

# Can Yerba Maté (*Ilex paraguariensis* A.-St.-Hil) and Its Constituents Affect Health and Obesity?

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## Abstract

The present commentary is a short narrative review of the available data concerning the influence of Yerba Maté, its relatives and constituents on health with special attention to its anti-obesity effects and their physiological mechanisms. The possible adverse side-effects of Yerba Maté, form and doses of its consumption are discussed. The available information demonstrates the ability of Yerba Maté and its constituents to prevent and to treat a wide array of disorders including obesity, although the potential of this plant to promote weight loss requires further elucidation.

**Keywords:** Yerba Maté, Phytotherapy, Polyphenol, Metabolism, Weight loss

## Introduction: Provenance and Properties

Yerba Maté (*Ilex paraguariensis* A.-St.-Hil), a plant from the *Aquifoliaceae* family, is wide-spread in tropical regions of South America (Southern Brazil, Northern Argentina, Paraguay, and Uruguay) [1]. From its leaves and branches, Maté extract can be produced by steeping in hot or cold water. Maté consumption, as an alternative to coffee or tea, is a traditional element of social life in its native countries. The *Ilex* family comprises approximately 600 species. Some of them, *Kudingcha* (*Ilex kudingcha* C.J. Tseng and *Ilex latifolia* Thunb from China), *Yaupon* (*Ilex vomitoria* from the Southeast USA) and *Guayusa* (*Ilex guayusa* Loes from South America) can be used to produce medicinal and stimulating beverages [2]. Yerba Maté, as well as its relatives, contains large amounts of caffeine polyphenols, alkaloids (mainly caffeine and theobromine), tannins, and saponins [1-4]. The content of these molecules in Yerba Maté is similar to that in coffee and tea, but Yerba Maté contains more polyphenols [1] with stronger antioxidant capacity [2,5,6] than green tea.

## Positive Effects on Human Health

Yerba Maté has antioxidant, antibacterial, anti-inflammation,

and antitumor properties. The most known are the metabolic effects of Yerba Maté. In traditional medicine, it is used as a diuretic drug. Biomedical research validated the ability of Yerba Maté to reduce the levels of insulin, glucose, lipids, and cholesterol in blood of animals and humans [3,7]. It prevents diseases of cardiovascular system as well as bone thinning in menopause women. It improves gastrointestinal microbiota [2,6,8,9].

In addition, Yerba Maté is a mild stimulator of the nervous system, which can increase exercise performance and mood [9].

Kudingcha, a relative of Yerba Maté, has in addition to these properties also can counter diabetes and neurodegenerative diseases [2], therefore it is possible, that Yerba Maté could have this effect as well.

The likely medicinal properties of Yerba Maté and its related species are explained by the presence of polyphenols and alkaloids, which have antibacterial, antioxidant, anti-inflammatory, and phytoestrogenic properties [2,10]. When phenols were eliminated from the Yerba Maté extract, its ability to decrease the level of lipids in human blood was eliminated as well [11].

## Positive Effects on Weight Reduction

Yerba Maté extract reduced obesity (accumulation of fat, levels of lipids in blood and body weight) in rats and mice [1-3,8,12-14]. On the other hand, consumption of Yerba Maté did not alter their body mass in rabbits [15] and even increased it in lambs [16]. These observations suggest species-specific differences in metabolic effects of Yerba Maté, which could be explained by different regulators of body weight targeted by Yerba Maté.

Andersen and Fogg [17] demonstrated reduction of body weight in patients with obesity after consuming a mixture of extracts from Yerba Maté, Guarana seeds (*Paullinia cupana*) and leaves of Damiana (*Turnera diffusa*). Other authors, however, did not report any data on changes in body weight of patients under the influence of Yerba Maté, Guarana and Damiana [18]. Kim et al. [19] studied the effect of pure Yerba Maté extract on patients with obesity and determined reduction of fat stores and body weight. Studies by other authors did not confirm the effect of Yerba Maté consumption on body weight and other anthropometric parameters [7], levels of lipids [11] and a marker of obesity (leptin) [10] in patients. Although the main studies were performed on patients suffered from obesity, the reported differences in Yerba Maté effect on human body weight could be due to initial state of patients, doses, duration of plant administration and variability in source and quality of Yerba Maté teas used in the reported studies.

