Himachal Journal of Agricultural Research 36 (1): 95-97, 2010

Histodynamics of the ovarian follicles in the prenatal buffalo

Rajesh Rajput, RL Bhardwaj and Andleeb Rafiq
Department of Anatomy and Histology
College of Veterinary and Animal Sciences
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176 062 (H.P.)

Abstract

Micrometrical and histodynamical studies have been conducted on the ovarian follicles of the eight prenatal buffaloes. Primary follicles occurred in clusters. Polyovular follicles and polynuclear ova were observed in the primary follicle stage. During the follicular growth there was proportionate growth of all the components of the follicles. Leutinised and haemoarrhagic follicles were also recorded. The proportionate growth of all the components of the follicle was recorded in the ovaries of prenatal buffaloes.

Key words: ovarian follicle, buffalo, micrometry, histodynamics.

Introduction

The studies on the follicular growth in prenatal buffaloes are scarce. Present study was undertaken to study the micrometrical, histological and histodynamical changes in different components of the ovarian follicles in different stages of development in the prenatal buffaloes.

Material and Methods

Ovaries of eight prenatal buffaloes were collected from the slaughter houses of Palampur. The samples were fixed in 10% neutral buffered formalin. The paraffin sections of 5-7 µm thickness were stained by Harris haematoxylin and eosin for routine histomorphology. The follicles were measured using calibrated ocular micrometer. Follicles were categorized into primordial (oocyte surrounded by single layer of low cuboidal/ squamous cells), primary (oocyte surrounded by cuboidal cell layer), secondary (oocyte surrounded by stratified epithelium) and tertiary/ antral/ Graafian follicle (having antrum).

Results and Discussion

Follicles

(a) Primordial follicle: They occurred in the cortex in ovary. It consisted of an ovum lined with one layer of low cuboidal cells. The diameter of primordial follicle was 24.25 µm. The diameter of the oocyte was 18.42 µm while that of the nucleus was 6.16 µm.

(b) Primary follicle: Primary follicles occurred in groups in the outer cortex close to the surface epithelium. The primary follicles (36.42 µm in diameter) were surrounded by a single layer of cuboidal type follicular cells as reported by Goswami (1985) in buffaloes. The nuclei of the follicular cells were round, 2-4µm in diameter. The oocyte was 23.10 µm in diameter with the nuclear diameter of 6.97 µm. This fits well with the observations of El Shiekh and Abdelhadi (1970) in buffaloes who reported follicles of 35-48 µm and oocyte of 21-28 µm in diameter. Rajakoski (1960) measured 45x30 µm diameter of primary follicles in cattle. Leeson and Leeson (1970) measured 40 µm diameter in the human ovary. Sometimes two ova occurred in a single follicle (polyovular follicle). It has been observed in various other species of animals (Hadek, 1958 and Stott, 1970). Polynuclear ova reported by Hartmann (1926) and Stott (1970) in dog and Joshi *et al.* (1977) in goat were also observed. Several stages of degenerating atretic primary follicles were also seen. Talukdar *et al.* (1991) have also observed atresia in all stages of follicles in goats.

(c) Secondary follicles: The growing follicles migrated to the deeper areas of the cortex during the phase of growth as in buffalo (Goswami, 1985). The secondary follicle had an oocyte surrounded by stratified cells enclosed within a basement membrane as reported by Goswami (1985) in buffaloes and Preidkalns (1987) in cows. They measured 76.27 µm in diameter. The oocyte measured 34.47 µm and the nucleus 7.33 µm in diameter. A well developed zona pellucida was seen in the secondary follicle as reported by Goswami (1985) and Singh (1993) in buffalo. The secondary follicle was surrounded by a basement membrane of 2.93 µm. A layer of spindle shaped epitheloid cells exterior to basement membrane constituted the thecal cells which were rich in blood capillaries. The theca differentiated into theca interna and theca externa as observed by Muglia *et al.* (1989). The follicular cells showed intercellular discontinuity which was filled with pool of nutritive follicular fluid referred as Call Exner body (*Copenhaver et al.*, 1978).

