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Letter to the Editor

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To the Editor:

The popularity of dietary kale has been increasing recently (1). Although *Brassica* (cruciferous) vegetable consumption has been associated with decreased cancer risk (2,3), there are concerns of possible adverse effects of *Brassica* ingestion on thyroid function. Naturally occurring indole glucosinolates in *Brassica* vegetables are converted to thiocyanate upon mastication (4). Thiocyanate, also present in cigarette smoke, is a competitive inhibitor of iodine at the sodium/iodide symporter on thyroid follicular cells (5) and inhibits thyroidal accumulation of iodine (6), thus potentially resulting in decreased thyroid hormone production. *Brassica* vegetables with high indole glucosinolate concentrations include two types of kale (*B. oleraceae* and *B. napus* leaves) and Brussels sprouts (4). Myxedema coma has been reported after several months of excessive consumption (>1.5 kg/day) of the *Brassica*, raw bok choy (7).

We report two complementary studies examining the effects of kale juice consumption on urine and serum thiocyanate concentrations, serum thyroid function, and thyroidal radioiodine uptake. Subjects were healthy adults without known thyroid dysfunction and who denied excessive dietary iodine intake or recent exposures to iodinated contrast agents or medications which can alter thyroid function. The studies were approved by the University of California, Los Angeles, Institutional Review Board.

In the first study (n = 10), spot urine samples were collected prior to and at the first void (up to 240 minutes) following ingestion of 15.2 ounces of a commercially available thiocyanate-rich kale juice (mean $\pm$ SD thiocyanate content, $2,411 \pm 122$ μ g/L). Urinary thiocyanate levels significantly increased (0.97 ± 0.40 μ g/mg creatinine) compared to baseline (0.63 ± 0.38 μ g/mg creatinine) ($P < .01$). This proof-of-concept study demonstrated that urinary thiocyanate measurements significantly increase with even a single intake of dietary kale.

In the second study (n = 5), baseline serum thyroid-stimulating hormone (TSH) and free thyroxine (FT4) concentrations; 24-hour urine thiocyanate, iodine, and creatinine concentrations; and thyroid 123 I uptake were obtained. Subjects then ingested two 15.2-ounce bottles of the kale juice daily for 7 consecutive days (measured content equivalent to dietary thiocyanate intake of 5,098 μ g/day). Both urine and serum thiocyanate

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DISCLOSURE

The authors have no multiplicity of interest to disclose.

concentrations increased significantly after 1 week of kale juice ingestion compared to baseline (36.7 ± 17.1 $\mu\text{g}/\text{mg}$ creatinine vs. 22.6 ± 15.3 $\mu\text{g}/\text{mg}$ creatinine [$P < .03$] and $1,112.4 \pm 580.8$ $\mu\text{g}/\text{mg}$ creatinine vs. $1,503.8 \pm 366.7$ $\mu\text{g}/\text{mg}$ creatinine [$P < .05$], respectively). All subjects had 24-hour urinary iodine concentrations >50 $\mu\text{g}/\text{L}$. Mean $\pm$ SD thyroid ^{123}I uptakes at 6 hours decreased significantly after 1 week of dietary kale juice ($-2.52 \pm 1.99\%$; $P < .05$) (Fig. 1) but not at 24 hours ($-3.62 \pm 3.58\%$; $P = .08$). There were no changes in serum TSH ($P = .15$) and FT4 concentrations ($P = .21$) before and following thiocyanate ingestion.

The effects of human consumption of *Brassica* vegetables on thyroid health are not well understood. This report demonstrates that urinary and serum thiocyanate concentrations increase after thiocyanate ingestion, and even a short duration of dietary thiocyanate exposure resulted in a significant decrease in the 6-hour thyroid ^{123}I uptake. From these studies, although kale consumption in the short term does not cause overt serum thyroid dysfunction, adequate iodine nutrition is recommended in individuals consuming large amounts of *Brassica* vegetables routinely. Larger studies of longer duration and from other *Brassica* vegetables are needed to help elucidate the impact of *Brassica* consumption on the thyroid.

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Fig. 1. Six-hour thyroid radioiodine (^{123}I) uptake before and following 1 week of dietary thiocyanate ingestion.