Comparison of Carbofuran and Imidacloprid toxicity on a mammalian model

Presented by

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Carbofuran

- Carbofuran is a carbamate pesticide.
- It forms Carbofuran- AChE complex which cause inhibition of acetylcholinesterase (AChE).
- It is used to control insects in a wide variety of field crops, including potatoes, corn and soybean etc.
- It is a systemic insecticide.

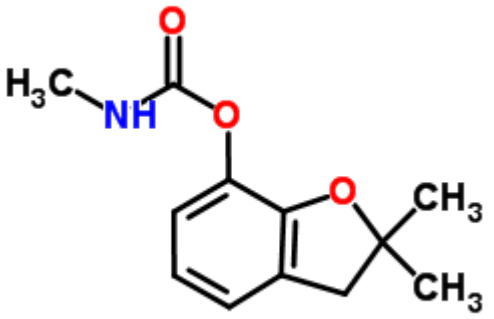

Fig 1: Structure of Carbofuran

http://www.chemspider.com/Chemical-Structure.2468.html

Carbofuran

- Carbofuran exhibits **TOXICITY** mediated by the same mechanism as that of the notorious V series nerve agents known as **Chemical Warfares** and presents a risk to human health.
- It is an **ENDOCRINE DISRUPTOR** and a probable reproduction/development intoxicant.
- Since its toxic effects are due to its activity as a **Cholinesterase inhibitor**, it is considered a **NEUROTOXIC** pesticide.

