

Effectiveness of Green Tea on Obesity

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ABSTRACT

Green tea is a product made from the *Camellia sinensis* plant. It can be prepared as a beverage, which can have some health effects or an “extract” can be made from the leaves to use as medicine. Green tea is used to improve mental alertness and thinking. It is also used for weight loss and to treat stomach disorders, vomiting, diarrhea, headaches, bone loss (osteoporosis), and solid tumor cancers. Some people use green tea to prevent various cancers, including breast cancer, prostate cancer, colon cancer, gastric cancer, lung cancer, solid tumor cancers and skin cancer related to exposure to sunlight. This review is done to evaluate and to create proper awareness among people on effectiveness of green tea on obesity.

KEYWORDS: Green tea, obesity, beverage

INTRODUCTION

Green tea has emerged as one of the most popular and widely preferred beverage next to water in Asian countries. For more than a century Asians have been aware of the beneficial effects of green tea ^[1]. Recently, many researches are being conducted to investigate the health benefits ^[2] of consuming green tea, including the prevention of cancer ^[3] and cardiovascular diseases ^[4], the anti-inflammatory ^[5], antiarthritic ^[6], antibacterial ^[7], antiangiogenic ^[8], antioxidative ^[9], antiviral ^[10], neuroprotective ^[11], and cholesterol-lowering effects ^[12] of green tea and isolated green tea constituents.

Obesity or overweight is a rapidly growing and commonly encountered medical problem in almost all countries. It poses a major threat to the health of large number of populations.

Obesity has also been identified as a key factor in a number of diseases, including coronary heart diseases, non–insulin-dependent diabetes hypertension, osteoarthritis, pulmonary dysfunction and certain types of cancer.^[13–15]

During the recent times, green tea is gaining limelight in westernised countries, where black tea was drunk previously. Green tea is made from the fresh leaves of *Camellia sinensis*. These fresh leaves are processed rapidly by means of steam in order to prevent from fermentation. Black tea is also made from the same plant as green tea but the only difference is that the leaves undergo an extra enzymatic oxidation step during the process^[1]

Another major difference between green tea and black tea is that the polyphenols in green tea such as epigallocatechin gallate (EGCG), epigallocatechin, and epicatechin gallate, which contributes to its beneficial effects (such as the anti-oxidant potential and anti-mutagenic capacity) are converted into thearubigins and theaflavins in black tea.^[16] Although black tea still can improve one's health, the conversion attenuates the effects reported after the intake of green tea^[17–19]

Since the 1990s, green tea has also been viewed as a natural herb that has the potential to enhance energy expenditure and fat oxidation, thereby inducing weight loss^[20,21].

With increasing prevalence of obesity and diabetes, the effect of green tea on these two medical conditions particularly has gained much attention. Tea catechins, especially epigallocatechin gallate, appears to have an antiobesity and antidiabetic effect on human body^[22].

Increased awareness needs to be created about obesity and the effects of green tea in reducing obesity. Hence, the aim of this study was to do a systematic review on the effect of green tea on obesity.

COMPOSITION OF GREEN TEA

Green tea is a very complex mixture of valued compounds including flavonols, flavonoids, polyphenols and other constituents such as amino acids, lipids, organic acids, polysaccharides, vitamins, and thiamine. Catechins is a type of polyphenol and are the main astringency component in green tea and modulates various genes involved in the progression and development of cancer. The chief catechins are (–)-epicatechin (EC), (–)-epigallocatechin (EGC), (–)-epicatechin-3-gallate (ECG) and (–)-epigallocatechin-3-gallate (EGCG)^[23–26]. About 30–42% of the dry weight of the green tea contains phenolic compounds^[23,27] and EGCG is one of the most abundant catechins that contains about 50–80% of the total catechins^[27]

OBESITY:

Obesity is a medical condition in which surplus body fat has accumulated to the extent that it may have a adverse effect on health.^[28] People are normally considered obese when their body mass index (BMI), a measurement obtained by dividing a person's weight by the square of the person's height, is over 30 kg/m², with the range 25–30 kg/m² defined as overweight.^[28] Some East Asian countries use lesser values.^[29] Obesity increases the

possibility of various diseases, particularly heart disease, type 2 diabetes, obstructive sleep apnea, certain types of cancer, and osteoarthritis.^[30]

