

## **HISTOLOGICAL CHANGES OF THE ADRENAL GLAND DURING PREGNANCY IN BUFFALOES (*Bubalus bubalis*)\***

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Literature on variations in the structure and the content of the cells of the adrenal gland due to factors like the age, reproductive status of the animal, season, exposure to stress are scanty (Smyth *et al.*, 1984; Makumyaviri *et al.*, 1985). The influence of stress of pregnancy and lactation in rats, is said to result in the increased weight of the adrenal gland (Hewitt and Van Liere, 1941). Only a few investigators have interpreted the exact physiological status of the gland as well as its histological changes during pregnancy. The present work was undertaken to compare the histological structure of the gland at various stages of pregnancy in buffaloes with that of non-pregnant ones.

### **Materials and methods**

Pieces of adrenal glands were collected from twenty four apparently healthy she-buffaloes, aged 4-8 years from the Corporation abattoir, Madras.

The animals were grouped as follows:

- Group - I Non-pregnant (the control) 6 animals
- Group - II Less than 90 days of pregnancy 7 animals
- Group - III Between 90 and 180 days of 7 animals pregnancy
- Group - IV More than 180 days of 4 animals pregnancy

The stages of pregnancy of the mothers were computed on the basis of the ages of their foetuses by adopting the formula of Soliman (1975).

Samples were collected and preserved in 10 per cent formalin, Zenker's fluid, 90 per cent alcohol, formol-dichromate and in Potassium dichromate - Osmium tetroxide as warranted by the different staining techniques. The materials were processed for paraffin embedding.

Comparisons were made between the various groups of animals after examining the H & E stained sections. The distribution of connective tissue fibres, muscle fibres, nerve cells and fibres, mast cells, pigment cells, chromaffin granules, lipofuscin pigments and medullary catecholamine cells were studied in detail by employing special staining techniques.

### **Results**

The adrenal parenchyma in all the four groups of the animals was clearly divisible into an outer cortex and an inner medulla. In general, the cortex was further subdivided into zona glomerulosa, zona fasciculata and zona reticularis.

The stroma was primarily composed of reticular fibres. Migratory invasions of the

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cortical tissue into the medulla (Fig. 1) and the medullary tissue into the cortex were common in all the groups of animals studied.

In general, the adrenals of the pregnant animals revealed hypertrophy of the cellular population of the outer two zones of the cortex and distension of the sinusoids of the cortex and the medulla. The vacuolation of the cells of the zona glomerulosa (Fig. 2) was characteristic of pregnancy, but their degree varied among the groups studied. Majority of the cells of the zona glomerulosa were highly vacuolated in the animals in group II than the other two groups.

Though the presence of cytoplasmic vacuolations was common in the cells of the zona fasciculata and the zona reticularis of the non-pregnant animals, it was found exaggerated in the pregnant animals.

Vacuoles in the cells of the zona glomerulosa were larger than those of the other two zones. The cytoplasmic vacuolations observed in the cortical cells were confirmed to be due to lipids by special staining methods.

The colloid bodies of the medulla increased in their number in the pregnant animals particularly in group IV. However, the cellular population of the medulla did not reveal any marked difference among the various groups of the animals studied.

## Discussion

Murphy and Schultz (1976) observed that an increased aldosterone production in any occasion invariably causes hyperplasia of the zona glomerulosa and also results in heavy accumulation of lipids in their cells.

In the present study, it is attributed that the hypertrophy of the cells in the zona glomerulosa resulting in the increased width of the zone observed in the adrenals of the pregnant animals might be due to an increased activity for the synthesis of excessive aldosterone to regulate the sodium outflow during pregnancy. Similar increase in the width of the zone in pregnant cows (Gobetto *et al.*, 1963) and in pregnant rabbits (Mrsevic *et al.*, 1980) have been recorded. The distension of the sinusoids in the cortex and the medulla of the adrenal gland in the pregnant animals is identical to the earlier findings in pregnant cows (Gobetto *et al.*, 1963).

Histomorphologically, in pregnant animals, a higher activity of the zona fasciculata was recorded from the hypertrophy and increased foaminess of the cells and distension of the sinusoids. This totally agrees with the earlier findings of Bell and Weber (1959) in ox. The higher activity of the zona fasciculata, as observed in the present study could be responsible for the increase in the plasma glucocorticoid level during pregnancy as reported by Demey-Ponsart *et al.* (1982) and Odagiri *et al.* (1988). The hypertrophy of the cells and the enlargement of the zona fasciculata during pregnancy are said to be due to the influence of higher levels of adrenocorticotrophic hormone (ACTH) (Mc Donald, 1980).

