Coffee interferes with the intestinal absorption of levothyroxine

Benvenga S, Bartolone L, Pappalardo MA, Russo A, Lapa D, Giorgianni G, Saraceno G, Trimarchi F. Altered intestinal absorption of L-thyroxine caused by coffee. Thyroid 2008; 18:293-301.

SUMMARY

BACKGROUND Many things interfere with levothyroxine (L-T_4) absorption, such as iron, bile acid–binding resins, cholestyramine and colestipol, over-the-counter drugs containing iron and calcium, gastric conditions such as achlorhydria, and food ingestion around the time L-T_4 is taken. The authors of this study have previously reported cases of delayed intestinal absorption of L-T_4 and have thus been more than usually attentive to this problem, eliciting detailed histories from their patients about the use of other drugs and the dietary habits patients follow when taking L-T_4. Primary physicians referred patients who were taking L-T_4 for replacement therapy or to suppress serum thyrotropin (TSH) that failed to produce the expected results. The authors found that several patients were consistently drinking coffee or espresso to facilitate swallowing their L-T_4 pills or were taking L-T_4 with water followed shortly by drinking coffee or espresso, suggesting that this might be the cause of the problem.

METHODS The study subjects were eight patients, all of whom were women. Their mean (±SD) age was 45±11.38 years (range, 31 to 62) and their serum TSH levels were 2.7±20 mIU/L (range, 2.9 to 55). Ten healthy volunteers, four men and six women aged 24 to 52 years, were also studied. Patients and volunteers underwent in vitro studies of intestinal L-T_4 absorption using an oral dose of L-T_4 in lieu of radioisotopic techniques. Instead of using ≥600 µg of L-T_4 for the test, which is the usual dose for this purpose, patients and volunteers were given two 100-µg L-T_4 tablets with approximately 200 ml of water to facilitate swallowing, which was the baseline study. A second test substituted espresso (25–30 ml) for water while ingesting L-T_4, and a third test used water alone to facilitate L-T_4 swallowing followed 1 hour later by espresso. The studies were repeated 4 to 6 weeks later and again after another 4 to 6 weeks, although in the last tests the sequence of water and espresso was random. To further test the in vivo effects of known inhibitors of L-T_4 intestinal absorption, two patients and two volunteers each ingested two packets of bran dissolved in 200 ml of water when they took L-T_4 or 20 ml of aluminum hydroxide plus magnesium hydrochloride (Maalox) 5 minutes after swallowing 200 µg of L-T_4. The in vitro experiments were done by combining a solution with 10 µg/dL of L-T_4 with either 200 or 400 µL of Maalox, or with sucralfate, or dietary fibers of bran.

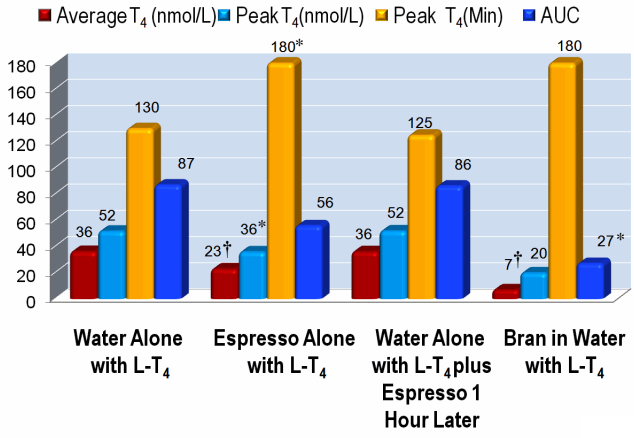

Figure 1. T_4 absorption in the acute loading test of 200 µg of oral T_4 in four different methods of ingestion. Bran was ingested by only two patients. AUC is area under the curve for T_4. *P<0.05 comparing patients with controls drinking water alone with L-T_4. †P<0.001 compared with controls drinking water.