Obesity is generally preventable through a combination of social changes and personal choices.^[28] The main treatments, are changes in diet and exercising^[30] Diet quality can be improved by decreasing the consumption of energy-dense foods, such as those high in fat and sugars, and by increasing the consumption of dietary fiber.^[28] Medications may be taken, along with a proper diet, to reduce appetite or decrease fat absorption.^[31] If diet, exercise, and medication are not operative, a gastric balloon or surgery may be performed to reduce stomach volume or bowel length, leading to feeling full earlier or a reduced ability to absorb nutrients from food.^{[32][33]}

Obesity is a primary preventable cause of death across the globe, with increasing rates in adults and children.^{[28][34]} In 2014, 600 million adults (13%) and 42 million children under the age of five were obese.^[28] Obesity is more common in women than men.^[28] According to the Experts it is one of the most serious public health problems of the 21st century.^[35] Obesity is stigmatized in much of the present world (particularly in the Western world), though it was seen as a symbol of wealth and fertility at other times in history and still is in some parts of the world.^[36] In 2013, the American Medical Association classified obesity as a disease.^{[37][38]}

CAUSES OF OBESITY

Lack of Energy Balance

A lack of energy balance is the major cause of overweight and obesity. Energy balance means that the energy IN equals the energy OUT.

Energy IN is the amount of calories or energy you get from the daily supplies. Energy OUT is the amount of energy our body uses for things like digesting, breathing and being physically active.

To maintain a healthy weight, our energy IN and OUT doesn't have to balance exactly every day. It's the balance over time that helps we maintain a healthy weight.

- More energy IN than energy OUT over time = weight gain
- More energy OUT than energy IN over time = weight loss
- The same amount of energy IN and energy OUT over time = weight stays the same^[39]

Overweight and obesity happen over time when we take in more calories than we use.

OTHER MAJOR CAUSE

- Genes and Family History
- Lack of Sleep
- Pregnancy
- Emotional Factors
- Smoking
- Age
- Health Conditions

- Medicines and drugs
- Environment
- Genes and Family History

EFFECTS ON LIPID METABOLISM

Green tea catechins by different pathways affect the lipid metabolism and play a cognitive role in the prevention of appearance of atherosclerotic plaque. Intake of green tea extract decreases the absorption of cholesterol and triglycerides^[40,41], thereby increasing the excretion of fat^[40]. However, the mechanism of this pathway is still under research.

EFFECTS ON CARBOHYDRATE METABOLISM

In a study with rats treated with alloxan, it has been found that green tea decreases the serum glucose levels^[42]. This suggests that the catechins in green tea interact with glucose metabolism. In an oral glucose tolerance test in normal rats, green tea catechins decreased plasma insulin levels but did not affect plasma glucose levels^[43]. Nevertheless, adipocytes increased glucose uptake. However, the interaction between catechins and glucose metabolism remains unclear and needs further investigation.

GREEN TEA AND OBESITY

We have received an increased attention in the effects of tea on obesity and diabetes. Tea catechins, especially EGCG, appear to have antidiabetic and antiobesity effects^[44]. Even though few clinical and epidemiological studies show the health benefits of EGCG on diabetes and obesity, the mechanisms of its actions are developing based on various laboratory data. These mechanisms may be related to a certain pathway, such as through the modulations of energy balance, food intake, lipid, endocrine systems, and carbohydrate metabolism, and redox status^[45].