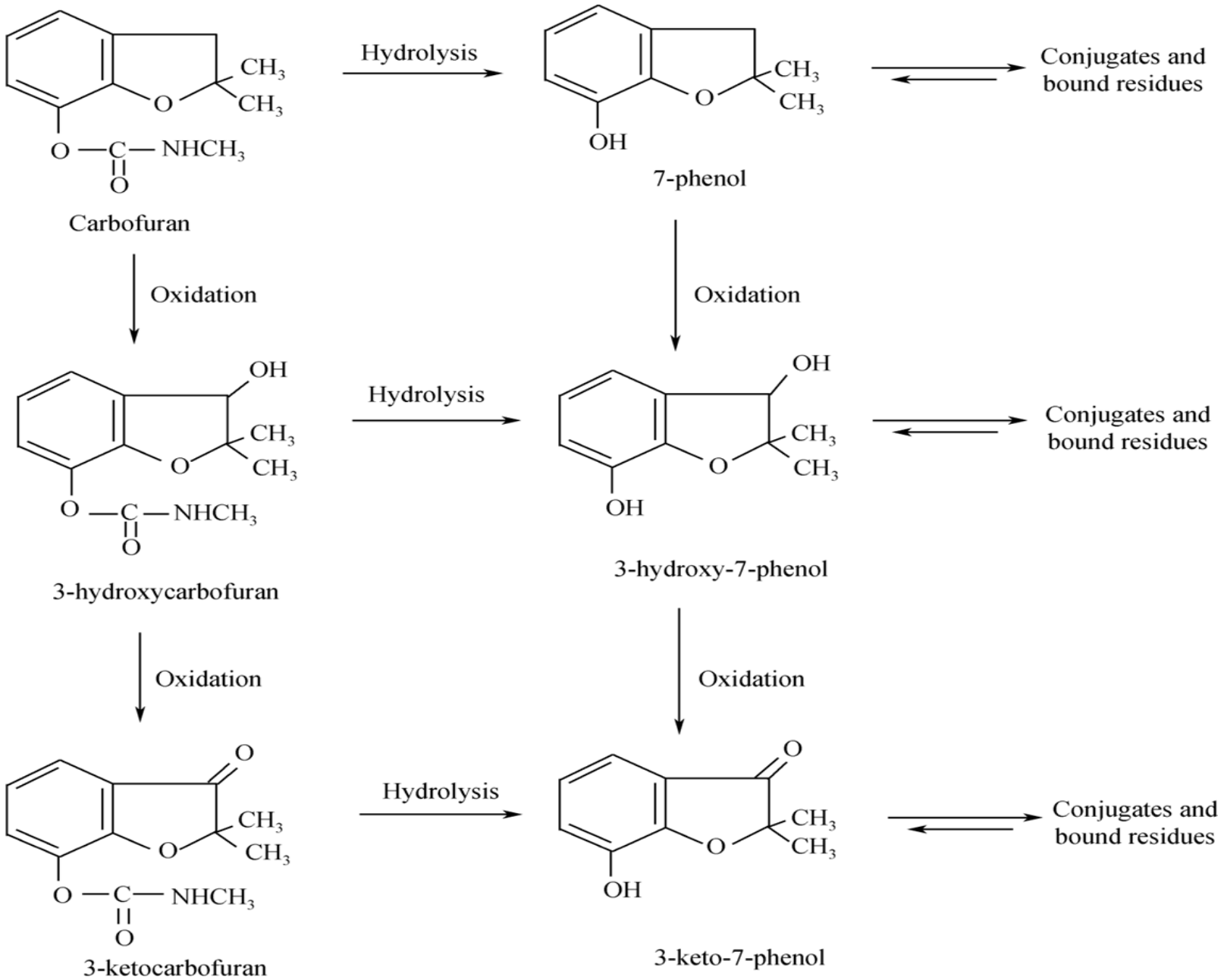

Fig 2: Metabolic pathway of Carbofuran

Imidacloprid

❖Imidacloprid is a type of neonicotinoid pesticide which act on the central nervous system of insects.

❖It is also a Systemic Insecticide that acts as an **INSECT NEUROTOXIN**.

❖it causes a blockage of the nicotinergic neuronal pathway. By blocking nicotinic acetylcholine receptors.

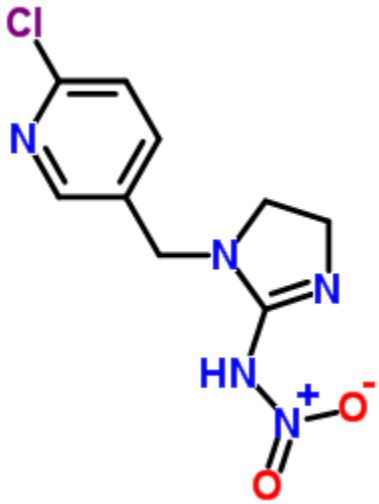

Fig 2: Structure of Imidacloprid

http://www.chemspider.com/Chemical-Structure.77934.html

Imidacloprid

- By blocking nicotinic acetyl choline receptors it prevents acetylcholine from transmitting impulses between nerves, resulting in the insect's paralysis and eventual death (Acetylcholinesterase has two type of receptors i.e., Nicotinic & Mascarinic receptors).
- Because imidacloprid binds much more strongly to insect neuron receptors than to mammal neuron receptors, this insecticide is more toxic to insects than to mammals.

- Different studies show that insecticides (Organophosphates, Carbamats and Neonicotinoids) also possess non-targeted affects on birds, mammals etc.
- Although the extent of toxicity is smaller as compared to the targeted organisms but heavy and prolonged exposure may pose significant risk to these non-targeted organisms.

Objectives

In view of the neurotoxic effects of both the compounds, present study was designed to investigate the comparative effect of Carbofuran and Imidacloprid on the following parameters in adult rabbits:

- ✓ Body weight
- ✓ Growth hormone
- ✓ Serum total proteins
- ✓ Albumin and
- ✓ Globulin

PLAN OF WORK

Experimental work was carried out after the acclimatization of animals. The blood sampling and biochemical analysis was done in the Physiology and Endocrinology laboratory of Zoology Department, LCWU, Lahore, Pakistan
Adult male rabbits n= 60

Phase I:

GROUPING

Control

Group1, n= 20
Normal saline on consecutive days for 4 weeks)

Carbofuran and Imidacloprid treated groups

Group 2, n= 20
Carbofuran (0.5 mg/kg of body weight) dissolved in vegetable oil thrice a week for upto 4 weeks).

Group 3, n= 20
Imidacloprid (25 mg/kg of body weight) dissolved in vegetable oil thrice a week for upto 4 weeks).

