ABSTRACT

Cadmium, a toxic environmental pollutant, causes severe damages to various tissues/organs of animals and most of the body burden of cadmium is derived from the contaminated feed and water.

Studies were conducted on cadmium toxicity and its impact on the metabolic changes in Japanese quail (Coturnix coturnix japonica Temminck and Schlegel). The animal feeds and their ingredients as well as tissues/organs of six commercially important farm animals including Japanese quail were analysed for cadmium, copper and zinc. The acute toxicity study and long term sublethal cadmium impacts on Japanese quail were evaluated. The bioaccumulation and bioconcentration of cadmium in different tissues/organs of Japanese quail and the associated physiological and biochemical changes, such as growth, blood component, proteins, lipids, enzymes of clinical importance (AST, ALT and GGT), histopathological changes in liver, kidneys, lungs, testes, ovaries and bone as well as chromosomal alterations were investigated.

The acute toxicity studies revealed that the LD$_{50}$ of oral cadmium for 3 week old Japanese quail was 40 mg/kg body weight. The sublethal oral dose of 4 mg/kg/day from 3rd to 8th week of age confirmed the bioaccumulation of cadmium in different tissues in dose related manner.
The order of accumulation of cadmium in different tissues/organs was kidneys > liver > lungs > heart > feathers > bone > muscles after one week; liver > kidneys > lungs > feathers > heart > bone > muscles after two weeks; and liver > kidneys > feathers > lungs > heart > bone > muscles after 3rd, 4th and 5th week of treatment. The study indicated that the kidneys accumulated relatively higher cadmium (31.1 µg/g) than the liver (26.78 µg/g) when the exposure time and administered cadmium were low and the accumulation of Cd was greater in liver (158 µg/g) than kidneys (132 µg/g) when the administered cadmium and exposure period were high. Further, the bioaccumulated cadmium in various tissues altered the copper and zinc contents by inhibiting copper excretion through excreta reducing zinc content in lungs, bone and excreta. The accumulation of cadmium in feather and excreta increased markedly during the period of investigation suggesting that the toxicant was probably eliminated from the body through feathers and excreta.

The bioaccumulation and bioconcentration of cadmium were found to reduce the growth, haemoglobin content, erythrocytic count and packed cell volume but elevated serum total protein. The cadmium accumulation in liver and kidneys reduced the protein but increased lipid content. The activities of AST and ALT in liver and kidneys of cadmium treated birds were decreased but the AST and ALT levels in serum were
highly elevated. The GGT activity in liver, kidneys as well as in serum was found to be increased in cadmium treated birds compared to the control.

The impact of cadmium produced necrosis, degenerative changes and excessive fat accumulation in liver, kidneys, testes and bone; atrophy of gonads and suppressed spermatogenesis / oogenesis; inhibition of erythropoietic activity in the bone marrow and emphysema in lungs of cadmium treated Japanese quail. Further, the impact of cadmium toxicity was found to produce pulverization of chromosomes.

The cadmium levels in different tissues/organs of various animals clearly indicated that preferential consumption of liver, kidneys and brain of farm animals would lead to heavy metal toxicity in consumers. Since the feeds and ingredients are the major sources of heavy metals to animals, periodical monitoring and control of feeds and ingredients for heavy metals would definitely protect the animals from metal toxicity and improve the health status and productivity of farm animals.