SHORT COMMUNICATIONS

ANTITHYROID ACTIVITY OF ONION VOLATILES*

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In a previous communication (Saghir, Cowan, and Salji 1966) data were presented which showed that n-propyl disulphide, the major volatile constituent of common onion (*Allium cepa*), inhibited thyroid activity in the rat. In the present paper, results are reported from further studies on the possible antithyroid activity of four other volatile compounds of *Allium:* methyl disulphide, allyl disulphide, allyl alcohol, and allyl monosulphide. Along with the n-propyl disulphide previously studied, these four compounds constitute the major volatile constituents of common onion; however, they are present also in other *Allium* species. Saghir, Mann, Bernhard, and Jacobsen (1964) found that methyl disulphide is the main component of rakkyo (*A. chinense*) and Chinese chives (*A. tuberosum*), both favourite food onions in China and Japan. In addition, the American wild *Allium* species emanate a preponderance of methyl sulphides when the tissues are injured (Saghir, Mann, Ownbey, and Berg 1966). Garlic (*A. sativum*) and great-headed garlic (*A. ampeloprasum*) have high proportions of allyl disulphide in their odour; furthermore, allyl monosulphide and allyl alcohol were reported recently as volatiles produced by *Allium* (Bernhard, Saghir, Jacobsen, and Mann 1964).

Materials and Methods

Pure grades of synthetic methyl disulphide, allyl disulphide, allyl monosulphide, and allyl alcohol were obtained from Eastman Organic Chemicals; previous work had shown these compounds to be identical to those found in *Allium* spp. (Jacobsen, Bernhard, Mann, and Saghir 1964). For the assessment of possible antithyroid activity, the "acute" test described previously (Saghir, Cowan, and Salji 1966) was used in which thyroidal radioiodine uptake was measured in female rats treated with the test materials. Five iodine-deficient albino rats of the Sprague-Dawley strain, weighing 150–200 g each, were assigned to each of the different test groups according to a randomized block design based on body weight. In each experiment, "normal" radioiodine uptake values were obtained using a control group treated with corn oil. In addition, a group in each experiment was treated with propylthiouracil, a known goitrogen, so that definite inhibition of thyroid function could be observed.

Prior to each experiment, the rats were starved for 24 hr; several non-toxic levels of the test materials were used and the appropriate amounts administered by stomach tube. One hour later, each rat was given, by intraperitoneal injection, 1 μc of carrier-free $Na^{131}I$ in 0·5 ml of 0·9% saline solution. Exactly 3 hr later, the animals were killed and the thyroids were removed and weighed. After digestion of

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the glands in alcoholic KOH, radioactivity was measured in each using a well-type crystal scintillation counter (Baird-Atomic). Percentage uptake was calculated by comparing the radioactivity in 1 mg of thyroid tissue with that in a standard dose counted at the same time as the thyroid digests.

TABLE 1

EFFECT OF VARIOUS LEVELS OF ALLYL SULPHIDES AND ALLYL ALCOHOL ON THE UPTAKE OF ^{131}I IN RATS

T, toxic levels

Dose per Rat in Each Group (μl)	Average* Percentage Uptake of ^{131}I per 1 mg Tissue for Groups of Rats Treated with:			
	Allyl Alcohol	Methyl Disulphide	Allyl Disulphide	Allyl Monosulphide
5	1·56	1·76		
10		1·83		
15	0·57			
20		1·32		
25	0·52			
30	T	0·87		
40	T	0·91	0·77	
50	T	T	0·65	
100	T	T	T	1·32
200	T	T	T	2·00
300	T	T	T	1·30
350	T	T	T	1·59
Control rats†	1·56	1·74	2·39	1·61
Goitrogen-treated rats‡	0·19	0·11	0·23	0·15
Least significant difference (5% level)	0·34	0·53	0·48	0·55

* Average of five values.

† Group of rats in each experiment treated with corn oil (100 μl/rat).

‡ Group of rats in each experiment treated with propylthiouracil (1 mg/rat).

Results and Discussion

The experimental results are presented in Table 1. The dose levels chosen for the volatiles studied (Table 1) were based on preliminary work which showed that these compounds were toxic to rats at different levels. Thus, in order to choose maximum non-toxic amounts for thyroid function studies, the toxicity level was determined for each compound. It is clear (Table 1) that the rat can tolerate relatively high levels of allyl monosulphide and lower levels of methyl disulphide and allyl disulphide; the allyl alcohol was highly toxic even at the 30-μl level.

It is evident that, at the higher levels used, allyl alcohol and methyl disulphide inhibited thyroid function significantly, as is shown by the low values for uptake of iodine-131 in the treated animals. Allyl disulphide inhibited thyroid function signifi-

cantly at both levels tested; however, allyl monosulphide showed no antithyroid activity even at the highest level used. This latter observation may point to a specificity of the disulphide moiety in thyroid inhibition.

Because of the apparent antithyroid nature of several of the volatile constituents of *Allium* species used as foods (onion, garlic, great-headed garlic, leek, chives, rakkyo, etc.) as well as of the wild *Allium* species, it may be speculated that the consumption of these may contribute to the prevalence of goitre in endemic areas such as the Lebanon area where iodine intake is low. Further work is planned to investigate the possibility that the inhibitory specificity of disulphide versus monosulphide observed in association with the allyl radical may be true with other radicals which have not been detected in onion odour.

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