The action of Yerba Maté on lipid metabolism of animals and humans can be facilitated by several mechanisms. Yerba Maté is capable of:

- Suppressing appetite and reducing food intake. The long-time diet containing Yerba Maté reduced consumption of food by rats and mice [3,13,18]. These effects are probably performed by altering the level of nonapeptide Y, which is a regulator of appetite, in brain (rat: [3]). Some data indicate the influence of Yerba Maté on leptin concentration in rodent's brain [13]. Other data do not validate the effect of chronic dietary intake of Yerba Maté on leptin concentration in murine blood [3,10].
- Slowing the rate of food's passage through the intestines and fecal output in overweight patients [17].
- Inhibiting the differentiation and growth of adipose cells isolated from obese rats and cultured *in vitro* [2,20]. The *in vivo* and *in vitro* studies on obese rats demonstrated, that Yerba Maté can down-regulate the expression of a number of genes that promote adipogenesis and up-regulate the expression of genes related to the inhibition of adipogenesis, which can mediate the plant effect on rat adipogenesis [20].
- Reducing the activity of enzymes of lipid synthesis and

lipids' accumulation in adipose cells and liver of obese rodents [2].

- Stimulating lipolysis [4].
- Increasing burning (oxidation) of fat in human sportsmen and healthy volunteers [21-24] and mice [25] and energy expenditure in mice [3]. On the other hand, the antioxidant properties of Yerba Maté polyphenols [6,25] and their ability to reduce oxidation of lipids in humans [4] has been reported. The reported differences in plant effects could be explained by differences in experimental models and treatments used in different studies.
- Increasing energy expenditure during exercise in humans [2,3,21-23].
- Affecting microbiota in human digestive system which play an important role in food digestion and fat metabolism [2,26,27].

## Possible Adverse Side-effects

The majority of the performed studies determined no negative effects of Yerba Maté consumption on health of animals [15,28] and human beings [17-19]. Yerba Maté is a very popular drink in some countries, and its production and consumption is not limited by any legislative or medicinal regulations. Nevertheless, the epidemiological studies provided indirect evidence that Maté consumption could be associated with development of cancers of the oral cavity and oropharynx [29]. Few cases of toxic effects of consuming preparations containing Yerba Maté on humans including ischemic stroke have been reported [30].

The adverse effect of Yerba Maté could be explained not by the plant itself, but presence of benzo[ $\alpha$ ]pyrene and other molecules with toxic, irritating [4] and carcinogenic [31] activity.

## Conclusion and Recommendations

Yerba Maté indisputably belongs to the category of efficient functional food (food with added value). Despite their potential adverse side-effects, Yerba Maté has many positive effects on health. At present more than 60 patents for products at the basis of Yerba Maté constituents related to the pharmaceutical area, food supplements and beverages, cosmetics, and nutraceuticals have been issued [8].

Simultaneously, Yerba Maté is a promising candidate for a natural product which could be used to manage lipid metabolism and in prevention and treatment of obesity. Existing data on the effect of Yerba Maté on weight reduction are currently limited, indefinite, and contradictory. The animal studies demonstrated the species-specific character of Yerba

Maté effect. At present, the positive effect of Yerba Maté on weight loss in humans was validated only by one clinical study [19] and one successful experiment [17], in which Yerba Maté was only one component in the tested mixture. Other studies have not confirmed this effect. The reported studies remain contradictory probably because of the variability in initial state of patients and methodology of treatment (see above) including quality and dose of administrated plant (see below). Therefore, further, and more profound human studies are needed to identify the characteristics of Yerba Maté on health including fat storage, its positive and adverse effects. At present the clinical application of Yerba Maté on weight loss requires further validation and is premature.

Clinical experiments demonstrated that Yerba Maté can be efficient at a large spectrum of daily doses – 0.112 g [18], 1 g [21,24], 3 g (corresponding 107 mg of phenols and 84.24 mg of chlorogenic acid; [11]), 50 g or 100 g [7,19]. Recommended dose is consumption of 0.5 l [23] to 1 l [10] of the beverage a day. Cold Maté beverage stimulates fat oxidation and dissipation of heat more than warm [23]. An extract from a fresh plant is preferable. Fermentation of the Yerba Maté plant, similarly as in black tea and oolong, leads to reduction of its antioxidation capacity [32].

Taken together, the available reports indicate the positive effects of Yerba Maté on human health. Moreover, there are indications that this plant could be promising for phytotherapy of obesity. Nevertheless, there is currently insufficient data of the clinical studies for conclusion concerning applicability of this plant as an anti-obesity drug.