Oral treatment for 28 days

Phase II:
Sampling and Laboratory Analysis

10 Animals were dissected after 7th and 28th day of Carbofuran and Imidacloprid exposure for blood sampling

Blood
(Serum separation by centrifugation at 3000rpm and stored at -20°C)

Biochemical Analysis (Total protein, albumin, Globulin and GH were analyzed

Data analysis

RESULTS

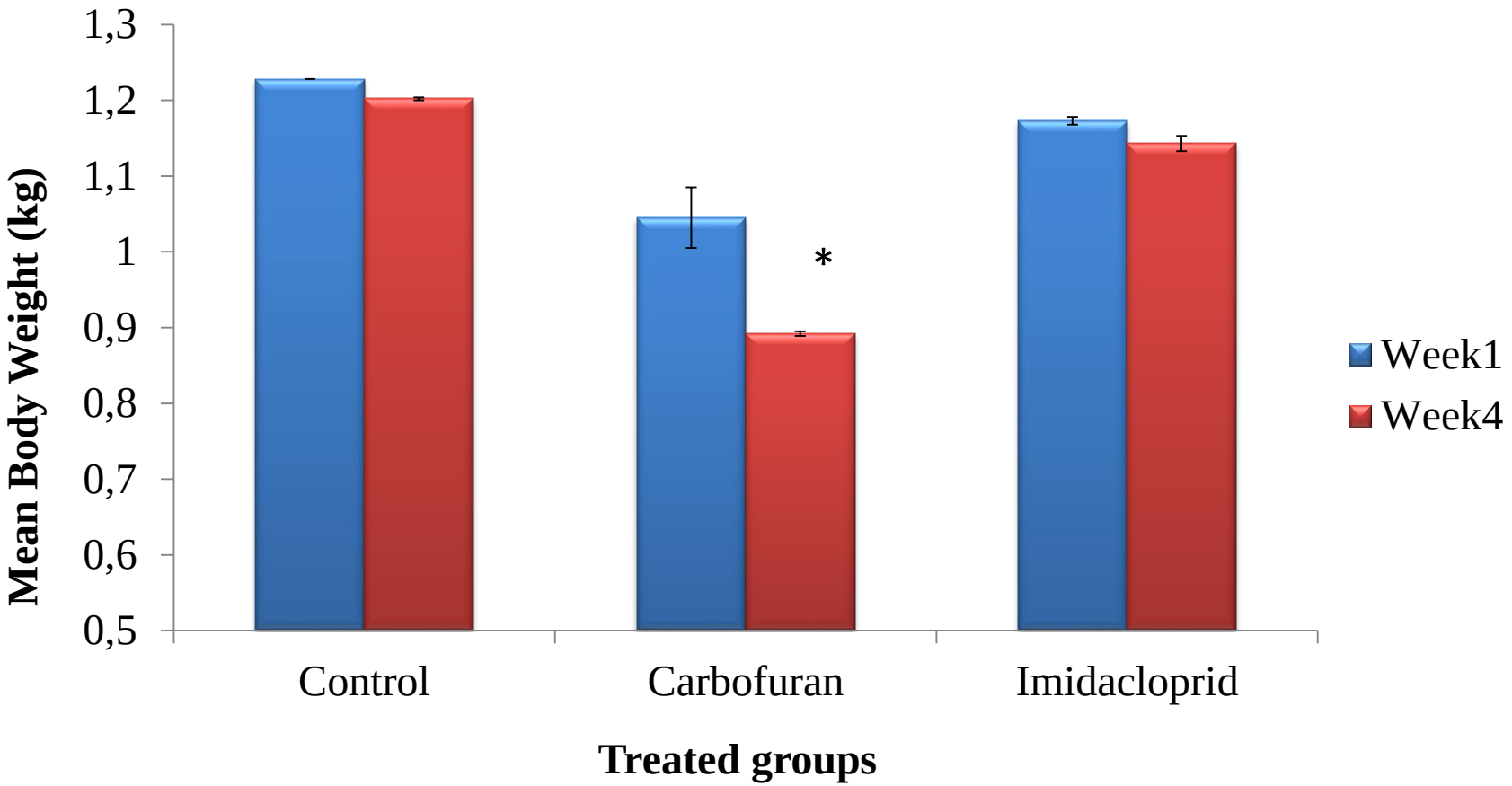

Fig 3: Comparison of mean ± SEM of body weights (kg) in control, carbofuran and imidacloprid treated groups after 1st and 4th week of treatment.
***p*<0.05**

