



UNIVERSITY OF
CALIFORNIA
Division of Agriculture
and Natural Resources
<http://anrcatalog.ucdavis.edu>

NUTRITION AND HEALTH INFO SHEET

Catechins

KARRIE HENEMAN, Assistant Project Scientist, Department of Nutrition, University of California, Davis; **SHERI ZIDENBERG-CHERR**, UC Cooperative Extension Nutrition Science Specialist, Department of Nutrition, University of California, Davis

What are catechins?

Catechins are phytochemical compounds found in plant-based foods and beverages. Based on their structure, catechins are classified as flavanols and include the following compounds: catechin, epicatechin, epigallocatechin, epicatechin gallate, and epigallocatechin gallate. High concentrations of catechin can be found in red wine, broad beans, black grapes, apricots, and strawberries. Epicatechin concentrations are high in apples, blackberries, broad beans, cherries, black grapes, pears, raspberries, and chocolate. Finally, epigallocatechin, epicatechin gallate, and epigallocatechin gallate are found in high concentrations in both black and green tea (1).

What is the catechin content of some common foods? (2)

Food	Catechin (mg/100g)	Epicatechin (mg/100g)	Epigallocatechin, epicatechin gallate, & epigallocatechin gallate (mg/100g)
apples	0.89	6.07	0.63
blackberries	37.06	4.66	0.78
black grapes	10.14	8.68	2.81
brewed black tea	1.47	2.13	23.06
brewed green tea	2.55	8.29	114.25
cherries	1.31	6.97	0.39
cocoa	0.00	26.20	0.00
dark chocolate	11.99	41.50	0.00
fava beans	8.16	7.82	4.65
milk chocolate	2.07	6.31	0.00
pears	0.27	3.76	0.78
raspberries	1.56	4.07	1.00
red table wine	7.02	3.28	0.07

Are there beneficial effects associated with consumption of catechins?

Consumption of catechins has been associated with a variety of beneficial effects, including increased plasma antioxidant activity (ability of plasma to scavenge free radicals), brachial artery dilation (blood vessel expansion), fat oxidation, and resistance of LDL to oxidation (1).

There seems to be a lot of media hype around red wine, chocolate, and tea. Are these really "super foods"?

As shown in the table above, red wine, chocolate, and tea are all high in catechins, in addition to a variety of other polyphenolic compounds. Below is a summary of the research on the effects of consuming these foods:

Red wine

Studies have investigated the relationship between consumption of red wine and susceptibility to chronic diseases such as lung cancer, prostate cancer, and cardiovascular disease.



- *Cardiovascular Disease:* Consumption of red wine is associated with a reduction in endothelin-1 (a molecule involved in blood pressure regulation), a reduction in myocardial ischemic reperfusion injury (an injury to the heart when blood is returned to the organ after a period of restriction), increased HDL, decreased platelet aggregation (clumping), increased fibrinolysis (breakdown of a clot), and increased antioxidant activity (3).
- *Lung Cancer:* In one recent investigation, consumption of red wine was associated with a reduced risk of lung cancer in comparison to those who did not consume any red wine (4).
- *Prostate Cancer:* In middle-aged men, a 6 percent decrease in risk of prostate cancer has been observed for every glass of red wine consumed per week (5).
- *Conclusions:* In light of this research, the American Heart Association does not recommend consumption of alcohol to reduce risk of cardiovascular disease and the American Cancer Society recommends limiting consumption of alcoholic beverages. If adults choose to drink alcoholic beverages, the Dietary Guidelines 2005 recommend they do so in moderation. Moderation is considered one drink (defined as 12 ounces of beer, 4 ounces of wine, 1.5 ounces of 80-proof spirits, or 1 ounce of 100-proof spirits) per day for women and two drinks per day for men (6). Some short-term research suggests that 100 percent purple grape juice may be an alcohol-free alternative to red wine for those interested in both the cardiovascular and anticancer effects of this beverage; however, a reduction in development of chronic disease and mortality due to consumption of grape juice has yet to be confirmed (7, 8). If you do choose to consume purple grape juice, remember to follow the Dietary Guidelines and limit juice consumption by choosing whole fruit for the majority of your daily fruit servings (6).

