



## Quercetin

Updated: March 28, 2020.

## OVERVIEW

### Introduction

Quercetin is a flavonoid found in many foods and herbs and is a regular component of a normal diet. Extracts of quercetin have been used to treat or prevent diverse conditions including cardiovascular disease, hypercholesterolemia, rheumatic diseases, infections and cancer but have not been shown to be effective in clinical trials for any medical condition. Quercetin as a nutritional supplement is well tolerated and has not been linked to serum enzyme elevations or to episodes of clinically apparent liver injury.

### Background

Quercetin is a flavonoid found in many foods and herbs that has been purported to be beneficial to health, improving metabolic function, modulating inflammation and decreasing serum cholesterol. Quercetin is found in high concentrations in apples, berries, green beans, asparagus, broccoli, tomatoes, onions, beer and red wine as well as in several herbs include Ginkgo biloba, St. John's wort, milk thistle and American elder, the typical Western diet having an estimated intake of 4 to 40 mg daily. The beneficial effects of quercetin have been suggested by several studies of human nutrition which have shown decreases in morbidity and mortality associated with higher intake of quercetin-rich foods such as fruits and green vegetables. Flavonoids have antioxidant effects that may protect against cell injury. In vitro, antioxidants such as quercetin have been shown to decrease oxidation of cholesterol esters which appears to play a role in the pathogenesis of atherosclerosis. Quercetin also has antiinflammatory activity inhibiting cyclooxygenase enzymes, synthesis of leukotrienes and prostaglandins and inhibiting histamine release. In cell culture and animal models, quercetin appears to have anticarcinogenic effects which have led to its evaluation in several forms of cancer. Finally, quercetin has been purported to improve athletic performance and reduce postexercise inflammation and oxidative stress. The diverse potential beneficial effects of quercetin have led it to be marketed in multiple dietary supplements with many health claims. Quercetin is available as an over-the-counter nutritional supplement typically in doses of 500 to 1000 mg daily. Quercetin is also frequently a component of multiingredient dietary supplements advertised as beneficial for general health, weight loss, body building and boosting energy. Quercetin is well tolerated and generally reported as having no discernable adverse effects. Abdominal discomfort, nausea and headache have been reported in some studies, but generally at low rates that are similar to those with placebo therapy.

### Hepatotoxicity

Quercetin supplements have not been linked serum aminotransferase elevations during therapy, although there have been few focused studies of its hepatic safety. Furthermore, there have been no published reports of

clinically apparent liver injury attributable to quercetin. Indeed, many in vitro and in vivo studies have shown that quercetin protects against hepatic injury caused by drugs and toxins including acetaminophen and cancer chemotherapeutic agents. These hepatoprotective effects have not been demonstrated in prospective clinical trials in humans.

Likelihood score: E (unlikely cause of clinically apparent liver injury).

Other Names: Often a component in Bioflavonoid Extracts

Drug Class: [Herbal and Dietary Supplements](#)

## PRODUCT INFORMATION

### REPRESENTATIVE TRADE NAMES

Quercetin – Generic

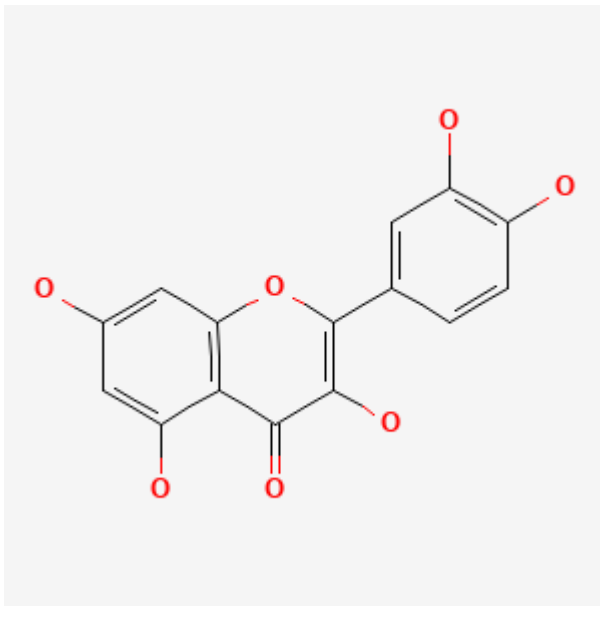
### DRUG CLASS

Herbal and Dietary Supplements

### SUMMARY INFORMATION

[Fact Sheet on Dietary Supplements for Exercise and Athletic Performance, NIH](#)

