ADVANCES IN BIORESEARCH VOL 2 [1] JUNE 2011: 196-198

http://www.soeagra.com
ISSN 0976-4089

RESEARCH ARTICLE

Thyrotoxicity of Carbontetrachloride (CCL_4) in Albino rats

Vinay Kumar
Department of Zoology, D.S. College Aligarh - 202001 (U. P.)
Email: vinaykumar137@gmail.com

ABSTRACT

The effects of carbontetrachloride (ccl_4) toxicity on the thyroid gland were studied in albino rats. The study was divided into two groups of five animals each. The rats of first group 'A' were administered olive oil alone to serve as control. Rats of group 'B' were administered 0.2 ml of 2% CCL_4 on each alternate day for fifteen days. Observations on thyroid-body weight relationship and hormonal assay for T3 and T4 were recorded. Sex differences on its thyrotoxicity have also been studied. Significant results were observed in thyrotoxicity of CCL_4 in both sexes of rats. Thyrosomatic index was higher in CCL_4 treated male rats. CCL_4 stimulated the T3 and T4 secretion in female rats whereas reverse occurred in male rats. These results suggested that secretion of these hormones is affected by CCL_4.

Keywords: *CCL_4, T3, T4, Thyrotoxicity*.

INTRODUCTION

Thyroid function is sensitive to the action of various chemicals of low concentration. Several compounds are capable of actively modifying the functional efficiency of the thyroid gland. They include drugs as well as environmental chemicals. Such agents generally operate by interference with the normal processes of thyroid hormone biosynthesis for example thiocyanate, perchlorate, nitrate and fluoroborate, are the inhibitors of iodide uptake by the thyroid gland.

Anti-thyroid agents might interfere in the manufacture of thyroid hormones largely by preventing the gland from inserting inorganic iodide into tyrosine residues. Hyperthyroidic states have occasionally been reported from industrial poisoning by halogenated methane [1]. In contrast, ethanol perse can alter the thyroid hormones levels in adult animals creating a hypothyroid state [2].

Though a large wealth of information is available on the toxicity of industrial solvents like toluene, carbontetrachloride; their thyrotoxicity remain poorly known. The present study was done to observe the effects of ccl_4 on thyroid hormones for example, T3 and T4 in laboratory rats. Sex differences on its thyrotoxicity have also been studied.

MATERIAL AND METHODS

Albino rats of both sexes weighing 150-180 gm body weight, used for the study, were housed under standard laboratory conditions. They were fed with standard rodent pellets and water *adlibitum*. The animals were grouped into two groups of five animals each.

Group A: control (administered olive oil only)

Group B: Rats were administered 0.2 ml of 2% CCL_4 on each alternate day for fifteen days.

After the treatment for 30 days rats of both sexes were sacrificed under light ether anesthesia. The blood samples were taken directly by cardiac puncture and centrifuged to obtain serum. Hormones like Triiodothyronine and thyroxine were estimated following the solid phase radioimmunoassay method using a RIA kit, supplied by diagnostic products corporation, Los Angeles, California, U.S.A. These analyses were performed at a local pathology laboratory equipped with RIA facility.

RESULTS

Present observations included biological observations, observations on thyroid-body weight relationship and hormonal assay for T3 and T4.

CCL_4 decreased the growth of laboratory rats. The decrease caused by CCL_4 was higher in female rats than the male rats. Thyrosomatic index was high in male rats.

Observations on T3 revealed that CCL_4 significantly stimulated the secretion of this hormone in female rats. However, reverse observations were recorded in male rats, where a decline in T3 values was observed after CCL_4 treatments.

CCL_4 stimulated the secretion of T4 in female rats, whereas, inhibited the secretion in male rats.

Table 1: Observations on thyroid hormones in male laboratory rats.

Treatment	Body wt. (g)		Weight gain/loss (%)	Thyroid wt. (g)	T_3 (ng/ml)	T_4 (ng/ml)
	Initial	Final				
CCL_4	130±6.35	100±6.35	-15.40%	0.23±0.021	0.65±0.028	43.24±0.29
Control	130±6.35	145±6.35	+11.53%	0.32±0.019	0.67±0.02	44.20±0.35

Results are mean + S.E. for 5 observations (n=5)

Table 2: Observations on thyroid hormones in female laboratory rats.