Chocolate

Kuna Indians, an island-dwelling population that consumes high levels of cocoa (more than 5 cups per day), have low rates of elevated blood pressure or hypertension (9). Furthermore, epidemiological research of elderly men suggests that consumption of cocoa-containing foods is associated with a reduced risk of mortality due to cardiovascular disease and all other causes (10).

- *Cardiovascular Disease:* Consumption of chocolate or cocoa has been associated with a variety of cardiovascular benefits, including decreased LDL oxidation, decreased platelet aggregation, increased antioxidant capacity, decreased oxidative stress (an imbalance in the ratio of antioxidants to free radicals), increased HDL concentration, increased levels of prostacyclin (a signaling molecule involved in the prevention of blood clot formation), decreased levels of leukotriene (a signaling molecule involved in inflammation and allergic reactions), increased nitric oxide, improved endothelial function, lower systolic and diastolic blood pressure, improved insulin sensitivity, decreased insulin resistance, decreased free radical-induced hemolysis (breakdown of red blood cells), improved brachial artery dilation, and decreased LDL cholesterol (12). Furthermore, in one recent investigation, consumption of approximately 30 kilocalories of dark chocolate daily for eighteen weeks was associated with decreased blood pressure (13).
- *Conclusions:* The Dietary Guidelines for Americans, 2005, recommend that the average person (who consumes 2,000 calories per day) consume 1,733 calories of nutrient-dense foods (fat-free or low-fat foods from the six core food groups of grains, vegetables, fruits, milk, meat and beans, and oils) and only 267 “discretionary calories” (added fats and sugars) (6). In light of current chocolate research, it may be beneficial to include a small piece of dark chocolate (equal to 30 calories) as part of the daily discretionary calorie allotment.

What is the antioxidant capacity of chocolate? (1)

Chocolate type	Antioxidant capacity (mmol Trolox equivalents)
cocoa liqueur per 100 g	40.0
dark (semisweet) chocolate per 100 g per 100 kcals	13.1 2.7
milk chocolate per 100 g per 100 kcals	6.7 1.3

Tea

Tea has been consumed by Asian populations for thousands of years and is purported to have numerous beneficial effects on health. Research has investigated the relationship between tea and a variety of topics including cardiovascular disease, cancer, weight management, diabetes, Alzheimer's disease, and bone density.

- **Cardiovascular Disease:** Epidemiological evidence suggests that consumption of tea is inversely associated with myocardial infarction (heart attacks) (14). Green or black tea flavonoids have been found to have vasculoprotective (protection of blood vessels), antioxidative, antithrombogenic (prevention of blood clot formation), anti-inflammatory, and lipid-lowering properties, which may be responsible for the reduced risk of cardiovascular disease (15). Unfortunately, it is not known if all of these actions also occur in the body when tea is consumed. Therefore, researchers still do not have a true understanding of the mechanism behind the cardioprotective effects of tea consumption.
- **Cancer:** According to the American Cancer Society, consumption of green tea has been associated with a reduced risk of skin, esophagus, stomach, colon, pancreas, lung, bladder, prostate, and breast cancer in experimental models. Unfortunately, the results from human research do not currently support the findings from these cell and animal studies. Therefore, consumption of tea solely for cancer prevention is not recommended (16).
- **Weight Management:** Despite promising findings in experimental systems, there is limited long-term human evidence to support the consumption of green tea for weight loss (17, 18).
- **Type 2 Diabetes:** Current research investigating the relationship between consumption of flavonoid-rich food and risk of type 2 diabetes has not found a significant relationship between tea consumption and risk of this chronic disease (19, 20).
- **Alzheimer's Disease:** Current epidemiological research investigating Alzheimer's Disease does not find a protective effect of tea consumption (21).
- **Bone Density:** In a recent investigation with elderly women (70 to 85 years old), black and green tea consumption was associated with a higher hip bone mineral density at the end of the study and, during the five-year course of the study, with a lower hip bone mineral density loss. The findings from this investigation were in support of previous research (22).
- **Conclusions:** Current research supports an inverse relationship between consumption of tea and risk of cardiovascular disease and loss of bone mineral density. In light of these findings, replacing a daily cup of coffee or caffeinated soda with a cup of unsweetened black or green tea may prove to be beneficial to overall health, even though no specific recommendations regarding tea consumption can be made at this time.