Total Protein (g/dl), Albumin and Globulin

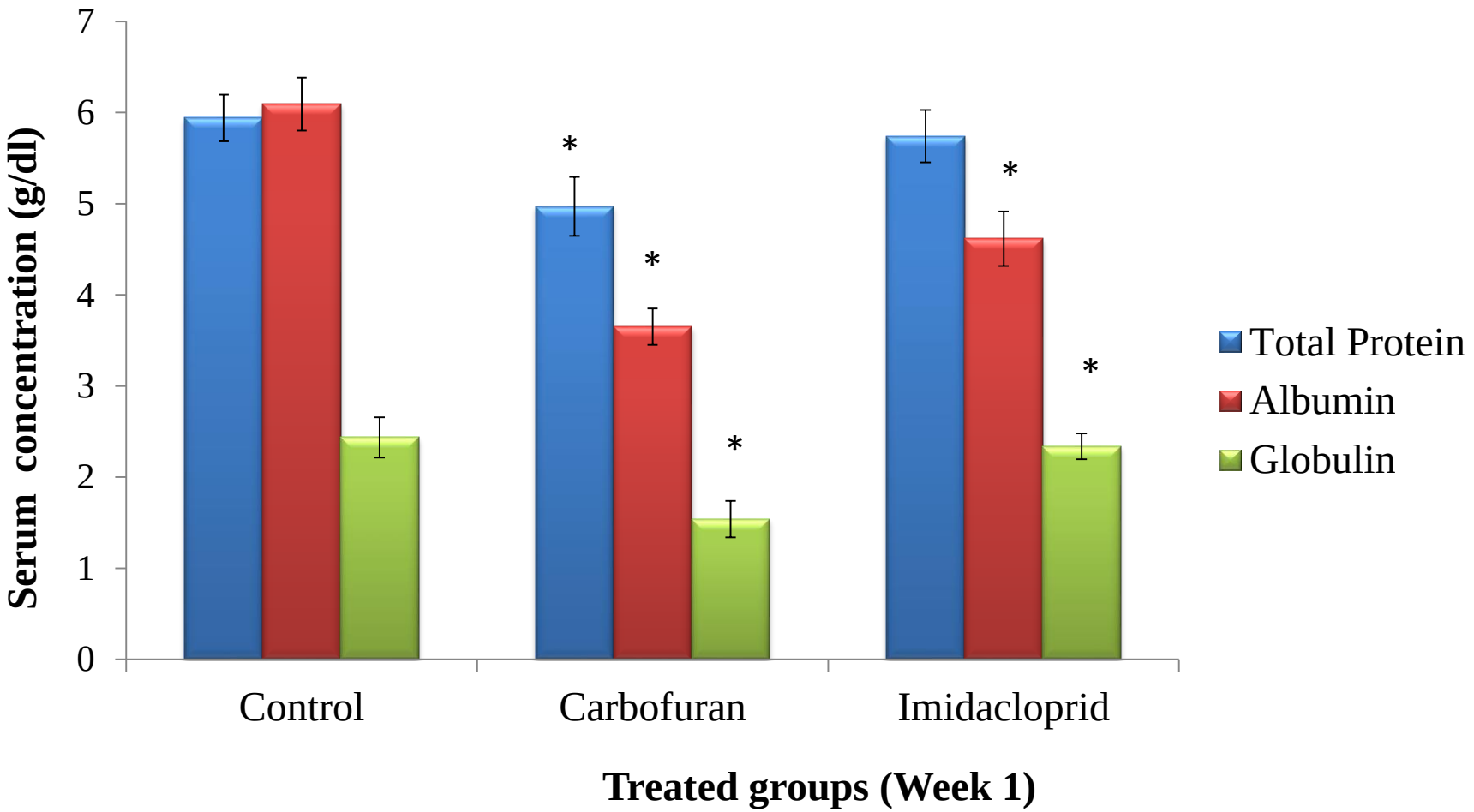

Fig 4: Comparison of mean ± SEM of serum Total protein, Albumin and globulin concentration (g/dL) in control, carbofuran and imidacloprid treated group rabbits after 1st week of treatment. * = $p < 0.05$; * In comparison to control

