

EFFECT OF SUPRACIDE AND SHARKESUPER ADMINISTRATIONS ON THYROID, GONADOTROPHIC AND FEMALE SEX HORMONES IN RABBITS

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ABSTRACT

The effects of the organophosphorus Supracide and the pyrethroids Sharkesuper on the serum concentration of thyrotrophic (TSH), triiodothyronine (T3), thyroxine (T4), estradiol, progesterone, follicle stimulating (FSH) and luteinizing (LH) hormones in mature female rabbits were investigated. The results indicated that the short (9 days) and long (45 days) treatments of rabbits with both Supracide and Sharkesuper through drinking water at a rate of 1/10 LD50 exhibited varying degrees of reduction in all hormones studied. The degree of reduction in the concentrations of progesterone produced by long-term administration of Supracide was more pronounced than that produced by Sharkesuper. On the other hand, Sharkesuper treatment had more capacity to reduce the levels of other hormones nearly to half their control levels than that evoked by supracide. This reveals that the impairment in each of thyroid function, reproductive performance and fertility rate was more evident by exposure to Sharkesuper rather than Supracide. Therefore, it becomes of utmost significance to limit or prohibit utilization of such pesticides to avoid the economic losses that can be caused among rabbit breeds.

INTRODUCTION

Organophosphorus compounds constitute a large proportion of insecticides used all over the world. Their insecticidal properties and acute toxicity in non-target species derive from the inhibition of acetylcholinesterase which disturbs the cholinergically - mediated - neurotransmission (Gralewicz and Socko, 1977).

The influence of insecticides on thyroid function and fertility in mammals received little attention. Reproduction in mammals is closely linked with the dynamics of thyroid activity. Singh and Singh (1980) found that organophosphorus compounds caused a reduction in thyrotrophic hormone and thyroid activity.

Younis *et al.* (1988) showed that oral administration of tamaron (organophosphorus) led to a decrease in serum levels of TSH, T4, T3, estradiol and progesterone in short and long terms treated female rats. Maiti *et al.* (1997) showed that the insecticide dimethoate administered to 3 groups of 8 cockerels caused reduction in serum concentration of thyroxine, 3, 3,5-triiodothyronine and hepatic type-1 iodothyronine 5-mono-deiodinase activity. It is concluded that dimethoate inhibits the extrathyroidal conversion of T4 to T3.

Ratlner *et al.* (1982) reported that short-term ingestion of organophosphorus can impair reproduction in female rats possibly by altering gonadotrophin or steroid hormones secretion. In addition, Boikova *et al.* (1979) stated that steroids administration diminished or removed the negative effects of pesticide (organophosphorus) on female rats reproduction.

The present investigation was aimed to clarify the effect of supracide (organophosphorus) and Sharkesuper (pyrethroids) administrations on reproductive performance of female rabbits through the study of thyroid activity, thyrotrophic, gonadotrophic and female sex hormones.

MATERIALS AND METHODS

Fifty non-pregnant, mature female white New Zealand rabbits of an average weight 3750 ± 500 g were used in the present investigation. The animals were kept under strict hygienic conditions and veterinary supervision throughout the experimental period which was in winter from November 1998 to January 1999. The rabbits were fed on maintenance diet composed of Arasco rabbit belts (protein 15.8%, fat 2.5% and fibers 7%), vitamins and good quality hay. They were divided at random into 5 equal groups of 10 rabbits each and treated as follows:

1. Rabbits in group I were considered as controls.
2. Rabbits in group II were treated with organophosphorus insecticide (Supracide-40EC, methidathion, Ciba-Gigy, Germany) orally through drinking water at a concentration of 70 ppm (1/0 LD50) for 9 days (short term).
3. Rabbits in group III were treated with Supracide in the same route and concentration as in group II but for a period of 45 days (long term).
4. Rabbits in group IV were treated with pyrethroidal insecticide (Sharkesuper-10EC, Permethrin, Scidco Co., Kingdom of Saudi Arabia) in the same route at a concentration of 740 pp (1/10 LD50) for 9 days (short term).
5. The rabbits of group V were treated with Sharkesuper in the same route and concentration as in group III for 45 days (long term).

At the end of each experimental period rabbits were slaughtered, individual blood samples were collected into tubes with no additives. The serum was separated by centrifugation (3000 rpm) and stored at -20°C until hormonal assays were carried out.

The measurements of serum TSH, T3, T4, estradiol, progesterone, FSH and LH were performed according to the Abbott System (AXSYM, USA) operations manual supplied by Abbott Laboratories Diagnostic Products, USA (1999). The concentrations of TSH, T3, estradiol, progesterone, FSH and LH were measured on the principle of microparticle enzyme immunoassay (MEIA) technology. In the procedure adopted the AXSYM reagents of each of TSH, T3, estradiol, progesterone, FSH and LH were pipetted with the samples. The reaction vessels were immediately transferred into the processing center. In this center, the glass fiber matrix in which antibody-antigen complex bind to the microparticle is washed. Then the antihormonal alkaline phosphatase conjugates and its substrates were added to the matrix cell. The fluorescent product was measured by the MEIA optical assembly.

The method used for determination of total T4 was also described by Abbott Laboratories Diagnostics but the procedure is based on fluorescence polarization immunoassay (FPIA) technology. The AXYM total T4 reagents and sample were pipetted into reaction vessels. The vessels were then transferred into the processing center where the intensity of polarized fluorescent light was measured by the FPIA optical assembly. The data of the present study were analyzed statistically by using "t" test (Snedecor and Cochran, 1980).

