ANTI-THYROID EFFECT OF WHITE CABBAGE GLUCOSINOLATES

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SUMMARY: The glucosinolates of crushed seeds of white cabbage were left for hydrolysis in contact with some distilled water, and the hydrolysis products were extracted, concentrated, and administered aurally to rats in doses representing 1, 2 and 4 gm seeds/100 gm body weight/day at intervals of 10, 20 and 30 days. The hydrolysate of 4 gm seeds/100 gm body weight/day fed for 30 days caused marked decreases in serum T_3 and T_4 concentrations analogous with those resulted from methimazole treatment.

Key Words: Glucosinolates, white cabbage, brassica oleracea L., anti-thyroid effect.

INTRODUCTION

The glucosinolates are naturally occurring compounds the presence of which has been detected within the Cruciferea, Capparaceae and Resedaceae families (1). On crushing different fresh parts of these, autolysis (hydrolysis) is brought about by contact of glucosinolates and the endogenous myrosinase enzyme system (which accompanies the glucosinolates in the plant), producing one or more of the following products: isothiocyanate (I), nitrile (II), thiocyanate (III), cyano-epithioalkane (IV), oxazolidinethione (V), or thionocarbamate (VI) along with glucose (1,2). The autolysis products of glucosinolates are shown in Figure 1.

Types of glucosinolates as well as their concentrations in white cabbage (*Brassica oleracea L., Var. capitata,* Family Cruciferae) were determined previously (3).

Since little is done in regards with the anti-thyroid effect of glucosinolate hydrolysis products (4), it has become the aim of this study to examine the effects of

Figure 1: Hydrolysis products of glucosinolates.

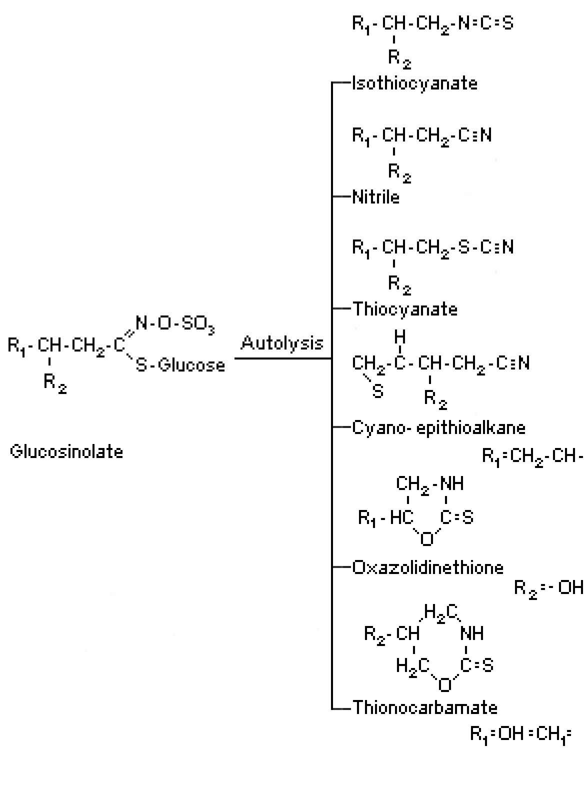

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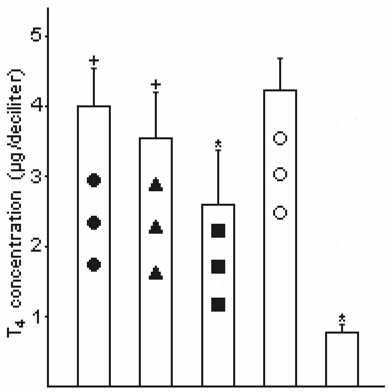
Figure 2: The effect of three different doses of white cabbage hydrolysate on serum T_4 concentration after 10 days oral administration. Serum T_4 concentration of control animals ❍, and of animals fed with 2 mg/100 gm body weight/day methimazole ❏, or white cabbage hydrolysate representative of 1 gm seeds/100 gm b. wt./d. ●, 2 gm seeds/100 gm b. wt./d. ▲, and 4 gm seeds/100 gm b. wt./d. ■.



* : p<0.01 T: Standard deviation +: not significant

these substances on rat serum T_3 and T_4 concentrations. The effect of extracted hydrolysis products on thyroid activity parameter was compared to that of methimazole as a well documented anti-thyroid agent.

MATERIALS AND METHODS

Plant material

Authenticated seeds of Brassica oleracea L., Var. capitata were obtained from Isfahan Agriculture Department.

