physicians to be aware of the potential for herbal supplements to contribute to

acute liver injury and be able to investigate the active agents reported in these formulations. The diagnostic criteria for cholestatic jaundice and drug-induced liver injury are discussed.

DOI: 10.1016/j.jemermed.2021.01.004
PMID: 33579656

13. Ocular complications of Garcinia cambogia extract diet pills: Case report. Cho HK, Han YS, Park JM.

Eur J Ophthalmol. 2020 Nov;30(6):NP21-NP26. doi: 10.1177/1120672119872364. Epub 2019 Oct 3.

BACKGROUND: Garcinia cambogia contains hydroxycitric acid. Hydroxycitric acid is a potent competitive inhibitor of adenosine triphosphate citrate lyase which is a key enzyme in the synthesis of fatty acids. Hydroxycitric acid also regulates the level of serotonin. In these regards, hydroxycitric acid has been reported to exhibit weight loss activity. Adverse reactions of G. cambogia from numerous clinical studies demonstrated relatively mild reactions. However, there are some complications of G. cambogia reported in the past: acute liver injury, acute hepatitis, and hepatic failure. However, ocular complications of G. cambogia have not been reported yet. **CASE PRESENTATION:** A 35-year-old female visited our clinic with decreased vision in the left eye and ocular pain in both eyes for the last 6 days. She also complained of headache, dizziness, and nausea. She had taken G. cambogia extract more than the recommended dose. There was myopic shift with anterior chamber shallowing in both eyes, especially in the left eye. Moreover, swelling and retinal folds of peripapillary retinal nerve fiber layer and macula were observed in both eyes. These ocular complications of G. cambogia extract resolved after discontinuation of the extract and topical and oral steroid treatment. Herein, we report the first case of ocular complications of G. cambogia extract diet pill assessed with optical coherence tomography of optic disk and macula along with dual Scheimpflug analyzer. **CONCLUSION:** It is necessary that physicians dealing with obesity advice patients about possible visual disturbance of this extract when taken in overdose so that they can see an ophthalmologist immediately.

DOI: 10.1177/1120672119872364
PMID: 31578090 [Indexed for MEDLINE]

14. Amphetamine-like Neurochemical and Cardiovascular Effects of α -Ethylphenethylamine Analogs Found in Dietary Supplements. Schindler CW, Thorndike EB, Partilla JS, Rice KC, Baumann MH.

J Pharmacol Exp Ther. 2021 Jan;376(1):118-126. doi: 10.1124/jpet.120.000129. Epub 2020 Oct 20.

Dietary supplements often contain additives not listed on the label, including α -ethyl homologs of amphetamine such as N, α -diethylphenethylamine (DEPEA). Here, we examined the neurochemical and cardiovascular effects of α -ethylphenethylamine (AEPEA), N-methyl- α -ethylphenethylamine (MEPEA), and DEPEA as compared with the effects of amphetamine. All drugs were tested in vitro using uptake inhibition and release assays for monoamine transporters. As expected, amphetamine acted as a potent and efficacious releasing agent at dopamine transporters (DAT) and norepinephrine transporters (NET) in vitro. AEPEA and MEPEA were also releasers at catecholamine transporters, with greater potency at NET than DAT. DEPEA displayed fully efficacious release at NET but weak partial release at DAT (i.e., 40% of maximal effect). In freely moving, conscious male rats fitted with biotelemetry

transmitters for physiologic monitoring, amphetamine (0.1-3.0 mg/kg, s.c.) produced robust dose-related increases in blood pressure (BP), heart rate (HR), and motor activity. AEPEA (1-10 mg/kg, s.c.) produced significant increases in BP but not HR or activity, whereas DEPEA and MEPEA (1-10 mg/kg, s.c.) increased BP, HR, and activity. In general, the phenethylamine analogs were approximately 10-fold less potent than amphetamine. Our results show that α -ethylphenethylamine analogs are biologically active. Although less potent than amphetamine, they produce cardiovascular effects that could pose risks to humans. Given that MEPEA and DEPEA increased locomotor activity, these substances may also have significant abuse potential. SIGNIFICANCE STATEMENT: The α -ethyl homologs of amphetamine have significant cardiovascular, behavioral, and neurochemical effects in rats. Given that these compounds are often not listed on the ingredient labels of dietary supplements, these compounds could pose a risk to humans using these products.