RESULTS

Data presented in Table 1 show that administration of Supracide and Sharkesuper into mature female rabbits led to a highly significant decrease ($P < 0.01$) in serum concentrations of TSH, T3 and T4 in long term treatment in comparison with respective control. There was a significant decrease in the levels of TSH and T3 during short term in both Supracide and Sharkesuper treated animals.

A significant decrease ($P < 0.05$) in the serum concentration of T4 was observed by short term treatment of Sharkesuper only. Concerning the concentrations of estradiol and progesterone, there were highly significant reductions in all treated rabbits with Supracide and Sharkesuper in both short and long terms as compared with control animals. Likewise, there was a highly significant decrease in the concentration of FSH during short and long term treatments of Sharkesuper, while there was a significant fall in the level of this hormone following short and long term treatments of Supracide. Although there was a significant decrease in LH levels during short and long terms treated rabbits with Sharkesuper, there was a non-significant variation during the two terms of Supracide treatment.

It was apparent from the calculation of reduction percentages that the long term administration of Supracide was more pronounced for progesterone reaching to 94.14% reduction of its control level. Contrarily, the long term administration of Sharkesuper evoked reduction in levels of other tested hormones nearly to half of their control levels. However, the reduction rate in the levels of both estradiol and progesterone was 72.41% for the former and 80.52% for the later.

It was clear from the results that Sharkesuper treatment was more effective on the reduction of the serum levels of TSH, T3, T4, estradiol, progesterone, FSH and LH during both short and long terms in comparison with supracide.

DISCUSSION

There is an increasing interest from the hygienic point of view for the safety of the feeding stuffs for consumption. Pesticides are widely used for agricultural and animal purposes. Therefore, a great chance for air, water and food pollution from these compounds could be expected. Moreover, feeds of plant origin may contain residues of these compounds. Therefore, it was decided to perform this investigation to determine more clearly the

patterns of change in the serum thyrotropic, thyroid functions, steroids and reproductive performance following the addition of Supracide (organophosphorus) and Sharkesuper (methidathion) into drinking water of mature female rabbits for short and long periods. The results of the present investigation revealed that Supracide and Sharkesuper appeared to decrease thyroid activity where T3, T4, and TSH concentrations were reduced. Sharkesuper of long term administration had more considerable reduction effect on most of the hormone levels than Supracide. In addition, the administration of Supracide for a period of 45 days had more reduction effect on the progesterone levels where they were sharply dropped reaching to 94.14% reduction of its control level.

Previous paper indicated that organophosphorus led to reduction of TSH and thyroid functions (Singh and Singh, 1980; Younis *et al.*, 1988). It seems from the present study that the Supracide and Sharkesuper administrations may suppress thyroid activity. The suppression may probably be attributed to deiodination of amino acid tyrosine or indirectly to blockage of TSH synthesis and release from anterior pituitary gland (Dickson, 1977; Salem *et al.*, 1989). Furthermore, the hepatotoxic effect of Supracide and Sharkesuper may interfere with the metabolic

degradation of thyroid hormones minimizing the catalytic activity of iodothyronine 5-mono-deiodinase enzyme of the liver (Salem *et al.*, 1989; Maiti *et al.*, 1997).

The significant fall in the levels of FSH and LH might be attributed to the suppression of hypothalamic releasing hormone secretions for FSH and LH induced by toxic effect on the hypothalamus. This seems to be in accordance with the data previously reported by Ratlner *et al.* (1982). Similarly, reduction in serum estrogen and progesterone concentrations could be due to the inhibitory effect of Supracide and Sharkesuper on pituitary FSH and LH release (Ratlner *et al.*, 1982). Moreover, the organophosphorus compounds caused ovarian toxicity and follicular atresia (Jarrell *et al.*, 1987) which led to reduction in estradiol and progesterone levels.

In the light of these findings, the thyroid functions, fertility rate and reproduction performances were impaired owing to the organophosphorus Supracide and pyrethroids Sharkesuper administrations. Therefore, the use of such pesticides must be limited or totally prohibited as they cause economic losses in the rabbit breeding.

Table 1: Serum levels of thyrotropic (TSH), triiodothyronine (T3), thyroxin (T4), estradiol, progesterone, FSH and LH in Supracide and Sharkesuper in treated rabbits

Hormones	Control	Supracide				Sharkesuper			
		Short term		Long term		Short term		Long term	
		Mean ±SE	Reduction (%)	Mean±S E	Reduction (%)	Mean ±SE	Reduction (%)	Mean± SE	Reduction (%)
TSH (μIU/ml)	0.95± 0.03	0.64** ±0.01	32.63	0.51** ±0.01	46.32	0.67** ±0.06	29.47	0.48** ±0.02	49.47
T3 (ng/dl)	87.63± 3.20	74.40** ±0.090	15.10	71.20** ±1.06	18.75	72.80** ±3.70	16.92	58.60* *±3.60	33.13
T4 (μg/dl)	4.18± 0.07	4.01 ±0.02	4.07	3.49** ±0.04	16.51	3.15** ±0.26	24.64	2.09** ±0.15	50.00
Estradiol (pg/ml)	9.06± 0.27	5.01** ±0.11	44.70	3.20** ±0.37	64.68	3.30**± 0.37	63.58	2.50** ±0.22	72.41
Progesteron (ng/ml)	5.80± 0.27	0.62** ±0.05	89.31	0.34** ±0.06	94.14	3.07** ±0.10	47.51	1.13** ±0.07	80.52
FSH (mIU/ml)	3.05± 0.19	2.11** ±0.21	30.82	1.93** ±0.23	36.72	1.76** ±0.23	42.30	1.44** ±0.18	52.79
LH (mIR/ml)	0.57± 0.03	0.55 ±0.04	3.51	0.46** ±0.07	19.30	0.41** ±0.06	28.70	0.32** ±0.04	43.86

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