## CHEMICAL FORMULA AND STRUCTURE

DRUG	CAS REGISTRY NUMBER	MOLECULAR FORMULA	STRUCTURE
Quercetin	117-39-5	C <sub>15</sub> -H <sub>10</sub> -O <sub>7</sub>	

## ANNOTATED BIBLIOGRAPHY

References updated: 28 March 2020

Zimmerman HJ. Unconventional drugs. Miscellaneous drugs and diagnostic chemicals. In, Zimmerman, HJ. Hepatotoxicity: the adverse effects of drugs and other chemicals on the liver. 2nd ed. Philadelphia: Lippincott, 1999: pp. 731-4.

*(Expert review of hepatotoxicity published in 1999; several herbal medications linked to liver injury are discussed, but quercetin is not mentioned).*

Seeff L, Stickel F, Navarro VJ. Hepatotoxicity of herbals and dietary supplements. In, Kaplowitz N, DeLeve LD, eds. Drug-induced liver disease. 3rd ed. Amsterdam: Elsevier, 2013, pp. 631-58.

*(Review of hepatotoxicity of herbal supplements, does not mention quercetin).*

Quercetin. In, PDR for Herbal Medicines. 4th ed. Montvale, New Jersey: Thomson Healthcare Inc. 2007: pp. 1001-3.

*(Compilation of short monographs on herbal medications and nutritional supplements).*

Shoskes DA, Zeitlin SI, Shahed A, Rajfer J. Quercetin in men with category III chronic prostatitis: a preliminary prospective, double-blind, placebo-controlled trial. *Urology*. 1999;54:960-3. PubMed PMID: 10604689.

*(Among 30 men with symptoms of prostatitis treated with quercetin [500 mg twice daily] or placebo for 1 month, improvement in symptom scores was greater with quercetin than placebo and side effects were minimal; no mention of ALT elevations or hepatotoxicity).*

Russo MW, Galanko JA, Shrestha R, Fried MW, Watkins P. Liver transplantation for acute liver failure from drug-induced liver injury in the United States. *Liver Transpl*. 2004;10:1018-23. PubMed PMID: 15390328.

*(Among ~50,000 liver transplants reported to UNOS between 1990 and 2002, 270 [0.5%] were done for drug induced acute liver failure, including 7 [5%] for herbal medications, but none were attributed to quercetin).*

Shoskes D, Lapierre C, Cruz-Correa M, Muruve N, Rosario R, Fromkin B, Braun M, et al. Beneficial effects of the bioflavonoids curcumin and quercetin on early function in cadaveric renal transplantation: a randomized placebo controlled trial. *Transplantation*. 2005;80:1556-9. PubMed PMID: 16371925.

*(Among 43 patients undergoing renal transplantation treated with a combination of curcumin [480 mg] and quercetin [20 mg] or placebo, serum creatinine improved more rapidly with the herbal supplement and side effects were minimal, although one subject developed transient "unexplained" elevations in "liver function tests").*

Andrade RJ, Lucena MI, Fernández MC, Pelaez G, Pachkoria K, García-Ruiz E, García-Muñoz B, et al. Drug-induced liver injury: an analysis of 461 incidences submitted to the Spanish Registry over a 10-year period. *Gastroenterology*. 2005;129:512-21. PubMed PMID: 16083708.

*(Reports of drug induced liver injury to a Spanish network found 570 cases, herbal medications accounted for 9 cases but none were attributed to quercetin).*

Chalasani N, Fontana RJ, Bonkovsky HL, Watkins PB, Davern T, Serrano J, Yang H, Rochon J; Drug Induced Liver Injury Network (DILIN). Causes, clinical features, and outcomes from a prospective study of drug-induced liver injury in the United States. *Gastroenterology*. 2008;135:1924-34. PubMed PMID: 18955056.