DOI: 10.1124/jpet.120.000129
PMCID: PMC7788351
PMID: 33082158 [Indexed for MEDLINE]

15. Review: Usnic acid-induced hepatotoxicity and cell death. Kwong SP, Wang C.

Environ Toxicol Pharmacol. 2020 Nov;80:103493. doi: 10.1016/j.etap.2020.103493. Epub 2020 Sep 19.

Increasing prevalence of herbal and dietary supplement-induced hepatotoxicity has been reported worldwide. Usnic acid (UA) is a well-known hepatotoxin derived from lichens. Since 2000, more than 20 incident reports have been received by the US Food and Drug Administration after intake of UA containing dietary supplement resulting in severe complications. Scientists and clinicians have been studying the cause, prevention and treatment of UA-induced hepatotoxicity. It is now known that UA decouples oxidative phosphorylation, induces adenosine triphosphate (ATP) depletion, decreases glutathione (GSH), and induces oxidative stress markedly leading to lipid peroxidation and organelle stress. In addition, experimental rat liver tissues have shown massive vacuolization associated with cellular swellings. Additionally, various signaling pathways, such as c-JNK N-terminal kinase (JNK), store-operated calcium entry, nuclear erythroid 2-related factor 2 (Nrf2), and protein kinase B/mammalian target of rapamycin (Akt/mTOR) pathways are stimulated by UA causing beneficial or harmful effects. Nevertheless, there are controversial issues, such as UA-induced inflammatory or anti-inflammatory responses, cytochrome P450 detoxifying UA into non-toxic or transforming UA into reactive metabolites, and unknown mechanism of the formation of vacuolization and membrane pore. This article focused on the previous and latest comprehensive putative mechanistic findings of UA-induced hepatotoxicity and cell death. New insights on controversial issues and future perspectives are also discussed and summarized.

DOI: 10.1016/j.etap.2020.103493
PMID: 32961280 [Indexed for MEDLINE]

16. The scoop on brain health dietary supplement products containing huperzine A. Crawford C, Wang YH, Avula B, Bae JY, Khan IA, Deuster PA.

Clin Toxicol (Phila). 2020 Oct;58(10):991-996. doi: 10.1080/15563650.2020.1713337. Epub 2020 Jan 28.

Context: Public health concerns are emerging surrounding huperzine A commonly found in dietary supplements. We sought to determine the actual content of products claiming to contain huperzine A and whether the ingredients on the supplement facts labels matched the analyses. Methods: We identified and analyzed 22 dietary supplement products listing huperzine A on product labels. We found these products were listed in Natural Medicines and Dietary Supplement Databases and being queried by Military Service Members for enhanced mental focus, alertness and energy. Analyses were conducted by using Liquid Chromatography-Quadrupole Time of Flight Mass Spectrometry. Results: Sixteen (73%) products had at least one ingredient claimed on the supplement facts label not detected through analysis. Compounds not reported on the label were detected in 16 (73%) products analyzed. Nine products (41%) listed ingredients not meeting the regulations for being a dietary supplement ingredient according to the FDA. Ingredients of most concern detected include stimulants: demelverine, 1,5-dimethylhexylamine, 1,3-dimethylhexylamine, N-phenethyl dimethylamine, halostachine, higenamine, noopept, β -PEA, vinpocetine, sulbutiamine; and hordenine, currently on the FDA advisory list. Quantitative analysis showed the presence of huperzine A in the range from detected under the limits of quantification (DUL) to 267.1 μ g/ serving. Only two supplements showed huperzine A content within 10% of the declared amount. Conclusions: In a study of dietary supplements claiming to contain huperzine A, we found products that had at least one ingredient claimed on the supplement facts label not detected through analysis. Moreover, some ingredients not on the label could be dangerous and likely do not meet the definition of a dietary supplement ingredient according to the FDA. Quantitative analysis of huperzine A showed the amount detected was not in line with what appeared on the product label. Consumers should be aware of deceptive label claims and warned not to purchase products containing potentially dangerous ingredients.

