ENDOCRINE DISRUPTORS AND THYROID HOMEOSTASIS IN ADULT BUFFALO

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ABSTRACT

The present study conducted on 80 adult buffalo screened their plasma samples for thyroid hormone profile and pesticide residues (endocrine disruptors). About 51 buffalo were pesticide negative and remaining had low (27.1±12.1 ng/ml) or high (106.6±82.2 ng/ml) pesticide residues. However, circulating pesticides had no consistent (p>0.05) relation with plasma thyroid hormones.

Keywords: Buffalo, Endocrine Disruptor, Fertility, Pesticide, Thyroid

In India, in recent decades, inadverent usage of pesticides, also known as endocrine disruptors, has increased tremendously. At the same time, dairy animal fertility has declined continuously despite an advancement in assisted reproductive technologies. The presence of pesticide residues in blood is suggestive of their toxic impact on reproductive axis (Ghuman *et al*., 2013). These pesticides include biologically persistent organochlorines and highly toxic organophosphorus pesticides. The blood biochemical and hormonal evaluation is widely used for detecting the early impact of endocrine disruptors that may ultimately have greater toxicity at higher levels of biological organization (Lehtonen *et al.,* 2007). Therefore, this study was planned to assess the association between circulating endocrine disruptors and plasma thyroid hormones in adult buffalo.

The present study was carried out on 80 adult buffalo of Punjab state. Multiple pesticide residue analysis from blood samples was carried out using gas chromatography (GC) and Gas chromatography-mass spectrometry (*GC-MS*) as described earlier (Kaur *et al.,* 2015). Plasma Triiodothyroniine (T3) and Total Thyroxine (T4) hormones were estimated using Radioimmunoassay Kits (BRIA MAG 3 and BRIA MAG 4, respectively) procured from BARC, Navi Mumbai (www.britatom.gov.in). Intra-assay coefficient of variation (CV) for T3 was 4.3% at 0.7±0.03 ng/ml, and for T4 was 3.9% at 5.0±0.75 ng/ml. Using SPSS 15.0, One Way ANOVA *Post Hoc Multiple Comparison Test* was applied for the difference in hormones.

Out of adult buffalo screened, the buffalo not detected positive for any pesticide residue (0 ng/ml) were 51, detected positive for low pesticide (27.1±12.1 ng/ml) were 26 and three buffalo had high plasma pesticide residues (106.6±82.2 ng/ml, Table). These pesticide residues may be associated with damaging alterations in the reproductive tract as the number of histopathological alterations were high (3.43±1.29) in reproductive tract of calf highly contaminated with pesticide residues in comparison to tracts positive for low residue (1.57±0.60) or pesticide negative tract (0.28±0.10, Kaur *et al.,* 2015). With regrad to thyroid homeostasis, there was no difference (p>0.05) in plasma thyroid hormones following comparison between buffalo not detected positive or detected positive for low or high pesticide residues in their blood samples (Table). Similalry, in a previous study, a consistent pattern in serum activities of thyroid hormones was absent in cattle and buffalo of low pesticide usage and high pesticide usage area with normal or abnormal reproductive status (Ratnakaran *et al.,* 2012). Neverthless, in same study, chlorpyriphos and methyl parathion residues were negatively correlated with serum T3, whereas, serum

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Table: Plasma thyroid hormones (Triiodothyronine, T3; Thyroxine, T4) and pesticide contamination in blood plama of adult buffalo

Blood plasma samples	Plasma T3 (ng/ml)	Plasma T4 (ng/ml)
Pesticide negative (n =51, 0 ng/ml)	0.4±0.3	6.3±3.6
Low-pesticide positive (n=26, >0-100 ng/ml)	0.4±0.2	5.5±2.4
High-pesticide positive (n=3, >100 ng/ml)	0.3±0.1	4.8±1.0

cyfluthrin exhibited positive correlation with serum T3 and T4 (Ratnakaran *et al.,* 2012).

In present study, a trend (p>0.05) of decrease in plasma thyroid hormones (T4) was observed from pesticide negative to highly pesticide positive buffalo (Table). In fact, low-dose exposure of pregnant rats to endocrine distuptors reduces circulating T4 in dam as well as offspring due to direct impact on thyroid system (Kuriyama *et al.,* 2007). Various pesticides are potential disruptors of thyroid homeostasis through their ability to impact hypothalamic-pituitary-thyroid axis (Zoeller, 2010). Thyroid hormones are known to stimulate sertoli cell proliferation and have direct effect on oocytes and sperms as well as thyroid disruption can alter circulating GnRH and sex steroid hormones (Dittrich, 2011). In brief, the association of plasma thyroid hormone status with circulating concentrations of endocrine disruptors was not existing.

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