Recent data on human studies indicates that the ingesting of green tea and green tea extracts may help reduce body weight, body fat, by increasing fat oxidation and postprandial thermogenesis. In a randomized, double-blind, placebo-controlled, cross-over pilot study, 6 obese men have been given 300 mg EGCG per day for two days. Fasting and postprandial changes in the energy expenditure and substrate oxidation were evaluated. Resting energy expenditure did not differ considerably between placebo treatments and EGCG, although during the first postprandial monitoring phase, respiratory quotient values were significantly decreased with EGCG treatment compared to the placebo. These outcomes suggest that EGCG has the potential to increase fat oxidation in men and may contribute to the antiobesity effects of green tea. However, more studies with a bigger sample size and a wide range of age and body mass index are required to define the optimal dose^[46]

CONCLUSION

The primary objective of this review was to discuss the effect of green tea on obesity. Obesity is a serious, chronic disease that can have a negative effect on many systems in your body. People who are overweight or obese have a much greater risk of developing serious conditions, including Heart disease, Type 2 diabetes, Bone and joint disease. Obesity has emerged as the most commonly reported medical problem in this modern era. The factors contributing to obesity vary from pathological to physiological origin. Green tea consumption has existed from our ancestral period. But green tea has been gaining limelight only during this century, increasing its consumption as a healthy drink among the masses. From this review, it is clear that green tea plays a significant role in both prevention and reduction of obesity. The effects on obesity included those involved in the reduction of body plasma triglycerides and low density lipoprotein (LDL) content. Though certain adverse effects were reported, the positive effects still outnumber the adverse ones. The responsibility to create awareness regarding green tea consumption and its effect on obesity is in our hands. Further research needs to be initiated in this field in future, to investigate on the adverse effects and aiming at measures to eliminate them and create a healthier population.

REFERENCES

1. Shixian Q, VanCrey B, Shi J, Kakuda Y, Jiang Y. Green tea extract thermogenesis-induced weight loss by epigallocatechin gallate inhibition of catechol-O-methyltransferase. *J Med Food* 2006; 9: 451–458.
2. McKay DL, Blumberg JB: The role of tea in human health: An update. *J Am Coll Nutr* 2002, 21:1-13.
3. Kavanagh KT, Hafer LJ, Kim DW, Mann KK, Sherr DH, Rogers AE, Sonenshein GE: Green tea extracts decrease carcinogen-induced mammary tumor burden in rats and rate of breast cancer cell proliferation in culture. *J Cell Biochem* 2001, 82:387-398.
4. Sueoka N, Suganuma M, Sueoka E, Okabe S, Matsuyama S, Imai K, Nakachi K, Fujiki H: A new function of green tea: prevention of lifestyle-related diseases. *Ann N Y Acad Sci* 2001, 928:274-280.
5. Dona M, Dell'Aica I, Calabrese F, Benelli R, Morini M, Albini A, Garbisa S: Neutrophil restraint by green tea: inhibition of inflammation, associated angiogenesis, and pulmonary fibrosis. *J Immunol* 2003, 170:4335-4341.
6. Haqqi TM, Anthony DD, Gupta S, Ahmad N, Lee MS, Kumar GK, Mukhtar H: Prevention of collagen-induced arthritis in mice by a polyphenolic fraction from green tea. *Proc Natl Acad Sci USA* 1999, 96:4524-4529.
7. Sudano Roccato A, Blanco AR, Giuliano F, Rusciano D, Enea V: Epigallocatechin-gallate enhances the activity of tetracycline in staphylococci by inhibiting its efflux from bacterial cells. *Antimicrob Agents Chemother* 2004, 48:1968-1973.
8. Sartippour MR, Shao ZM, Heber D, Beatty P, Zhang L, Liu C, Ellis L, Liu W, Go VL, Brooks MN: Green tea inhibits vascular endothelial growth factor (VEGF) induction in human breast cancer cells. *J Nutr* 2002, 132:2307-2311.
9. Osada K, Takahashi M, Hoshina S, Nakamura M, Nakamura S, Sugano M: Tea catechins inhibit cholesterol oxidation accompanying oxidation of low density