DOI: 10.1080/15563650.2020.1713337
PMID: 31990212 [Indexed for MEDLINE]

17. The Popularity of the Dietary Supplements and Functional Foods in The Coronavirus Pandemic Among The Google Users in the USA, UK, Germany, Italy and France. Günelan E, Cebioğlu İK, Çonak Ö.

Complement Ther Med. 2021 Feb 15:102682. doi: 10.1016/j.ctim.2021.102682. Online ahead of print.

OBJECT: The aim of this retrospective infodemiological study was to evaluate people's interests in dietary supplements and functional foods during the coronavirus pandemic via analysis of Google search engine statistics. DESIGN & SETTINGS: The category, period, and regions selected in the Google Trends were "health," "15 January-15 May 2020," in the USA, the United Kingdom (UK), Germany, Italy, and France, respectively. The most commonly searched dietary supplements and functional foods (n=32) during the pandemic were determined from a pool of keywords (n=1,286) based on the terms' relative search volumes (RSVs) within the last five years. Correlation analyses were conducted to investigate associations between coronavirus-related parameters with each keyword's RSV for each country. Selected keywords (n=25) were analyzed using the gtrendsR package in the R programming language; the ggplot2 package was used to visualize the data, the Prophet package was used to estimate the time series, and the dplyr package was used to create the data frame. RESULTS: Significantly strong positive correlations were identified between daily RSVs of the terms "black seed," "vitamin C," "zinc," and "quercetin," and search queries for "coronavirus" and "COVID-19" in the USA (Spearman's correlation coefficient >0.8, p<0.000), and between the RSVs of the terms "vitamin C" and "zinc," and daily search queries for "coronavirus" and/or "COVID-19" in the UK (Spearman's correlation coefficient > 0.8, p<0.05).

CONCLUSION: Google Trends can be a beneficial tool for following public interest in identifying outbreak-related misinformation, and scientific studies and statements from authorities and the media play a potential role in driving internet searches.

DOI: 10.1016/j.ctim.2021.102682

PMCID: PMC7883724

PMID: 33601014

18. Determination of interest in vitamin use during COVID-19 pandemic using Google Trends data: Infodemiology study. Çimke S, Yıldırım Gürkan D.

Nutrition. 2021 Jan 10;85:111138. doi: 10.1016/j.nut.2020.111138. Online ahead of print.

OBJECTIVE: The aim of this study was to determine the interest in vitamin use during the COVID-19 pandemic using Google Trends data. METHOD: Searches were made between January 1, 2016 and August 30, 2020. First, the word "vitamin" was searched. Additionally, the search words "vitamin," "COVID-19," "immunity," and "Vitamin D," "Vitamin C," "Vitamin E," and "Vitamin A" were searched comparatively. Search was made in Turkish (in Turkey) and English (in world). Additionally, the word "vitamin" was translated into some countries' languages and was searched. Relative search volumes (RSVs) obtained in searches are presented with graphics. RSVs, downloaded as .csv were transferred to SPSS. Descriptive data was given as numbers and percentages. Kruskal-Wallis analysis was used to determine the difference of RSVs according to years and seasons. Additionally, rising queries related to search words were presented. RESULTS: Findings from the present study determined that the trend toward vitamins reached 100 RSVs in March 2020, when COVID-19 was declared a pandemic. Vitamins D and C were the most frequently searched vitamin type in Turkey and worldwide. It was determined that the searches consisting of a combination of COVID-19 and vitamins were made. CONCLUSION: Vitamins attract the public interest globally. Seasonal variation and COVID-19 shaped the popularity of vitamins both worldwide and in Turkey. The search was highest in the autumn and spring, but the largest search related to all search terms was determined to be in March 2020. Interest in vitamins has increased since the beginning of the COVID-19 pandemic.

DOI: 10.1016/j.nut.2020.111138

PMCID: PMC7797169

PMID: 33578243