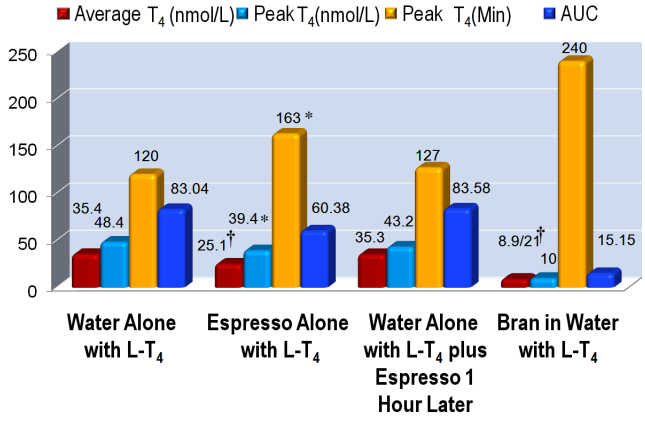

Figure 2. Data for 9 volunteers. See Figure 1 explanation. *P<0.05 and †P<0.001 for result vs. water alone.

RESULTS The main in vivo findings of intestinal T_4 absorption are shown in Figures 1 to 3. Taking 200 µg of L-T_4 while drinking espresso significantly lowered the average serum T_4 (P<0.001) and the peak serum T_4 concentrations (P<0.05) compared with taking L-T_4 with water alone. It also lowered the T_4 area under the curve, but this was not significantly different from that found in the control observations. Drinking

espresso 1 hour after taking L-T_4 had no significant effect on L-T_4 intestinal absorption. However, the decrease in L-T_4 absorption with simultaneous L-T_4 and espresso ingestion was not as great as with L-T_4 and bran (Figures 1 and 2) or L-T_4 with Maalox (Figure 3). These effects were seen in both patients and volunteers (Figures 1 to 3). The in vitro studies that tested the recovery of T_4 from a solution containing a known concentration of T_4 found that espresso was 1.8-fold to 2.5-fold weaker than bran and 1.7- to 2.7-fold weaker than Maalox in lowering the T_4 concentration in the solution.

CONCLUSION Drinking coffee or espresso at the time L-T_4 is taken interferes with the intestinal absorption of L-T_4.

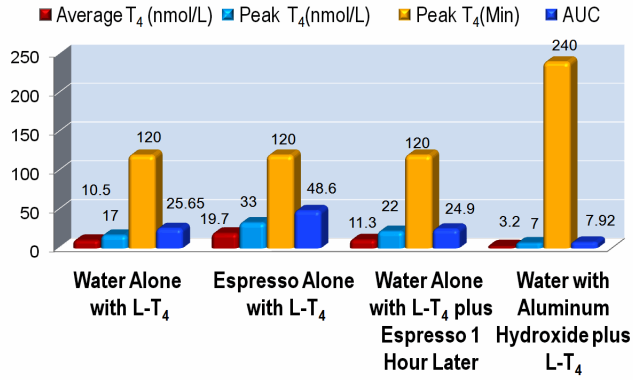

Figure 3. T_4 index data for one volunteer.

COMMENTARY

This study clearly shows that drinking espresso or coffee may interfere with intestinal absorption of L-T_4 if one drinks it with or shortly after levothyroxine is taken. This pattern of taking espresso or coffee with L-T_4 was highly consistent among the eight study patients. The effect was significant, but is not as severe as that produced by Maalox or by bran ingested at the time L-T_4 is taken. The effect of espresso was obviated by drinking it 60 minutes after taking L-T_4. The study also shows that espresso sequesters L-T_4 in vitro, although one of the volunteers had an increase in the absorption of L-T_4 with coffee ingestion. The mechanism by which espresso decreases L-T_4 absorption is uncertain, but the authors opine that it acts by sequestering L-T_4, rendering the hormone less available for uptake by intestinal epithelium. Also, all the in vivo studies were done with espresso and not coffee per se, raising some concerns that these findings might not apply to regular coffee. For instance, the effects of coffee on the gastric epithelial cells differ according to different roasting methods and different coffees and may vary in their effect on the intestinal mucosa (1, 2). Still, all eight patients had TSH levels in the therapeutic range, after being instructed to refrain from drinking coffee and to abstain from eating for 60 minutes after taking L-T_4. Coffee does not change the gastric pH, nor does it impair gastric emptying and intestinal transit in normal volunteers. Because the Benvenga study is retrospective, it relied on the recollections of patients rather than a systematic recording of the timing of meals and coffee ingestion. Still, the observations are strong enough, and the recommendations are simple enough to merely warn patients about this problem and to add coffee to the list of things to be avoided at the time that L-T_4 is taken.

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References

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2. Ehrlich A, Basse H, Henkel-Ernst J, et al. Effect of differently processed coffee on the gastric potential difference and intragastric pH in healthy volunteers. Methods Find Exp Clin Pharmacol 1998;20:155-61.