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File: ■ Yerba Maté (*Ilex paraguariensis*)
■ Hypercholesterolemia
■ Statin Enhancement

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RE: Yerba Maté Infusion Consumption Improves Lipid Levels

de Morais EC, Stefanuto A, Klein GA, et al. Consumption of yerba maté (*Ilex paraguariensis*) improves serum lipid parameters in healthy dyslipidemic subjects and provides an additional LDL-cholesterol reduction in individuals on statin therapy. *J Agric Food Chem*. August 20, 2009: [epub ahead of print] Doi: 10.1021/jf901660g.

Cardiovascular disease (CVD) is a main cause of morbidity and mortality worldwide. Decreasing high levels of low-density lipoprotein cholesterol (LDL-C) and/or increasing low levels of high-density lipoprotein cholesterol (HDL-C) can help reduce the pathological processes related to CVD. Statins, which may decrease serum LDL-C by 30% to 40%, are used to treat hypercholesterolemia. Of growing interest is the use of alternative treatments to reduce and/or prevent hypercholesterolemia. The objectives of this study were to evaluate the cholesterol-lowering potential of green and roasted yerba maté (*Ilex paraguariensis*) infusions in healthy subjects with normal lipid levels and those with dyslipidemia and to investigate whether the yerba maté infusion could provide an additional cholesterol reduction in subjects taking a stable statin dose.

Yerba maté is rich in phenolics and saponins with potential lipid-lowering properties. For centuries, due to its caffeine content it was used as a stimulant beverage by the South American native peoples, and is still used as such today. Some studies have reported that the aqueous extract of yerba maté inhibited LDL oxidation in vitro, and others have confirmed the high antioxidant activity of the plant extracts. The authors' own studies have shown that the aqueous extract of yerba maté inhibited the progression of atherosclerosis in cholesterol-fed rabbits and improved the vascular contraction and relaxation in LDL receptor-knockout mice with atherosclerosis. They also have reported that acute ingestion of yerba maté infusion by humans increased the antioxidant protection of plasma and LDL particles against ex vivo copper-mediated lipid peroxidation.

For the study reported in this article, yerba maté infusions were prepared from commercially available green or roasted loose leaves of yerba maté, purchased from Leao Junior SA (Curitiba-PR, Brazil). Infusions were prepared by mixing boiling water and dried and minced leaves of commercial green or roasted yerba maté in a proportion of 50 or 20 mg/mL, respectively. After 10 minutes of extraction, the mixture was filtered and consumed immediately by the subjects.

Determination of total saponin and total polyphenol contents and a chromatographic analysis of phenolic compounds and xanthines in the yerba maté green and roasted leaves and their respective infusions were conducted.

Subjects were recruited through an announcement at the Federal University of Santa Catarina. Their general health and dyslipidemia status were verified by a standard questionnaire and measurement of biochemical and hematological parameters. After exclusion criteria were applied that eliminated 16 (including adverse responses to maté in 4 subjects involving oral or stomach mucosal irritation, insomnia, or nausea), 102 (36 men and 66 women; mean age, 48.4 ± 1.35 years) subjects were eligible.

The subjects were divided into 3 groups according to baseline serum lipids and lipoproteins values (as described in the IV Brazilian Guideline for Dyslipidemia and Prevention of Atherosclerosis):

- Group 1: 15 normolipidemic subjects
- Group 2: 57 dyslipidemic subjects (LDL-C ≥ 160 mg/dL; triglycerides ≥ 150 mg/dL; HDL-C ≤ 50 mg/dL for women and ≤ 40 mg/dL for men; or LDL-C/HDL-C ratio ≥ 2.5)
- Group 3: 30 hypercholesterolemic subjects on statin therapy. Statins given and the daily doses were simvastatin (10 mg), atorvastatin (20 mg), or lovastatin (40 mg).