Hydrolysis and collection of glucosinolate hydrolysis products

Seeds of white cabbage (600 gm) were powdered and then left for hydrolysis (autolysis) in contact with distilled water (1000 ml) at 25°C overnight (17 hours). Then diethyl ether was added and the mixture was shaken for 2 hours (5, 6). The ethereal layer was then separated, evaporated under reduced pressure leaving an oily residue which constitutes the hydrolysis products of glucosinolates (5).

Feeding of glucosinolate hydrolysis products and methimazole to rats

The hydrolysate of white cabbage seeds was administered orally to several groups of rats (five rats in each group, 200-300 gm). The administered doses were representatives of 1, 2 and 4 gm seeds/100 gm body weight/day. The groups were fed for 10, 20 and 30 days. For a similar period of time to three separate groups of rats, 2 mg/100 gm body weight/day methimazole was fed orally (7) and to another three groups distilled water was given, the latter three groups were considered as controls.

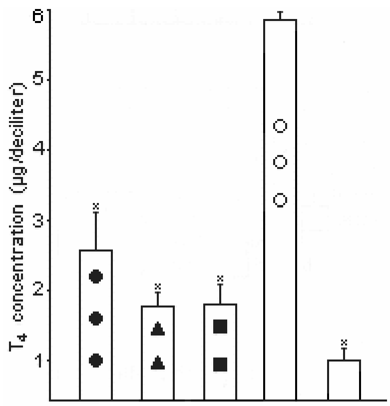
Determination of serum T_3 and T_4 concentrations

Groups of rats fed for different specified intervals of time with the glucosinolates hydrolysis products, methimazole and controls were decapitated, and blood samples were collected for analysis. Serum T_3 and T_4 concentrations were determined using radio immunoassay (RIA) method. Kits of T_3 and T_4were obtained from Diagnostic products corporation (DPC) (Los Angeles, CA 90045, USA), and the gamma counter used was computerized LKB model (wallac) connected to a recorder.

RESULTS AND DISCUSSION

Figures 2, 3 and 4 show the effects of three different doses of white cabbage hydrolysate on serum T_4 concentration after 10, 20 and 30 days compared with serum T_4 concentrations of groups fed with methimazole, and groups fed with distilled water for the same intervals of time. Methimazole reduced serum T_4 to about 1/5 th of its original concentration in 10 days, and this reduction was continued during the next 10 and 20 days but to about 1/9 th and 1/7 th of its original concentration respectively. How-

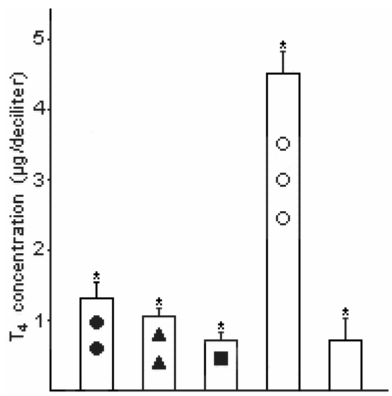
Figure 3: The effect of three different doses of white cabbage hydrolysate on serum T_4 concentration after 20 days oral administration. Serum T_4 concentration of control animals ❍, and of animals fed with 2 mg/100 gm body weight/day methimazole ❏, or white cabbage hydrolysate representative of 1 gm seeds/100 gm b. wt./d. ●, 2 gm seeds/100 gm b. wt./d. ▲, and 4 gm seeds/100 gm b. wt./d. ■.



x : p<0.001 T: Standard deviation

ever, when the hydrolysates representatives of 1 and 2 gm seeds/100 gm body weight/day were fed for 10 days caused no significant decrease in serum T_4 concentration, but the hydrolysate of 4 gm seeds/100 gm body weight/day fed for 10 days caused significant decrease in serum T_4. All groups fed with different mentioned doses of hydrolysate but for longer intervals (i.e. 20 and 30 days)

Figure 4: The effect of three different doses of white cabbage hydrolysate on serum T_4 concentration after 30 days oral administration. Serum T_4 concentration of control animals ❍, and of animals fed with 2 mg/100 gm body weight/day methimazole ❑, or white cabbage hydrolysate representative of 1 gm seeds/100 gm b. wt./d. ●, 2 gm seeds/100 gm b. wt./d. ▲, and 4 gm seeds/100 gm b. wt./d. ■.

