

POLYCHLORINATEDBIPHENYLS IN MILK AND RUMEN LIQUOR OF STRAY CATTLE IN CHENNAI*

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ABSTRACT

In this study, milk and rumen liquor of stray cattle were found to contain measurable concentration of PolyChlorinatedBiphenyls (PCB). A notable finding in this study is that stray cattle have high level of PCBs where as the PCB in control group can not be detected. Since, reduction in space in the urban areas has pushed the cattle population to fend themselves in the streets, bovine milk act as a potential source of PCBs for residents in Chennai. To our knowledge, this is the first comprehensive study on exposure of stray cattle to PCBs by intake of plastic waste in India.

Key Words: PCB – Stray cattle – Plastic waste.

INTRODUCTION

The indiscriminate ingestive behavior of cattle predisposes them to accidental swallowing of both penetrating and non penetrating foreign bodies that settle in the reticulum and rumen most of the times. Low nutritional status of cattle have forced the cattle to scavenge for food in the urban streets and refuse dumps paving way for consumption of both penetrating and non penetrating foreign bodies.

The sequelae of penetrating foreign body in cattle are known and their diagnoses often are simple. However, non penetrating foreign bodies pose a great problem for the diagnosis. Further, the effects of these non penetrating foreign bodies such as plastic bags, nylon rope etc on the nutrition and health aspect of cattle has not been elucidated. Lorber *et al.* (2004) suggested that toxic chemicals

and pesticides have the potential to disrupt beneficial and necessary biological systems which threaten the biosecurity.

Bioaccumulation of these inhaled PCBs leads to effects like reduced growth, alteration in hormone receptor binding and alteration in steroid hormone balance of population (IPCS, WHO-1992). Andrews *et al.* (2003) reported that approximately 35 per cent of an adult's daily intake of persistent, bioaccumulative and toxic pollutants is derived from dairy products.

MATERIALS AND METHODS

The study consisted of apparently healthy animals and clinical cases. Ten apparently healthy animals selected from a private farm were used for studying normal parameters. It was ensured that

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these normal animals were raised indoors and not allowed to stray.

Sick cattle attending Large Animal Medicine Out-Patient Gastroenterology unit, MVC Teaching Hospital, Chennai – 7 were screened for signs suggestive of ruminal impaction and/or chronic recurrent bloat. From these animals, thirty animals were selected after careful history of being stray cattle, history of recurrent bloat and having clinical symptoms suggestive of ruminal impaction for the study. Five animals from these thirty animals were also confirmed having non-penetrating foreign bodies in the rumen after performing rumenotomy.

The present study consisted of two groups.

Control group: Apparently healthy animal (10 animals)

Affected group: Animal with non-penetrating foreign body (30 animals).

Estimation of PCBs from milk and rumen liquor

Sample extraction

Milk and rumen fluid collected from affected animals were kept in chemically cleaned containers and stored at -20°C until analysis. Approximately 10g of sample was added to 10g diatomaceous earth packed in a glass column and extracted with diethyl ether. After concentration, it was eluted with a mixture of hexane and dichloromethane (1:1) at a flow rate of 5ml/min. The lipid removed extract was concentrated and passed through 12g of activated florisil (previously activated) packed in a glass column. The column was eluted with two 50 ml portions (Subramanian *et al.* 2007). Total PolyChlorinatedBiphenyls were screened by thin layer chromatography (TLC) and confirmation done by gas chromatograph (Shimadzu, GC-17A) equipped with an electron capture detector

(GC-ECD) and an automatic injector (AOC-20i).

Sample analysis

Samples were evaporated, concentrated and spotted on Aluminium oxide coated TLC plates (Merck, Germany). TLC plates were then developed in developing solutions (Developing tank 1 – Heptane, diethyl ether and acetic acid ; Developing tank 2 – Heptane, acetone), dried, dipped in chromogen (silver nitrate) and viewed under short UV (265 nm) for 30 minutes. The spots developed corresponding to standards were compared. PCBs were also quantified using GC-ECD.