Total Protein (g/dl), Albumin and Globulin

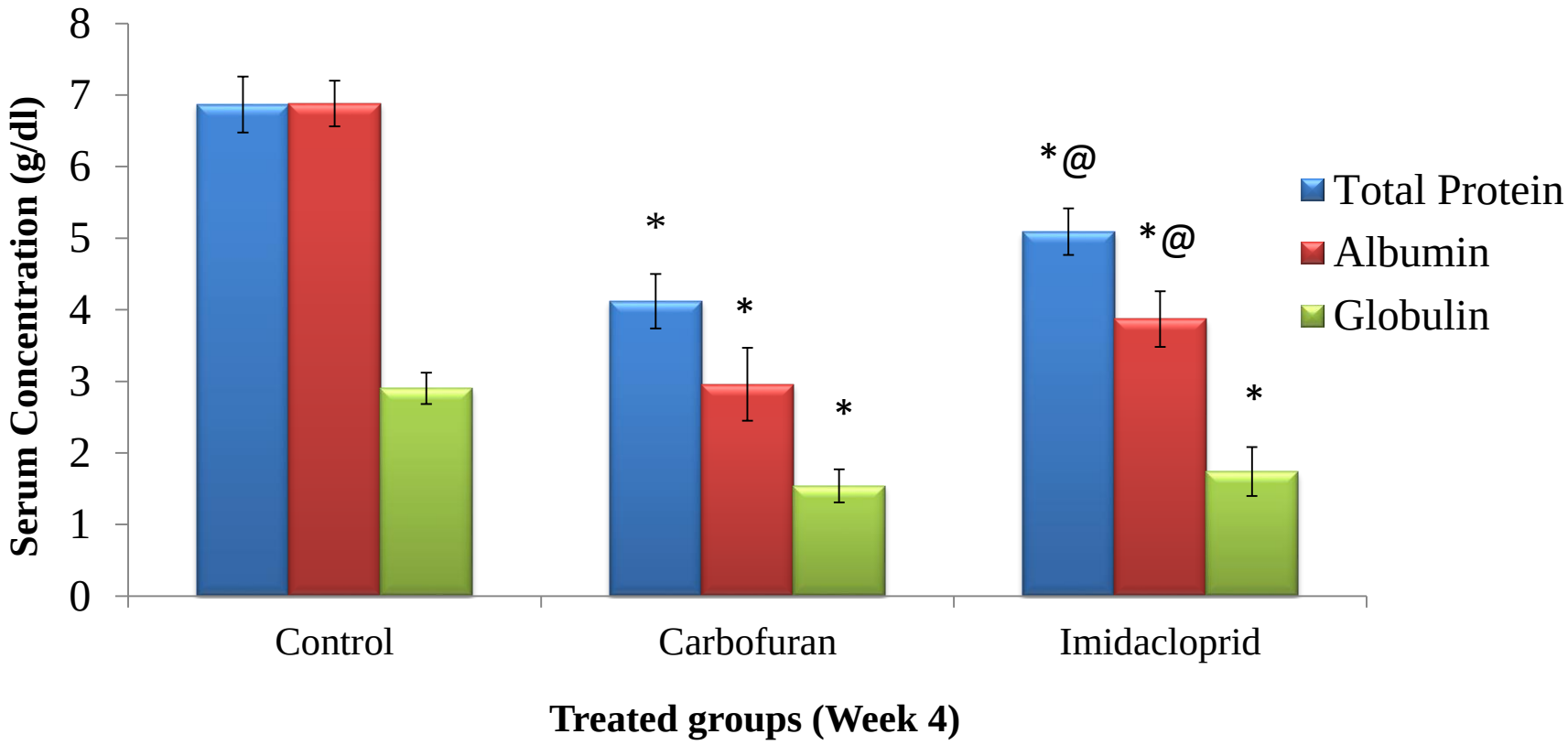

Fig 5: Comparison of mean ± SEM of serum Total protein, Albumin and globulin concentration (g/dL) in control, carbofuran and imidacloprid treated group rabbits after 4th week of treatment.