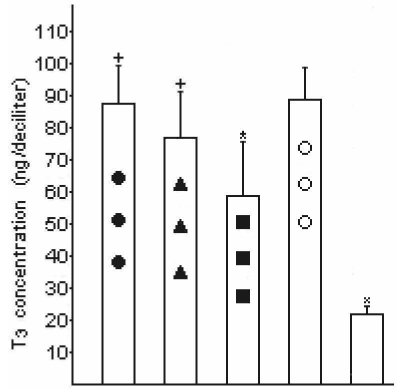


x: p<0.001 T: Standard deviation

were shown to have remarkable serum T_4 decrease. This effect was so noticeable that the hydrolysate of 4 gm seeds/100 gm body weight/day fed 30 days, caused a decrease analogous with that caused with methimazole.

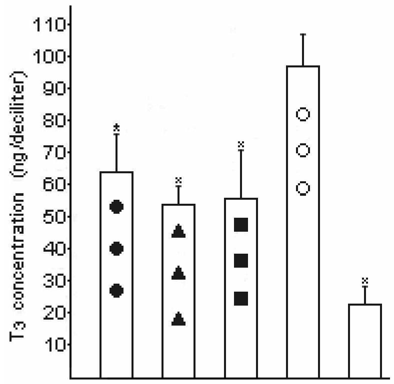
Figures 5, 6 and 7 show the effects of the same three different doses of white cabbage hydrolysate on serum T_3 concentration after 10, 20 and 30 days compared with serum T_3 concentrations of groups fed with methimazole, and groups fed with distilled water for the same intervals of time. Here again, the hydrolysates representatives of 1 and 2 gm seeds/100 gm body weight/day fed for 10 days caused no significant decrease in serum T_3 concentration,

Figure 5: The effect of three different doses of white cabbage hydrolysate on serum T_3 concentration after 10 days oral administration. Serum T_3 concentration of control animals ❍, and of animals fed with 2 mg/100 gm body weight/day methimazole ❑, or white cabbage hydrolysate representative of 1 gm seeds/100 gm b. wt./d. ●, 2 gm seeds/100 gm b. wt./d. ▲, and 4 gm seeds/100 gm b. wt./d. ■.



+: not significant * : p<0.01
x : p<0.001 T : Standard deviation

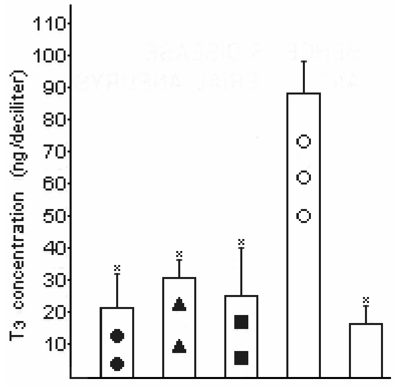
Figure 6: The effect of three different doses of white cabbage hydrolysate on serum T_3 concentration after 20 days oral administration. Serum T_3 concentration of control animals ❍, and of animals fed with 2 mg/100 gm body weight/day methimazole ❑, or white cabbage hydrolysate representative of 1 gm seeds/100 gm b. wt./d. ●, 2 gm seeds/100 gm b. wt./d. ▲, and 4 gm seeds/100 gm b. wt./d. ■.



*: p<0.01 x : p<0.001 T: Standard deviation

but the hydrolysate of 4 gm seeds/100 gm body weight/day fed for 10 days as well as the hydrolysates of 1,

Figure 7: The effect of three different doses of white cabbage hydrolysate on serum T_3 concentration after 30 days oral administration. Serum T_3 concentration of control animals ❍, and of animals fed with 2 mg/100 gm body weight/day methimazole ❑, or white cabbage hydrolysate representative of 1 gm seeds/100 gm b. wt./d. ●, 2 gm seeds/100 gm b. wt./d. ▲, and 4 gm seeds/100 gm b. wt./d. ▲.



x : p<0.001 T: Standard deviation

2 and 4 gm/100 gm body weight/day fed for 20 and 30 days caused significant decreases in serum T_3 concentration. Therefore, it is concluded that seeds of white cabbage contain strong anti-thyroid acting constituents.

REFERENCES

1. Vaughan JG, Macleod AJ, Jones BMG : "The Biology and Chemistry of the Cruciferae", Academic Press, New York, 1979.

2. Afharypuor S : Ph.D. Thesis, University of Manchester, Manchester, 1986.

3. Van Etten CH, Daxenbicler ME, Williams PH, Kwolek WF : J Agric Food Chem, 24:452, 1976.

4. Van Etten CH, Tookey HL : In: "Herbivores", Ed by GA Rosenthal and DH Janzen, Academic Press, London, p 472, 1979.

5. Lokwood GB, Afsharypuor S : J Chromatogr, 356:438, 1989.

6. Cole RA : Phytochemistry, 15:759, 1976.

7. Sitar DS, Thornhill DP : J Pharmacol Exp Ther, 184:439, 1973.

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