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Research Article

Behavioral Changes in Broiler Chicks Exposed to Carbaryl

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Abstract

Background: Pesticides are the synthetic chemicals used for to protect crops and livestock from various pests. Carbaryl a carbamate pesticide have the potential to cause behavioral disturbances in broiler chicks. Carbaryl inhibit the action of enzyme acetylcholinesterase due to this neurotrans-mission is block in the nervous system of animals because it is absorbed by gastrointestinal tract.

Results: Twenty days old broiler chicks of either sex were taken for the study and evenly divided into two groups consisting one control and one treated group. 2mg/kgbw of Carbaryl was added into the diet of treated group for 21 days. Difficulty in walking, dizziness, less food consumption, weakness and less activity was recorded in treated group.

Conclusion: Behavioural effects of carbaryl are briefly reviewed earlier. The results of present study showed that a dose of 2mg/kgbw of carbaryl cause neurotoxic effects in both animals and humans.

Keywords: Carbaryl; Behaviour; Nervous system

Background

Pesticides are the chemicals which are used for to eliminate or control a variety of pests such as fungi, insects, rodents and weeds that can damage various crops and livestock [1-3]. Pesticides have become omnipresent contaminants of our environment and have been found in air, water, soil and in human and animal tissue [4]. Pesticides are widely used in agriculture, homes, soil treatment and for gardening [5,6]. A large number of animals are adversely affected by carbaryl. It causes acute and chronic toxicity in arthropods, earthworms, frogs, birds, fishes and in some bacterias such as nitrogen fixing bacteria [7]. The use of such types of chemicals increased the level of these chemicals in environment and in the food which affects the human health and causes various severe diseases such as cancer, genetic disorders, respiratory diseases, embryo toxic effect, negative effects on developing bird eggs and their hatching, neurological effects and behavioural effects [8-10].

Continuous exposure to these chemicals may cause several abnormalities and also reduces the life span [11,12]. Carbaryl is an insecticide which belongs to class carbamate. Carbamates are esters and derived from dimethyl N-methyl carbonic acid. It inhibits the normal functioning of nervous system in insects by blocking the neurotransmission via inhibition of the enzyme acetylcholinesterase (AChE) because carbaryl is absorbed by gastrointestinal tract very readily and is rapidly metabolized [13].

Various physiological disturbances may cause by exposure to pesticides this may lead to behavioural changes in animals. Researchers from the USSR Academy of Medical Sciences studied that carbaryl have an ability to disrupt the normal functioning of hormones and endocrine system [14]. It inhibits the activity of two sex hormones i.e., oestrogen and progesterone in humans [15]. Carbaryl is frequently used in poultry industry, livestock and in garden to control the pest [16]. Carbaryl is readily absorbed through skin and spreads up in a variety of tissues and organs of the body. Various researchers from Institute of Agriculture Medicine, Poland showed that carbaryl ends up in the organs such as liver and brain when applied on the skin [17]. Toxicologists of University of North Carolina showed that carbaryl suppressed the immune system in the laboratory animals [18].

Health effects of Carbaryl

a. Vomiting [19]

b. Nervous system disorders [20]

c. Respiratory disease [21,22]

d. Cardiovascular disorders
e. Reproductive disorders [23]
f. Skin disorders
g. Dizziness
h. Abdominal cramps
i. Muscle weakness [24]
j. Incoordination
k. Central nervous system depression [25]
l. Headache
m. Unconsciousness
n. Diarrhoea
o. Cancer [26]
p. Endocrine disruption [27]
q. Genetic damage [28]

Material and Method

Animals

Twenty-day old broiler chicks (Gallus gallus) of weight ranging from 25-30gm were taken for the study.

Experimental laboratory

The experiment was conducted in the Laboratory of Reproductive Biology, Dayanand Girls P.G. College, Kanpur. Broiler chicks were housed in stainless steel cages with room temperature 22±3ºC, Relative humidity 50-70% and Photoperiod of 12 hours dark and 12 hours light.

Experimental Design

Broiler chicks were divided into two groups: control and treated group. Treated group supplemented with 2mg/kgbw of carbaryl and control group was fed on the basal di-et for 21 days. The behaviour of broiler chicks were recorded daily.

Results and Discussion

Table 1: Carbamate Pesticides with their effects.

Pesticide name	Lethal dose (LD50)	Health Effects	
Aldicarb	0.84 mg/kg	Nausea, Weakness, Tremors, Paralysis in respiratory system, Headache, Cancer	Kizer, Kenneth W [43]
Aminocarb	30 mg/kg	Respiratory failure and Convulsions	
Bendiocarb	34-64 mg/kg	Inhibits Acetylcholinesterase enzyme activity	R.E.D. Facts [47]
Carbaryl	850 mg/kg	Inhibit Cholinesterase enzyme and Carcinogenic	Interim Reregistration Eligibility Decision for Carbaryl [42]
Carbofuran	8-14 mg/kg	Disrupt the normal functioning of hormones, Decreases sperm count and sperm motility	Pant et al. [46], Lau et al. [44]
Carbosulfan	90-250 mg/kg	Reversible inhibition of cholinesterase enzyme	Carbosulfan [40]
Ethiofencarb		Muscle weakness, abdominal pain, vomiting, dizziness	Ethiofencarb [41]

Carbamate pesticides damage human health as well as the whole environment and also affect the avian species. These pesticides are widely used in gardens and in various types of vegetable crops for their protection from insects, weeds and fruit fly. Carbaryl commonly found in groundwater be-because it does not dissolve in water. If organisms exposed to these pesticides directly or indirectly than it may cause various abnormalities [29-31]. Carbaryl inactivate the essential enzymes which are important for human's nervous system and for other animals like birds by inhibiting the acetylcholinesterase activity. Acetylcholinesterase is responsible for hydrolysing acetylcholine to acetic acid and choline which is important for normal functioning of peripheral nervous system and central nervous system [32-34]. Carbaryl may cause quantitative and qualitative changes in birds as well as functional and structural changes in birds (Table 1).

The function of carbaryl is to disrupt the normal functioning of cholinesterase enzyme which is important for normal functioning of nervous system. When broiler chicks exposed to carbaryl it disrupts the normal functioning of nervous system which changes the behavioural activity of broiler chicks. Broiler chicks exposed to carbaryl were less active than controls. Behavioural changes were examined in treated group such as difficulty in walking, weakness in the legs, dizziness, frequent defecation and less food consumption. Decrease in aggressive behaviour was also found in broiler chicks fed with carbaryl. Broiler chicks exposed to carbaryl are less active than normal broiler chicks.

Contrary to our results Greu & Shipley [35] found less activity and showing significantly more time perching and less time for singing and foraging in male starlings (Sturnus vulgaris) when treat-ed with dicrotophos. Oral Intoxication were reported in white leghorn chickens (Gallus gallus domesticus) when treated with 500mg/kg/day and in mallard ducks (Anas platyrhynchos) administered 1000 mg/kg/day of bromacil a herbicide [36-39] reported loss of equilibrium in bull frog tadpoles and in Hylaarborea tadpoles when treated with malathion and dimethoate respectively [40-47].

Conclusion

Results of this study showed that carbaryl a carbamate pesticide which is frequently used in poultry industry causes neurotoxic effects such as behavioural changes in broiler chicks even in low concentration.

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