## References

1. Gambero A, Ribeiro ML. The positive effects of yerba maté (*Ilex paraguariensis*) in obesity. *Nutrients.* 2015 Jan 22;7(2):730-50.
2. Gan RY, Zhang D, Wang M, Corke H. Health Benefits of Bioactive Compounds from the Genus *Ilex*, a Source of Traditional Caffeinated Beverages. *Nutrients.* 2018 Nov 5;10(11):1682.
3. Gamboa-Gómez CI, Rocha-Guzmán NE, Gallegos-Infante JA, Moreno-Jiménez MR, Vázquez-Cabral BD, González-Laredo RF. Plants with potential use on obesity and its complications. *EXCLI J.* 2015 Jul 9;14:809-31.
4. Gawron-Gzella A, Chanaj-Kaczmarek J, Cielecka-Piontek J. Yerba Mate-A Long but Current History. *Nutrients.* 2021 Oct 21;13(11):3706.
5. Jongberg S, Racanicci AMC, Skibsted LH. Mate extract is superior to green tea extract in the protection against chicken meat protein thiol oxidation. *Food Chem.* 2019 Dec 1;300:125134.
6. Nogueira Silva Lima MT, Boulanger E, Tessier FJ, Takahashi JA. Hibiscus, Rooibos, and Yerba Mate for Healthy Aging: A Review on the Attenuation of In Vitro and In Vivo Markers Related to Oxidative Stress, Glycoxidation, and Neurodegeneration. *Foods.* 2022 Jun 7;11(12):1676.

7. Messina D, Soto C, Méndez A, Corte C, Kemnitz M, Avena V, et al. [Lipid - lowering effect of mate tea intake in dyslipidemic subjects]. *Nutr Hosp.* 2015 May 1;31(5):2131-9.

8. Gerber T, Nunes A, Moreira BR, Maraschin M. Yerba mate (*Ilex paraguariensis* A. St.-Hil.) for new therapeutic and nutraceutical interventions: A review of patents issued in the last 20 years (2000-2020). *Phytother Res.* 2023 Feb;37(2):527-48.

9. José MFB, Machado RP, Araujo PAB, Speretta GF. Physiological effects of yerba maté (*Ilex paraguariensis*): a systematic review. *Nutr Rev.* 2023 Aug 10;81(9):1163-79.

10. Balsan G, Pellanda LC, Sausen G, Galarraga T, Zaffari D, Pontin B, et al. Effect of yerba mate and green tea on paraoxonase and leptin levels in patients affected by overweight or obesity and dyslipidemia: a randomized clinical trial. *Nutr J.* 2019 Jan 19;18(1):5.

11. Souza SJ, Petrilli AA, Teixeira AM, Pontilho PM, Carioca AA, Luzia LA, et al. Effect of chocolate and mate tea on the lipid profile of individuals with HIV/AIDS on antiretroviral therapy: A clinical trial. *Nutrition.* 2017 Nov - Dec;43-44:61-68.

12. Borges MC, Vinolo MA, Nakajima K, de Castro IA, Bastos DH, Borelli P, et al. The effect of mate tea (*Ilex paraguariensis*) on metabolic and inflammatory parameters in high-fat diet-fed Wistar rats. *Int J Food Sci Nutr.* 2013 Aug;64(5):561-9.

13. Yimam M, Jiao P, Hong M, Brownell L, Lee YC, Hyun EJ, et al. Appetite Suppression and Antiobesity Effect of a Botanical Composition Composed of *Morus alba*, Yerba mate, and *Magnolia officinalis*. *J Obes.* 2016;2016:4670818.

14. Andrade VMM, de Moura AF, da Costa Chaves K, da Rocha CPD, de Andrade CBV, Trevenzoli IH, et al. Yerba mate consumption by ovariectomized rats alters white adipose tissue. *Mol Cell Endocrinol.* 2023 Mar 15;564:111881.

15. de Andrade F, de Albuquerque CA, Maraschin M, da Silva EL. Safety assessment of yerba mate (*Ilex paraguariensis*) dried extract: results of acute and 90 days subchronic toxicity studies in rats and rabbits. *Food Chem Toxicol.* 2012 Feb;50(2):328-34.

16. Lobo RR, Vincenzi R, Rojas-Moreno DA, Lobo AAG, Silva CMD, Benetel-Junior V, Ghussn LR, et al. Inclusion of Yerba Mate (*Ilex paraguariensis*) Extract in the Diet of Growing Lambs: Effects on Blood Parameters, Animal Performance, and Carcass Traits. *Animals (Basel).* 2020 Jun 1;10(6):961.