*(Among 300 cases of drug induced liver disease in the US collected between 2004 and 2008, 9% of cases were attributed to herbal medications, but quercetin was not specifically implicated in any of the cases).*

García-Cortés M, Borraz Y, Lucena MI, Peláez G, Salmerón J, Diago M, Martínez-Sierra MC, et al. *Rev Esp Enferm Dig*. 2008;100:688-95. [Liver injury induced by "natural remedies": an analysis of cases submitted to the Spanish Liver Toxicity Registry]. Spanish. PubMed PMID: 19159172.

*(Among 521 cases of drug induced liver injury submitted to Spanish registry, 13 [2%] were due to herbals, but none specifically to quercetin).*

Jacobsson I, Jönsson AK, Gerdén B, Hägg S. Spontaneously reported adverse reactions in association with complementary and alternative medicine substances in Sweden. *Pharmacoepidemiol Drug Saf*. 2009;18:1039-47. PubMed PMID: 19650152.

*(Review of 778 spontaneous reports of adverse reactions to herbals to Swedish Registry; no specific mention of quercetin).*

Reuben A, Koch DG, Lee WM; Acute Liver Failure Study Group. Drug-induced acute liver failure: results of a U.S. multicenter, prospective study. *Hepatology*. 2010;52:2065–76. PubMed PMID: 20949552.

*(Among 1198 patients with acute liver failure enrolled in a US prospective study between 1998 and 2007, 133 [11%] were attributed to drug induced liver injury of which 12 [9%] were due to herbals, but none were attributed to quercetin).*

Bigelman KA, Fan EH, Chapman DP, Freese EC, Trilk JL, Cureton KJ. Effects of six weeks of quercetin supplementation on physical performance in ROTC cadets. *Mil Med*. 2010;175:791–8. PubMed PMID: 20968271.

*(Among 57 ROTC college students treated with a 6 week course of quercetin vs placebo, measures of physical fitness were similar in quercetin- and placebo-treated subjects; no mention of adverse events).*

Stickel F, Kessebohm K, Weimann R, Seitz HK. Review of liver injury associated with dietary supplements. *Liver Int*. 2011;31:595–605. PubMed PMID: 21457433.

*(Review of current understanding of liver injury from herbals and dietary supplements focusing upon Herbalife and Hydroxycut products, green tea, usnic acid, Noni juice, Chinese herbs, vitamin A and anabolic steroids; quercetin not discussed).*

Teschke R, Wolff A, Frenzel C, Schulze J, Eickhoff A. Herbal hepatotoxicity: a tabular compilation of reported cases. *Liver Int*. 2012;32:1543–56. PubMed PMID: 22928722.

*(A systematic compilation of all publications on the hepatotoxicity of specific herbals identified 185 publications on 60 different herbs, herbal drugs and supplements, but quercetin is not listed).*

Björnsson ES, Bergmann OM, Björnsson HK, Kvaran RB, Olafsson S. Incidence, presentation and outcomes in patients with drug-induced liver injury in the general population of Iceland. *Gastroenterology*. 2013;144:1419–25. PubMed PMID: 23419359.

*(In a population based study of drug induced liver injury from Iceland, 96 cases were identified over a 2 year period, including 15 [16%] due to herbal and dietary supplements, none of which listed quercetin as a component).*

Navarro VJ, Barnhart H, Bonkovsky HL, Davern T, Fontana RJ, Grant L, Reddy KR, et al. Liver injury from herbals and dietary supplements in the U.S. Drug-Induced Liver Injury Network. *Hepatology*. 2014;60:1399–408. PubMed PMID: 25043597.

*(Among 85 cases of HDS associated liver injury [not due to anabolic steroids] enrolled in a US prospective study between 2004 and 2013, quercetin was not listed among the components of products taken by patients).*

Seeff LB, Bonkovsky HL, Navarro VJ, Wang G. Herbal products and the liver: a review of adverse effects and mechanisms. *Gastroenterology*. 2015;148:517–532.e3. PubMed PMID: 25500423.

*(Extensive review of possible beneficial as well as harmful effects of herbal products on the liver does not mention or discuss quercetin).*

Chalasani N, Bonkovsky HL, Fontana R, Lee W, Stolz A, Talwalkar J, Reddy KR, et al; United States Drug Induced Liver Injury Network. Features and outcomes of 899 patients with drug-induced liver injury: The DILIN Prospective Study. *Gastroenterology*. 2015;148:1340–52.e7. PubMed PMID: 25754159.

