Effective use of a health care technique requires an accurate assessment of the specific technique and its benefits, risks, costs, and alternatives as applied to specific problems. Such an assessment requires applying the technique in varied clinical situations and publishing the results in the medical literature. De facto rationing of forms of technology such as MRI under the banner of cost containment impedes technology assessment and thwarts improvement in patient care. This ultimately costs society and patients dearly in terms of delayed diagnoses, erroneous diagnoses, and needless therapies.

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1. Cramer BM, Schlegel EA, Thueroff JW. MR imaging in the differential diagnosis of scrotal and testicular disease. Radiographics 1991;11:9-21.
2. Johnson JO, Mattrey RF, Phillipson J. Differentiation of seminomatous from nonseminomatous testicular tumors with MR imaging. AJR Am J Roentgenol 1990;154:539-43.

THE NICOTINE CONTENT OF COMMON VEGETABLES

To the Editor: The presence of nicotine and its metabolite cotinine in the body fluids of nonsmokers is usually taken as evidence of exposure to environmental tobacco smoke. Recently, the Centers for Disease Control and Prevention studied 800 people, both smokers and nonsmokers, all of whom tested positive for urinary cotinine.[1]

There is considerable evidence that nicotine is present in certain human foods, especially plants from the family Solanaceae (such as potatoes, tomatoes, and eggplant). Castro and Monji,[2] Sheen,[3] and Davis et al.[4] have reported on the nicotine content of foods and drinks. We have been able to confirm some of their findings in our laboratory. Gas chromatography and mass spectroscopy[5] were used to determine the nicotine and cotinine content of common vegetables and black tea available from a local supermarket. The vegetables analyzed were tomatoes, potatoes, cauliflower, and green peppers. They were thoroughly washed with tap water, as is done for human consumption. All the vegetables were treated in a similar manner so that any contamination from the tap water would be equally applicable. The vegetables (including their skins) were diced, pureed in a blender, prepared,[4] and assayed.[5]

Cotinine could not be detected in any of the samples. Measurable amounts of nicotine were found in some of the vegetables (Table 1). Green peppers, black tea, and Ann Arbor city water had no detectable nicotine. Table 1 compares the results of the present study with those previously reported.

In indoor air, a low concentration of nicotine from tobacco smoke is about 1 μg per cubic meter. A person weighing 70 kg with a tidal volume of 4 ml per kilogram of body weight breathing 20 times per minute would exchange 5.6 liters of air per minute. If we assume that nicotine is completely absorbed from the lungs, it would take 179 minutes, or about 3 hours, of breathing in an environment with minimal smoke to absorb 1 μg of nicotine. Table 1 shows the amount of each vegetable by wet weight one would have to eat to obtain an amount of nicotine comparable to that of a passive smoker. Of course, the route of absorption is quite different in eating as compared with inhaling. Furthermore, if the vegetables are thoroughly cooked, the nicotine will diffuse into the cooking water and less will be ingested. It appears that the dietary intake of nicotine in nonsmokers may be of practical importance in the interpretation of the role of passive smoke inhalation when one is determining nicotine and cotinine levels in body fluids.

Table 1. Nicotine Content of Common Vegetables.

Vegetable	Highest Reported Mean Nicotine Content	Reference	Amount of Vegetable Required to Obtain 1 μg of Nicotine*
	ng/g		*g*
Cauliflower	16.8	Davis et al.[4]	59.5
Cauliflower	3.8	Present study	263.4
Eggplant	100.0	Castro and Monji[2]	10.0
Potato peel	4.8	Davis et al.[4]	208.0
Potato pulp	15.3	Davis et al.[4]	65.4
Potatoes	7.1	Present study	140.4
Green tomatoes	42.8	Castro and Monji[2]	23.4
Pureed tomatoes	52.0	Castro and Monji[2]	19.2
Ripe tomatoes	4.3	Castro and Monji[2]	233.0
Ripe tomatoes	4.1	Present study	244.0
Tomatoes	10.7	Sheen[3]	93.5

*One microgram of nicotine is the amount a passive smoker would absorb in about three hours in a room with a minimal amount of tobacco smoke.

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1. Preliminary data: exposure of persons aged ≥4 years to tobacco smoke — United States, 1988-1991. MMWR Morb Mortal Wkly Rep 1993;42:37-9.
2. Castro A, Monji N. Dietary nicotine and its significance in studies on tobacco smoking. Biochem Arch 1986;2:91-7.
3. Sheen SJ. Detection of nicotine in foods and plant materials. J Food Sci 1988;53:1572-3.
4. Davis RA, Stiles MF, deBethizy JD, Reynolds JH. Dietary nicotine: a source of urinary cotinine. J Food Chem Toxicol 1991;29:821-7.
5. Domino EF, Hariharan M, VanNoord T, Demana T. Current experience with HPLC and GC-MS analyses of nicotine and cotinine. Med Sci Res 1992;20: 859-60.