Treatment	Body wt. (g)		Weight gain/loss (%)	Thyroid wt. (g)	T_3 (ng/ml)	T_4 (ng/ml)
	Initial	Final				
CCL_4	125±6.35	95±6.35	-23%	0.15±0.024	0.90±0.07	44.3±0.19
Control	125±6.35	140±6.35	+11.53%	0.15±0.024	0.55±0.02	38.04±0.14

Results are mean + S.E. for 5 observations (n=5)

DISCUSSION

The Thyroid gland is perhaps the only endocrine gland that stores its products extracellularly i.e. in the lumen of the follicle. This gland has the capacity to concentrate iodine to several hundred thousand times the concentration of this element in blood plasma. After the transport of iodine from the blood into the cells, it is oxidized in the presence of hydrogen peroxide to a different ionic species. The oxidized ion subsequently iodinates the tyrosine residues of thyroglobulin to form mono and diiodotyrosine. Triiodotyrosine is formed when one molecule each of monoiodotyrosine and diiodotyrosine are coupled. Thyroxine is formed when two molecules of diiodotyrosine are joined.

The activity of thyroid is regulated by thyrotropin or thryroid stimulated hormone (TSH) of the anterior lobe of pituitary which in turn is controlled by thyrotropin releasing factor (TRF) of the hypothalamus. Chronic hypersecretion of thyrotropin results in highly vascular gland with columnar epithelial cells and relatively little colloid. Thus secretion of the thyroid hormones can be severely affected by ionic imbalance particularly that of iodine.

The most striking effect of thyroid secretion is the control of the metabolic rate of the body. When hypothyroidism begins, it leads to cretinism and enlargement of thyroid is called goiter. Due to these changes body can be severely affected. Excessive consumption of goitrogens may interfere with iodine in the thyroid and may result in its enlargement.

This information is further strengthened by the fact that hyperplastic and neoplastic responses of the rat thyroid may be induced by a number of chemicals. Some information is available on heavy metal toxicity on thyroid function in man and experimental animals [3-8]. It has been reported that percentage uptake of I131 is significantly reduced in metal treated rats suggesting that they inhibit the thyroid function.

Present results show that male and female rats respond differently to toluene. The secretion of T3 and T4 in female rats might accompany hypersecretion of TSH influencing the hypothalamo-hypophyseal feedback mechanism. However, reverse may be expected for male rats. Another possible reason seems to be the inhibition of enzymes specially 5-thyroxine deiodinase which is involved in the conversion of T4 to T3 [9].

Adequate secretion of thyroid hormones is necessary for normal growth and development. Since CCL_4 is excessively used as industrial solvent, there are sufficient chances of human exposure in their environment.

CONCLUSION

Prolonged exposure to industrial solvent like CCL_4 has been found to cause thyrotoxicity in rats. It can be concluded that the secretion of thyroid hormones is affected by this solvent.

REFERENCES

[1]. Krasnyuk, E.P. (1964). Vrachebn. Delo; 1,115.
[2]. Portoles, M, *et al* (1988). Horm. Metabol. Res;20, 267-270.
[3]. Zeltser, M.E. (1962). Jr. Inst. Kraevoji Pathol. Akad Nand Kaz SSR; 10, 116-120.
[4]. Sandstead, H.H. (1967). Proc. Soc. Expt. Biol Med; 124, 18-20.
[5]. Sandstead, H.H. *et al* (1969). Arch intern Med; 123, 632-635.
[6]. Der, R *et al* (1977). Res commun Patho Pharmacol: 17, 237-253.
[7]. Robins, JM, *et al* (1983). Arch intern Med;143, 220-224.
[8]. Shrivastava, V.K. *et al*(1987) Bull Enriron Contam Toxicol; 38, 981-984.1.Burcker,
[9]. Gergus, Z *et al* (1988). Biochem. Pharmacol; 37. 4307-4312.