*(Among 899 cases of drug induced liver injury enrolled in a prospective database between 2004 and 2012, HDS were implicated in 145 [16%], the single major herbal cause being green tea and no case implicating quercetin [Navarro et al Hepatology 2014]).*

García-Cortés M, Robles-Díaz M, Ortega-Alonso A, Medina-Caliz I, Andrade RJ. Hepatotoxicity by dietary supplements: A tabular listing and clinical characteristics. *Int J Mol Sci.* 2016;17:537. PubMed PMID: 27070596.

*(Listing of published cases of liver injury from HDS products, does not include specific mention of quercetin).*

Serban MC, Sahebkar A, Zanchetti A, Mikhailidis DP, Howard G, Antal D, Andrica F, et al; Lipid and Blood Pressure Meta-analysis Collaboration (LBPMC) Group. Effects of quercetin on blood pressure: a systematic review and meta-analysis of randomized controlled trials. *J Am Heart Assoc.* 2016;5(7):e002713. pii. PubMed PMID: 27405810.

*(Systematic review of 7 controlled trials in 587 patients comparing quercetin [100 to 1000 mg daily] to placebo given for 4-10 weeks for its effect on blood pressure found a mild effect particularly with doses of 500 mg or above and that it was “safe and well tolerated...with no report of serious adverse events”).*

Panche AN, Diwan AD, Chandra SR. Flavonoids: an overview. *J Nutr Sci.* 2016;5:e47. PubMed PMID: 28620474.

*(Review of structure, distribution and function of the flavonoids, natural plant polyphenols found largely in fruits and vegetables that have a multitude of functions and may have health benefits in humans).*

Brown AC. Liver toxicity related to herbs and dietary supplements: Online table of case reports. Part 2 of 5 series. *Food Chem Toxicol* 2017; 107 (Pt A): 472-501.

*(Description of an online compendium of cases of liver toxicity attributed to HDS products; quercetin is not mentioned or discussed).*

de Boer YS, Sherker AH. Herbal and dietary supplement-induced liver injury. *Clin Liver Dis.* 2017;21:135–49. PubMed PMID: 27842768.

*(Review of the frequency, clinical features, patterns of injury and outcomes of HDS hepatotoxicity with specific mention of anabolic steroids, black cohosh, germander, green tea, kava, pyrrolizidine alkaloids and proprietary multiingredient dietary supplements [MIDS]; does not mention quercetin).*

Vega M, Verma M, Beswick D, Bey S, Hossack J, Merriman N, Shah A, et al; Drug Induced Liver Injury Network (DILIN). The incidence of drug- and herbal and dietary supplement-induced liver injury: preliminary findings from gastroenterologist-based surveillance in the population of the State of Delaware. *Drug Saf.* 2017;40:783–7. PubMed PMID: 28555362.

*(A prospective, population based registry of cases of drug induced liver injury occurring in Delaware during 2014, identified 20 cases [2.7 per 100,000] overall, including 6 due to HDS products, all of which were proprietary multiingredient products, none specifically listing quercetin as a component).*

Andres S, Pevny S, Ziegenhagen R, Bakhiya N, Schäfer B, Hirsch-Ernst KI, Lampen A. Safety aspects of the use of quercetin as a dietary supplement. *Mol Nutr Food Res.* 2018;62(1):1700447. PubMed PMID: 29127724.

*(Extensive review of the safety of quercetin supplements from the German Federal Institute for Risk Assessment focusing upon possible carcinogenicity, reproductive, androgenic and estrogenic effects and drug interactions, concludes that there is inadequate information on the safety of quercetin supplements in humans and that patients “consult a physician prior to the use”; no mention of hepatotoxicity).*

Huang H, Liao D, Dong Y, Pu R. Clinical effectiveness of quercetin supplementation in the management of weight loss: a pooled analysis of randomized controlled trials. *Diabetes Metab Syndr Obes.* 2019;12:553–63. PubMed PMID: 31114281.

*(Systematic review of 9 controlled trials in 525 patients comparing quercetin [100 to 1000 mg daily] to placebo given for 2-12 weeks found no evidence for an effect on body weight or waist circumference and “treatment was well tolerated, and no drug-related adverse reactions were reported”).*