- lipoprotein in vitro. *Comp Biochem Physiol Part C Toxicol Pharmacol* 2001, 128:153-164.
10. Weber JM, Ruzindana-Umunyana A, Imbeault L, Sircar S: Inhibition of adenovirus infection and adenain by green tea catechins. *Antiviral Res* 2003, 58:167-173.
 11. Weinreb O, Mandel S, Amit T, Youdim MBH: Neurological mechanisms of green tea polyphenols in Alzheimer's and Parkinson's diseases. *J Nutr Biochem* 2004, 15:506-516.
 12. Raederstorff DG, Schlachter MF, Elste V, Weber P: Effect of EGCG on lipid absorption and plasma lipid levels in rats. *J Nutr Biochem* 2003, 14:326-332.
 13. Noppa H., Body weight change in relation to incidence of ischemic heart disease and change in risk factors for ischemic heart disease, *American Journal of Epidemiology*, 111, 1980, 693–704.
 14. Hubert HB, Feinleib M, McNamara PM, Castelli W P, Obesity as an independent risk factor for cardiovascular disease: a 26-year follow-up of participants in the Framingham Heart Study, *Circulation*, 67(5), 1983, 968 –77.
 15. Kromhout D, Body weight, diet, and serum cholesterol in 871 middle-aged men during 10 years of follow-up (the Zutphen Study), *The American Journal of Clinical Nutrition*, 38(4), 1983, 591– 8.
 16. Wolfram S, Wang Y, Thielecke F. Anti-obesity effects of green tea: from bedside to bench. *Mol Nutr Food Res* 2006; 50: 176–187.
 17. Krul C, Luiten-Schuite A, Tenfelde A, van Ommen B, Verhagen H, Havenaar R. Antimutagenic activity of green tea and black tea extracts studied in a dynamic in vitro gastrointestinal model. *Mutat Res* 2001; 474: 71–85.
 18. Langley-Evans SC. Antioxidant potential of green and black tea determined using the ferric reducing power (FRAP) assay. *Int J Food Sci Nutr* 2000; 51: 181–188.
 19. Serafini M, Ghiselli A, Ferro-Luzzi A. In vivo antioxidant effect of green and black tea in man. *Eur J Clin Nutr* 1996; 50: 28–32.
 20. Westerterp-Plantenga M, Diepvens K, Joosen AM, Berube-Parent S, Tremblay A. Metabolic effects of spices, teas, and caffeine. *Physiol Behav* 2006; 89: 85–91.
 21. Diepvens K, Westerterp KR, Westerterp-Plantenga MS. Obesity and thermogenesis related to the consumption of caffeine, ephedrine, capsaicin, and green tea. *Am J Physiol Regul Integr Comp Physiol* 2007; 292: R77–R85.
 22. Kao YH, Chang HH, Lee MJ, Chen CL: Tea, obesity, and diabetes. *Mol Nutr Food Res* 2006, 50(2):188-210.
 23. D. A. Balentine, S. A. Wiseman, and L. C. M. Bouwens, "The chemistry of tea flavonoids," *Critical Reviews in Food Science and Nutrition*, vol. 37, no. 8, pp. 693–704, 1997. View at Publisher · View at Google Scholar · View at Scopus
 24. C. J. Dufresne and E. R. Farnworth, "A review of latest research findings on the health promotion properties of tea," *Journal of Nutritional Biochemistry*, vol. 12, no. 7, pp. 404–421, 2001. View at Publisher · View at Google Scholar · View at Scopus
 25. J. V. Higdon and B. Frei, "Tea catechins and polyphenols: health effects, metabolism, and antioxidant functions," *Critical Reviews in Food Science and Nutrition*, vol. 43, no. 1, pp. 89–144, 2003. View at Publisher · View at Google Scholar · View at Scopus

