SPINAL RETICULAR FORMATION IN GOAT FOETUSES*

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ABSTRACT
Prenatal development of reticular formation in the spinal cord of goat was studied using 52 foetuses of various ages. Reticular formation appeared by 48 days in the second month of gestation in the groove between the dorsal and ventral or lateral horns, as extensions of gray matter into the adjacent white matter. It represented the lamina V of gray matter of spinal cord. By fourth month, reticular formation presented lateral and medial parts. Reticular formation was better developed at the cervical level and extended upto the fourth sacral segment of spinal cord.

Key words: Goat foetus, Prenatal, Reticular formation, Spinal cord

INTRODUCTION
Reticular formation is considered as the seat of consciousness making the animal aware about the changes in its surroundings. The occurrence of reticular formation in the spinal cord of domestic animals has been described earlier (Jenkins, 1978; Rizzo, 2006). But a review of literature showed that the description about the developmental details of the reticular formation in the spinal cord are very limited in goats. Therefore, this study was conducted to investigate the various changes occurring in the reticular formation at different stages of prenatal growth in goats.

MATERIAL AND METHODS
The study was conducted using 52 goat foetuses of different ages. The age of the foetuses was calculated using the formula derived by Singh et al. (1979), for goat foetuses, \( W^{1/3} = 0.096 \times (t - 30) \), where, \( W \) = Body weight in g and \( t \) = Age in days. The foetuses were divided into five age groups corresponding to five months of gestation. The fixation was done in 10 per cent neutral buffered formalin for 48 hours. For foetuses in third month of gestation, spinal cord within the vertebral column was fixed after cutting into region-wise pieces. In foetuses of fourth and fifth month of gestational age, the spinal cord was exposed by laminectomy, dissected out, cut into individual segments and fixed. The fixed specimens were washed, dehydrated and embedded in high melting paraffin (MP 58-60°C).
Serial sections of 5\( \mu \)m thickness were made. Histological staining techniques employed were: Ehrlich's haematoxylin and eosin (H & E) staining, Holzer’s method for glial fibres, Sevier - Munger method for neural tissues, Van Gieson’s method for collagen fibres and Holmes silver nitrate method for axis cylinders and myelin sheaths. The cytological techniques like aldehyde-thionin-PAS method and phosphotungstic acid haematoxylin (PTAH) method for central nervous system and oil red ‘O’ in propylene glycol method for lipids (Luna, 1968) were also employed. The data collected were analysed statistically following Snedecor and Cochran (1985).

RESULTS AND DISCUSSION
The spinal cord primordium -the neural tube- presented three layers: an inner ependymal, middle mantle and outer marginal layers by 24 days of gestation in 14 mm embryo. By 48 days of gestation in the middle of the second month, in foetuses of CRL 40 mm (Fig. 1), the gray and white matter started to present the form of dorsal, lateral and ventral columns. By this stage, near the base of the dorsal horn, in the groove between the dorsal and ventral or lateral horns, the gray matter showed a series of projections, viz. the reticular processes, into the adjacent white matter of the lateral funiculus. Here the gray and white matter intermingled as the reticular formation, which extended along the length of the

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**Fig 1:** C.S. of First sacral segment. 48 days. H & E x 100

- DH: Dorsal horn
- LH: Lateral horn
- VH: Ventral horn
- RF: Reticular formation
- CC: Central canal

**Fig 2:** C.S. of thoracic region. 58 days. H & E x100

- DH: Dorsal horn
- VH: Ventral horn
- RF: Reticular formation
**Fig 3:** Lateral aspect of spinal cord at anterior lumbar region. 62 days.

H & E x 100
RF- Reticular formation

**Fig 4:** C.S. of fourth lumbar segment at lateral aspect. 102 days. H & E x 100

M- Medial part of reticular formation
L- Lateral part of reticular formation
spinal cord up to the fourth sacral segment in the present study. The reticular formation became clearer towards the end of the second month in foetuses of 60 to 71 mm CRL (Fig. 2).

By third month in foetuses with 87 to 130 mm CRL, the neurons in the reticular formation were with indistinct cell boundaries and an average nuclear size of 3.6 μm (Fig. 3). The cells were most numerous in the zone between the ventral part of the dorsal gray horn and the lateral funiculus of white matter. The column was with an average width and height of 87.5 μm each by this age in most regions, which increased to 95 μm in width and 133 μm in height at the cervical enlargement.

The spinal cord presented ten laminae in the gray matter; viz. laminae I to IV in the dorsal horn; V and VI at the base of the dorsal horn; VII forming the intermediate gray matter; VIII and IX in the ventral horn and X around the central canal. The reticular formation represented the lamina V.

By the beginning of fourth month, reticular formation consisted of lateral and medial parts. The lateral part represented the reticular nucleus and contained polygonal cells (Fig. 4) with 16.0 to 18.0 μm length and an average nuclear size of 10.8 μm by fourth month. The lateral part had an average size of 162 μm as width and 225 μm height by this stage of gestation. The medial part consisted of neurons with an average size of 10.8 μm. The medial part of reticular formation measured 125 mm in height and width by fourth month of gestation. Truex and Carpenter (1969) also described medial and lateral divisions for lamina V in man. In the present study, the lamina V attained this form only from fourth month onwards, even though it started to appear by the middle of the second month.

By the beginning of fifth month, the lateral part (Fig. 5) was with spindle-shaped or polygonal neurons having a maximum average length of 32.4 μm and a centrally positioned 14.4 μm sized nucleus. Nucleolus and Nissl bodies were distinct. Neurons in the medial part had a size of 10.8 to 14.4 μm.

By the end of gestation, reticular nucleus had a size of 375 μm. The maximum cell size was 39.6 μm. It showed bundles of myelinated fibres (Fig. 6), which varied in size from 37 μm to 64.8 μm.
In the present study, the cells of lamina V, which were of medium to small size were most numerous in the zone between the ventral part of the dorsal horn and the lateral funiculus of white matter. The axons of the cells pass in part to the lateral and ventral funiculi of the opposite side by way of the ventral white commissure and in part to the lateral funiculus of the same side (Larsell, 1951).

Reticular formation was better developed at cervical level with well developed fibre tracts. The reticular formation was less developed in other regions. It confirmed the findings of Truex and Carpenter (1969).

The reticular formation was traced up to the fourth sacral segment in this study. Jenkins (1978) also reported that the reticulospinal fibres extended up to the lumbosacral segments. Taluja et al. (1991) also reported the presence of reticular formation in the lumbar enlargement region in goat foetuses.

REFERENCES