*,@ = $p < 0.05$; * In comparison to control, @ in comparison to Carbofuran

Growth Hormone (µg/L)

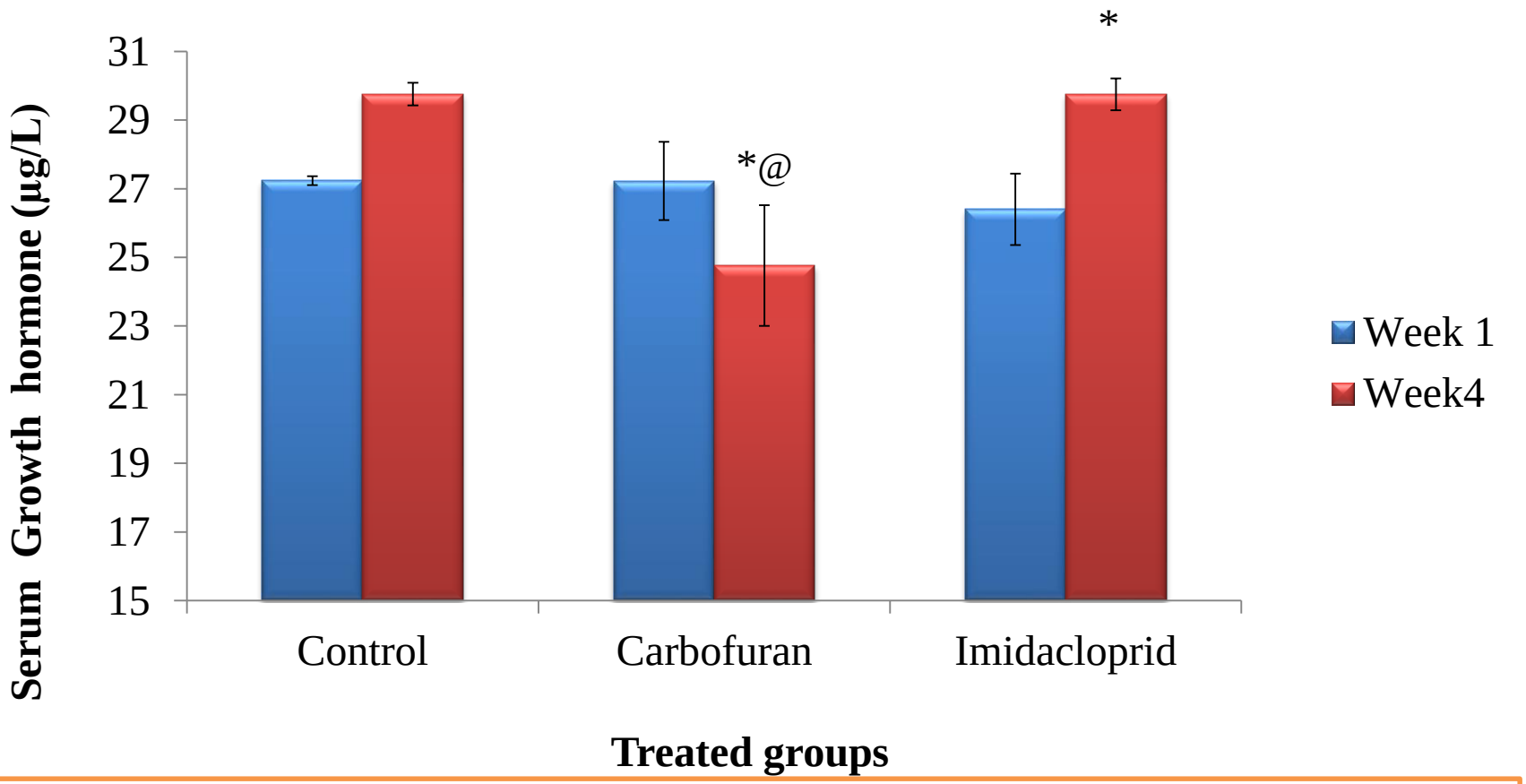

Fig 6: Comparison of mean ± SEM of serum GH concentrations (µg/L) in control, carbofuran and imidacloprid treated group rabbits after 1st week of treatment.
*, @ = $p < 0.05$; * In comparison to control; @ in comparison to Carbofuran

Conclusion

•From the results of the present study it is concluded that Carbofuran being the antagonist of AChE is more toxic than Imidacloprid in affecting different parameters (body weight, GH, total protein, albumin and globulin) of mammalian model.

• This is a short term study hence the findings can be more authenticated if the study is carried out for chronic exposure.

Thank you