METRIC CONVERSIONS

English	Conversion factor for English to metric	Conversion factor for metric to English	Metric
grain	64.80	0.015	milligram (mg)
fluid ounce (fl oz)	29.57	0.034	milliliter (ml)
ounce (oz)	28.35	0.035	gram (g)
cup	236.6	0.004	milliliter (ml)

REFERENCES

1. Williamson, G., and C. Manach. 2005. Bioavailability and bioefficacy of polyphenols in humans. II. Review of 93 intervention studies. *Am J Clin Nutr* 81:243S–255S.
2. United States Department of Agriculture (USDA). 2007. USDA database for the flavonoid content of selected foods. USDA Nutrient Data Laboratory Web site, http://grande.nal.usda.gov/nal_display/index.php?info_center=4&tax_level=2&tax_subject=279&topic_id=1387.
3. Peregrin, T. 2005. Wine—a drink to your health? *J Am Diet Assoc* 105:1053–1054.
4. Ruano-Ravina, A., A. Figueiras, and J. M. Barros-Dios. 2004. Type of wine and risk of lung cancer: A case-control study in Spain. *Thorax* 59:981–985.
5. Schoonen, W. M., C. A. Salinas, L. A. Kiemeny, and J. L. Stanford. 2005. Alcohol consumption and risk of prostate cancer in middle-aged men. *Int J Cancer* 113:133–140.
6. United States Department of Health and Human Services. 2005. Dietary Guidelines for Americans Web site, <http://www.health.gov/dietaryguidelines/dga2005/document/pdf/DGA2005.pdf>.
7. Willett, W. C. 2007. Ask the doctor: For the health of my heart and arteries, how does regular consumption of red wine compare with grape juice or the equivalent in grapes? *Harv Heart Lett* 17:7.
8. Park, Y. K., E. Park, J. S. Kim, and M. H. Kang. 2003. Daily grape juice consumption reduces oxidative DNA damage and plasma free radical levels in healthy Koreans. *Mutat Res* 529:77–86.
9. N, K. H. 2006. Vascular action of cocoa flavanols in humans: The roots of the story. *J Cardiovasc Pharmacol* 47 Suppl 2:S99–102.
10. Buijsse, B., E. J. Feskens, F. J. Kok, and D. Kromhout. 2006. Cocoa intake, blood pressure, and cardiovascular mortality: The Zutphen Elderly Study. *Arch Intern Med* 166:411–417.
11. Steinberg, F. M., M. M. Bearden, and C. L. Keen. 2003. Cocoa and chocolate flavonoids: Implications for cardiovascular health. *J Am Diet Assoc* 103:215–223.
12. Ding, E. L., S. M. Hutfless, X. Ding, and S. Girotra. 2006. Chocolate and prevention of cardiovascular disease: A systematic review. *Nutr Metab (Lond)* 3:2.
13. Taubert, D., R. Roesen, C. Lehmann, N. Jung, and E. Schomig. 2007. Effects of low habitual cocoa intake on blood pressure and bioactive nitric oxide: A randomized controlled trial. *Jama* 298:49–60.
14. Scalbert, A., C. Manach, C. Morand, C. Remesy, and L. Jimenez. 2005. Dietary polyphenols and the prevention of diseases. *Crit Rev Food Sci Nutr* 45:287–306.