During pregnancy, the activity of the zona reticularis was more as evidenced from the distension of sinusoids. However, the hypertrophy of the cellular population of the zone was not so apparent. This concurs with the earlier findings of Bell and Weber (1959) in pregnant cows.

The findings of the earlier workers (Bell and Weber, 1959; Arvy, 1971) on the increase of the weight of the adrenal and on the enlargement of

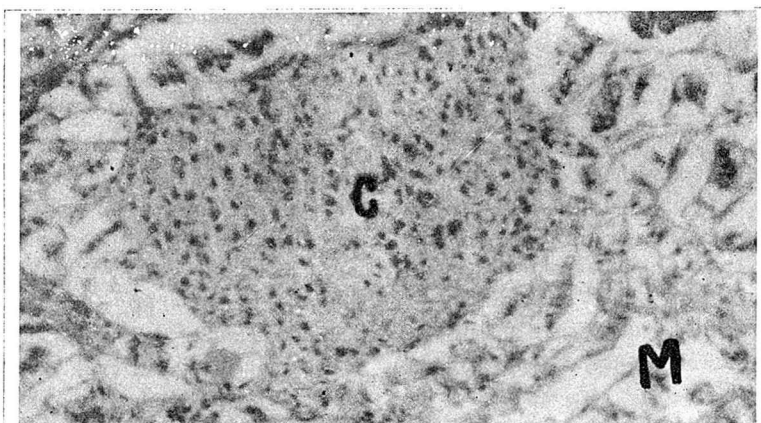


Fig.1 Photomicrograph of the adrenal gland of a buffalo (non-pregnant) showing island of cortical cells in the medulla  
C - Island of Cortical cells; M - Medulla; H&E x 200

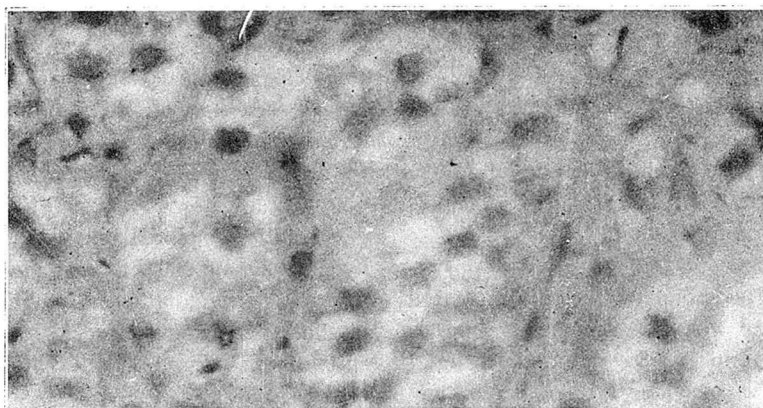


Fig.2 Zona glomerulosa of the adrenal gland of a buffalo (less than 90 days of pregnancy) showing the vacuolated cytoplasm of the cells  
H&E x 640

the gland during pregnancy in various species of animals are due to the consequence of the hypertrophy of the cells of the outer two zones.

The cellular components of the adrenal medulla in buffaloes were similar to those of

other domestic animals (Banks, 1974). Hyperactivity of the medulla during pregnancy was obvious from the increased vascularity. This is in agreement with the findings of Pellegrini and Pellegrini (1965) in pregnant cattle.

In few animals, the homogenous, colloid bodies of varying shapes and sizes observed in the medulla in the present study is similar to the reports of Prasad and Sinha (1981) in different species of animals. Their presence in an increased number in the animals belonging to group IV is suggestive of a morphological manifestation of an acute or extreme functional stress on the adrenal medulla as opined by Smollich (1965).

### Summary

The histomorphology of the adrenal glands of the pregnant buffaloes was compared with non-pregnant animals. The general histomorphology of the gland was the same for both the pregnant and the non-pregnant groups of animals studied. However, hypertrophy of the cellular population of the cortex, increased cytoplasmic vacuolations of the cortical cells and the distension of the sinusoids were observed during pregnancy. The cells of the zona fasciculata were highly vacuolated in all the pregnant animals studied.

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