17. Andersen T, Fogh J. Weight loss and delayed gastric emptying following a South American herbal preparation in overweight patients. *J Hum Nutr Diet.* 2001 Jun;14(3):243-50.

18. Harrold JA, Hughes GM, O'Shield K, Quinn E, Boyland EJ, Williams NJ, Halford JC. Acute effects of a herb extract formulation and inulin fibre on appetite, energy intake and food choice. *Appetite.* 2013 Mar;62:84-90.

19. Kim SY, Oh MR, Kim MG, Chae HJ, Chae SW. Anti-obesity effects of Yerba Mate (*Ilex Paraguariensis*): a randomized, double-blind, placebo-controlled clinical trial. *BMC Complement Altern Med.* 2015 Sep 25;15:338.

20. Arçari DP, Santos JC, Gambero A, Ribeiro ML. The in vitro and in vivo effects of yerba mate (*Ilex paraguariensis*) extract on adipogenesis. *Food Chem*. 2013 Nov 15;141(2):809-15.
21. Alkhatib A. Yerba Maté (*Illex Paraguariensis*) ingestion augments fat oxidation and energy expenditure during exercise at various submaximal intensities. *Nutr Metab (Lond)*. 2014 Sep 2;11:42.
22. Alkhatib A, Atcheson R. Yerba Maté (*Ilex paraguariensis*) Metabolic, Satiety, and Mood State Effects at Rest and during Prolonged Exercise. *Nutrients*. 2017 Aug 15;9(8). pii: E882.
23. Maufrais C, Sarafian D, Dulloo A, Montani JP. Cardiovascular and Metabolic Responses to the Ingestion of Caffeinated Herbal Tea: Drink It Hot or Cold? *Front Physiol*. 2018 Apr 6;9:315.
24. Willems MET, Şahin MA, Cook MD. Matcha Green Tea Drinks Enhance Fat Oxidation During Brisk Walking in Females. *Int J Sport Nutr Exerc Metab*. 2018 Sep 1;28(5):536-41.
25. Walton CM, Saito ER, Warren CE, Larsen JG, Remund NP, Reynolds PR, et al. Yerba Maté (*Ilex paraguariensis*) Supplement Exerts Beneficial, Tissue-Specific Effects on Mitochondrial Efficiency and Redox Status in Healthy Adult Mice. *Nutrients*. 2023 Oct 20;15(20):4454.
26. de Vasconcellos AC, Frazzon J, Zapata Noreña CP. Phenolic Compounds Present in Yerba Mate Potentially Increase Human Health: A Critical Review. *Plant Foods Hum Nutr*. 2022 Dec;77(4):495-503.
27. Santos D, Frota EG, Vargas BK, Toniato Gris CC, Santos LFD, Bertolin TE. What is the role of phenolic compounds of yerba mate (*Ilex paraguariensis*) in gut microbiota? *Phytochemistry*. 2022 Nov;203:113341.
28. de Sousa WR, Lourenço BHLB, Reis MP, Donadel G, Marques MAA, Cardozo Junior EL, et al. Evaluation of Reproductive Toxicology of Aqueous Extract of Yerba Mate (*Ilex paraguariensis* A. St.-Hil.), a Traditional South American Beverage. *J Med Food*. 2019 Jan;22(1):97-101.
29. Goldenberg D. Maté: a risk factor for oral and oropharyngeal cancer. *Oral Oncol*. 2002 Oct;38(7):646-9.
30. Lüde S, Vecchio S, Sinno-Tellier S, Dopter A, Mustonen H, Vucinic S, Jonsson B, et al. Adverse Effects of Plant Food Supplements and Plants Consumed as Food: Results from the Poisons Centres-Based PlantLIBRA Study. *Phytother Res*. 2016 Jun;30(6):988-96.
31. Oranuba E, Deng H, Peng J, Dawsey SM, Kamangar F. Polycyclic aromatic hydrocarbons as a potential source of carcinogenicity of mate. *J Environ Sci Health C Environ Carcinog Ecotoxicol Rev*. 2019;37(1):26-41.
32. Kim Y, Talcott ST. Tea creaming in nonfermented teas from *Camellia sinensis* and *Ilex vomitoria*. *J Agric Food Chem*. 2012 Nov 28;60(47):11793-9.