26. H. Mukhtar and N. Ahmad, "Tea polyphenols: prevention of cancer and optimizing health," *The American Journal of Clinical Nutrition*, vol. 71, no. 6, supplement, pp. 1698S–1704S, 2000. View at Google Scholar
27. M. E. Harbowy, D. A. Balentine, A. P. Davies, and Y. Cai, "Tea chemistry," *Critical Reviews in Plant Sciences*, vol. 16, pp. 415–480, 1997. View at Google Scholar
28. "Obesity and overweight Fact sheet N°311". WHO. January 2015. Retrieved 2 February 2016.
29. Kanazawa, M; Yoshiike, N; Osaka, T; Numba, Y; Zimmet, P; Inoue, S (2005). "Criteria and classification of obesity in Japan and Asia-Oceania.". *World review of nutrition and dietetics* 94: 1–12. doi:10.1159/000088200. PMID 16145245.
30. Haslam DW, James WP (2005). "Obesity". *Lancet* (Review) 366 (9492): 1197–209. doi:10.1016/S0140-6736(05)67483-1. PMID 16198769.
31. Yanovski SZ, Yanovski JA (Jan 1, 2014). "Long-term drug treatment for obesity: a systematic and clinical review.". *JAMA: the Journal of the American Medical Association*(Review) 311 (1): 74–86. doi:10.1001/jama.2013.281361. PMC 3928674. PMID 24231879.
32. Colquitt, JL; Pickett, K; Loveman, E; Frampton, GK (Aug 8, 2014). "Surgery for weight loss in adults". *The Cochrane database of systematic reviews* (Meta-analysis, Review) 8: CD003641. doi:10.1002/14651858.CD003641.pub4. PMID 25105982.
33. *Encyclopedia of Mental Health* (2 ed.). Academic Press. 2015. p. 158. ISBN 9780123977533.
34. Dibaise JK, Foxx-Orenstein AE (July 2013). "Role of the gastroenterologist in managing obesity". *Expert Review of Gastroenterology & Hepatology* (Review) 7 (5): 439–51. doi:10.1586/17474124.2013.811061. PMID 23899283.
35. Woodhouse R (2008). "Obesity in art: A brief overview". *Front Horm Res. Frontiers of Hormone Research* 36: 271–86. doi:10.1159/000115370. ISBN 978-3-8055-8429-6. PMID 18230908.
36. Pollack, Andrew (June 18, 2013). "A.M.A. Recognizes Obesity as a Disease". *New York Times*. Archived from the original on June 18, 2013.
37. Jump up^ Weinstock, Matthew (June 21, 2013). "The Facts About Obesity". H&HN. American Hospital Association. Retrieved June 24, 2013.
38. (<http://www.nhlbi.nih.gov/health/health-topics/topics/obe/causes>)
39. Raederstorff, D. G., Schlachter, M. F., Elste, V. & Weber, P. (2003) Effect of EGCG on lipid absorption and plasma lipid levels in rats. *J. Nutr. Biochem.* 14:326-332
40. Loest, H. B., Noh, S. K. & Koo, S. I. (2002) Green tea extract inhibits the lymphatic absorption of cholesterol and alpha-tocopherol in ovariectomized rats. *J. Nutr.* 132:1282-1288.
41. Miura, Y., Chiba, T., Tomita, I., Koizumi, H., Miura, S., Umegaki, K., Hara, Y., Ikeda, M. & Tomita, T. (2001) Tea catechins prevent the development of atherosclerosis in apoprotein E-deficient mice. *J. Nutr.* 131:27-32.
42. Wu, L. Y., Juan, C. C., Ho, L. T., Hsu, Y. P. & Hwang, L. S. (2004) Effect of green tea supplementation on insulin sensitivity in Sprague-Dawley rats. *J. Agric. Food Chem.* 52:643-648
43. Hasegawa, N., Yamada, N. & Mori, M. (2003) Powdered green tea has antilipogenic effect on Zucker rats fed a high-fat diet. *Phytother. Res.* 17:477-480.

44. Yang MH, Wang CH, Chen HL: Green, Oolong and black tea extracts modulate lipid metabolism in hyperlipidemia rats fed high sucrose diet. *J Nutr Biochem* 2001, 12:14-20
45. Rudelle S, Ferruzzi MG, Cristiani I, Moulin J, Mace K, Acheson KJ, Tappy L: Effect of a thermogenic beverage on 24-hour energy metabolism in humans. *Obesity* 2007, 15(2):349-355
46. Schmidt M, Schmitz HJ, Baumgart A, Guedon D, Netsch MI, Kreuter MH, Schmidlin CB, Schrenk D: Toxicity of green tea extracts and their constituents in rat hepatocytes in primary culture. *Food Chem Toxicol* 2005, 43:307-314