The data obtained were analyzed as described by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

In urban areas, cattle are allowed to stray on the streets throughout the year due to lack of space and high cost of feed. Cattle do not sort their feed fastidiously. This leads to the ingestion of both penetrating and non-penetrating foreign bodies.

Plastics are the most common non-penetrating foreign body. Living in the modern society is hardly conceivable without the use of plastic products in every day activities. Thus the ingested foreign body results in conditions like chronic recurrent bloat and impaction. These non-penetrating foreign bodies remain in the rumen without getting cleared. They cause multitude rumen dysfunction such as indigestion, ruminal impaction and failure of eructation. These non-penetrating foreign bodies emanate certain toxic substances such as PCB which are of public health importance. The diagnosis of non-penetrating foreign bodies possess a greater difficulty and it is often possible to diagnose only after rumenotomy.

The prominent clinical signs observed were pale mucous membranes, absence of rumination,

reduced ruminal motility and atony. Absence of stratification of rumen was observed in all the affected animals.

Rectal examination revealed gas filled rumen and pelleted mucous coated dung. Igbokwe *et al.* (2003) reported abdominal distension, lack of faeces in the rectum and inappetence in animals with indigestible foreign body impaction. Reddy *et al.* (2004) observed inappetence, mild tympany with reduced ruminal motility and progressive loss of condition in animals with indigestible foreign bodies in rumen and reticulum. Hailat *et al.* (1996) observed lack of rumination, low haemoglobin, and distended abdomen in goats with non-penetrating foreign bodies. Clinical findings in the present study concurred with the findings of the above authors.

Estimation of PolyChlorinatedBiphenyls in milk and rumen liquor

In the present study, PCBs could not be detected in rumen fluid or milk in control group. The level of 2 PCBs, PCB 146 and PCB 155 were determined in affected animals in the rumen fluid and milk samples of five (16.67 per cent) and four (13.33 per cent) cases respectively. The mean of PCB 146 and 155 in rumen fluid and milk were found to be 5.32, 1.54, 6.18 and 2.2 ppm respectively.

Subramanian *et al.* (2007) recorded that the level of PCBs and other hexachlorocyclohexane (HCH) compounds level increased in breast milk of mother's in urban areas due to inhaled toxicant. Alcock *et al.* (2002) reported that milk samples collected from various farms located in the vicinity of industrial site such as municipal, waste incinerators, coal-fired power stations and cement kilns had polychlorinated biphenyls. In the present study, PCBs were not identified in all the animals with non-penetrating foreign bodies. This might be

due to the type of plastic materials ingested and sojourn of these plastics in the rumen. Travis and Hattemer-Frey (1991) reported that 98 per cent of exposure to dioxin like compounds (PCBs) were especially through meat and dairy products. They also suggested that people living near dumping site constantly drink the milk collected from the animals which consumed the dumped materials and they were more prone to these toxicants. Kunisue *et al.* (2004) observed that both cows and buffaloes near the dump site transfer higher amount of PCBs to their milk by feeding at the dump site containing greater amounts of DRCs through contaminated soils, water weeds and left over. Hence further investigations regarding pollution and transfer of PCBs in bovine milk are needed. So this study provides a window for further research and investigations regarding identification of PCBs in bovine milk. The test employed was helpful in detecting the presence of PCBs from levels of 2.2 ppm to 6.18 ppm. On calculation of the positive predictive value of this test (Smith, 1996), it was observed that the test could detect upto 30 per cent of positive cases. The test however needs to be refined and standardized with the established controls as the plastic foreign body could only be detected after certain period of stasis in the rumen. Early detection could add to the efficacy of the test.

In India, consumption of dairy products is generally higher. The residents in Chennai mostly drink the milk collected from stray animals and hence may be at a greater risk of exposure to PCBs. It is opined that public awareness and clean-up environment would substantially reduce this problem in Chennai.

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