The study was a single-blind, controlled trial. All subjects followed their normal lifestyle (diet and physical activities) for 30 days (baseline period). At least 2 weeks before the initial visit and throughout the baseline period, however, the subjects were asked to discontinue consuming yerba maté-containing beverages and using lipid-lowering products or drugs except for their statins.

They were instructed to prepare the maté infusions daily, with no sugar or sugar-like substances, and consume 330 mL 3 times daily for 40 days, immediately before or during their 3 daily meals. They could choose to drink either the green or roasted yerba maté infusions throughout the study; 16 drank green maté (4 normolipidemic and 12 dyslipidemic) and 86 consumed roasted maté infusion. All subjects in Group 3 drank roasted yerba maté. Though green maté infusion had about 3 times the total saponins and phenols and 50% more caffeine than the roasted maté infusion, similar serum lipid profile outcomes for the green and roasted maté led to pooling of the data.

Blood samples were collected before (during the baseline period at days -30, -15, and 0) and after 20 and 40 days of maté consumption. Dietary intake was recorded for 3 days

each during the baseline and the maté ingestion periods. During the consumption period, 12 subjects dropped out of the study because of personal reasons after 20-30 days.

The authors report the following results:

- For Group 1, the intake of yerba maté infusions caused 8.7% and 7.3% reductions in LDL-C and 16% and 10% reductions in the LDL-C/HDL-C ratio, after 20 and 40 days, respectively ($P < 0.05$), as compared with mean baseline values. Yerba maté consumption did not change the levels of total cholesterol, HDL-C, non-HDL-C, triglycerides, apo B-100, or apo B/apo A-I ratio ($P > 0.05$).
- For Group 2, the intake of yerba maté infusions for 20 and 40 days reduced the total cholesterol by 3.5% and 4.6%, respectively ($P < 0.01$); LDL-C by 8.1% and 8.6%, respectively ($P < 0.001$); non-HDL-C by 5.4% and 6.5%, respectively ($P < 0.05$); and the LDL-C/HDL-C ratio by 12.1% and 11.2%, respectively ($P < 0.01$), compared with the baseline period. After 20 days of maté consumption, HDL-C had increased by 4.4% ($P < 0.01$), apo B-100 was reduced by 6.0% ($P < 0.05$), and the apo B/apo A-I ratio was lowered by 6.4% ($P < 0.05$). The triglyceride values were unchanged.
- For Group 3, during the baseline period of 30 days, the serum levels of LDL-C and HDL-C remained almost stable due to the statin therapy ($P > 0.05$). The ingestion of the roasted yerba maté infusion, in addition to the usual statin therapy, reduced the serum level of LDL-C by 10.0% ($P < 0.01$) after 20 days and by 13.1% after 40 days ($P < 0.05$). A higher yerba maté hypocholesterolemic tendency was seen in those subjects on atorvastatin and lovastatin therapies compared with those on simvastatin. The HDL-C level was increased by 6.2% after 40 days ($P = 0.006$). The LDL-C/HDL-C ratio was lowered by 9.4% ± 0.1% and 19.9% ± 0.2%, after 20 and 40 days, respectively ($P < 0.05$). No significant changes were noted in the total cholesterol, triglycerides, and non-HDL-C levels.

The authors suggest that "a probable mechanism for the LDL-C lowering ability of yerba maté is the blocking of cholesterol absorption in the small intestine and/or the inhibition of cholesterol synthesis in the liver, which can be attributed to the presence of saponins, phenolic compounds, flavonoids, and/or caffeine in the maté infusion." However, reasons for the similar responses to the total saponins, phenols, and caffeine consumed from the infusions of green maté (350 mg, 5.5 g, and 160 mg daily, respectively) and the roasted maté (130 mg, 1.7 g, and 110 mg daily, respectively) deserves additional investigation.

They conclude that the consumption of yerba maté infusion improved the lipid parameters in normolipidemic and dyslipidemic subjects and provided an additional LDL-C reduction in hypercholesterolemic subjects on statin treatment, which may reduce the risk for CVD.

—Shari Henson

The American Botanical Council has chosen not to reprint the original article.