15. Stangl, V., M. Lorenz, and K. Stangl. 2006. The role of tea and tea flavonoids in cardiovascular health. *Mol Nutr Food Res* 50:218–228.
16. American Cancer Society. 2007. Green tea. American Cancer Society Web site, http://www.cancer.org/docroot/ETO/content/ETO_5_3x_Green_Tea.asp.
17. Nagao, T., Y. Komine, S. Soga, S. Meguro, T. Hase, Y. Tanaka, and I. Tokimitsu. 2005. Ingestion of a tea rich in catechins leads to a reduction in body fat and malondialdehyde-modified LDL in men. *Am J Clin Nutr* 81:122–129.
18. Kovacs, E. M., and D. J. Mela. 2006. Metabolically active functional food ingredients for weight control. *Obes Rev* 7:59–78.
19. Nettleton, J. A., L. J. Harnack, C. G. Scrafford, P. J. Mink, L. M. Barraj, and D. R. Jacobs Jr. 2006. Dietary flavonoids and flavonoid-rich foods are not associated with risk of type 2 diabetes in postmenopausal women. *J Nutr* 136:3039–3045.
20. Song, Y., J. E. Manson, J. E. Buring, H. D. Sesso, and S. Liu. 2005. Associations of dietary flavonoids with risk of type 2 diabetes, and markers of insulin resistance and systemic inflammation in women: A prospective study and cross-sectional analysis. *J Am Coll Nutr* 24:376–384.
21. Dai, Q., A. R. Borenstein, Y. Wu, J. C. Jackson, and E. B. Larson. 2006. Fruit and vegetable juices and Alzheimer's disease: The Kame Project. *Am J Med* 119:751–759.
22. Devine, A., J. M. Hodgson, I. M. Dick, and R. L. Prince. 2007. Tea drinking is associated with benefits on bone density in older women. *Am J Clin Nutr* 86:1243–1247.

FOR FURTHER INFORMATION

To order or obtain printed ANR publications and other products, visit the ANR Communication Services online catalog at <http://anrcatalog.ucdavis.edu>. You can also place orders by mail, phone, or FAX, or request a printed catalog of our products from:

University of California
Agriculture and Natural Resources
Communication Services
6701 San Pablo Avenue, 2nd Floor
Oakland, California 94608-1239
Telephone: (800) 994-8849 or (510) 642-2431
FAX: (510) 643-5470
E-mail inquiries: danrcs@ucdavis.edu

© 2008 The Regents of the University of California
Division of Agriculture and Natural Resources
All rights reserved.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the written permission of the publisher and the authors.

Publication 8318

ISBN-13: 978-1-60107-601-4

Production of this material was supported by a grant from the Vitamin Cases Consumer Settlement Fund, created as a result of an antitrust class action. One of the purposes of the fund is to improve the health and nutrition of California consumers.

The University of California prohibits discrimination or harassment of any person on the basis of race, color, national origin, religion, sex, gender identity, pregnancy (including childbirth, and medical conditions related to pregnancy or childbirth), physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or service in the uniformed services (as defined by the Uniformed Services Employment and Reemployment Rights Act of 1994: service in the uniformed services includes membership, application for membership, performance of service, application for service, or obligation for service in the uniformed services) in any of its programs or activities.

University policy also prohibits reprisal or retaliation against any person in any of its programs or activities for making a complaint of discrimination or sexual harassment or for using or participating in the investigation or resolution process of any such complaint.

University policy is intended to be consistent with the provisions of applicable State and Federal laws.

Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Equal Opportunity Director, University of California, Agriculture and Natural Resources, 1111 Franklin Street, 6th Floor, Oakland, CA 94607, (510) 987-0096. **For information about ordering this publication, telephone 1-800-994-8849. For assistance in downloading this publication, telephone 530-754-3927.**

An electronic copy of this publication can be found at the ANR Communication Services catalog Web site, <http://anrcatalog.ucdavis.edu>.

This publication has been anonymously peer reviewed for technical accuracy by University of California scientists and other qualified professionals. This review process was managed by the ANR Associate Editor for Food and Nutrition.

pr-11/08-LR/CR