(d) Tertiary (Graafian) follicle: These follicles had an antrum which contained liquor folliculi. The Graafian follicle measured 1879.86 µm in diameter. The oocyte measured 66 µm in diameter and was usually placed eccentrically in the follicle. The nucleus of the oocyte measured 11.73 µm. The membrana granulosa showed cells which were heterochromatic and there was marked increase in the mitotic activity as reported in sheep (Turnbull *et al.*, 1977) and cattle (Lussier *et al.*, 1987). The follicular cells immediately around zona pellucida were columnar and radially arranged to form corona radiata. The whole mass i.e. corona radiata and membrana granulosa cells formed mound like cumulus oophorous as reported by Priedkalns (1987). The basement membrane was seen between membrana granulosa and theca cells as reported in buffaloes (Goswami, 1987 and Singh, 1993).

The theca interna was highly cellular and vascular as compared to theca externa and appeared to be comprised of steroidogenic cells responsible for the secretion of estrogen (Harrison and Wier, 1977). Increased vascularity has been reported by Guraya (1985), Preidkalns (1987) and Singh (1993) the theca externa was composed of concentrically arranged undifferentiated fibroblasts along with connective tissue fibers and muscle fibers. Blood vessels of various caliber were present in the theca interna, with a higher concentration towards the junctional zone between the theca interna and theca externa.

Dynamics of the follicular growth

Functional correlation (regression) between the oocyte and follicle: The oocyte/ follicle had a positive collinear relationship (Fig. 1). A mathematical analysis yielded a regression equation as $Y = 0.253X + 13.22$ ($R^2 = 0.492$). The curve was exponential i.e. with the oocyte growth, the follicle diameter continued to increase at approximately the same rate.

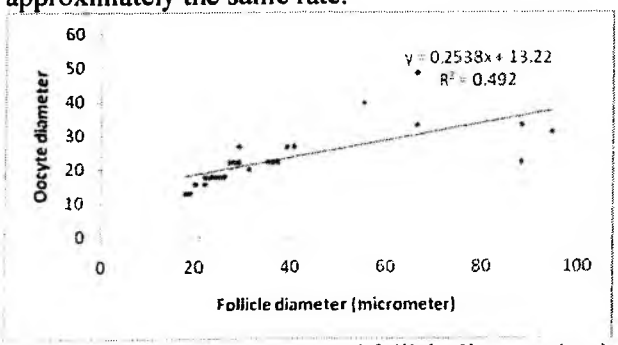


Fig. 1. Relation of the oocyte and follicle diameter (µm) in ovaries of prenatal buffaloes

Functional correlation (regression) between the oocyte nucleus and follicle: The oocyte nucleus/follicle relationship (Fig. 2) yielded the regression equation as $Y = 0.002X + 6.964$ ($R^2 = 0.239$). It depicted a linear growth pattern for the growth of the oocyte nucleus in relation to follicle.

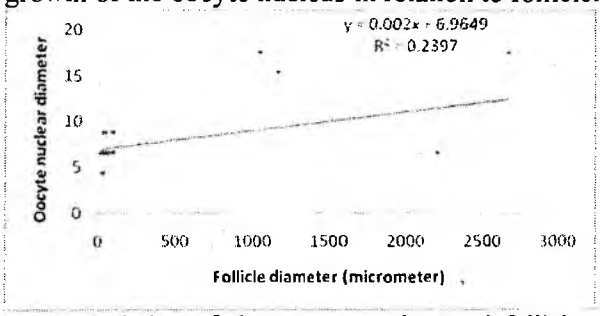


Fig. 2. Relation of the oocyte nuclear and follicle diameter (µm) in ovaries of prenatal buffaloes

Functional correlation (regression) between the oocyte nucleus and oocyte: The oocyte nucleus/oocyte diameter relationship (Fig. 3) yielded the regression equation as $Y = - 0.103X + 4.537$ ($R^2 = 0.380$). This was represented by a linear positive regression.

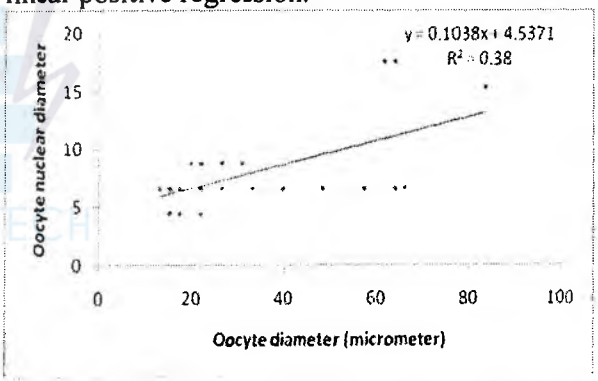


Fig. 3. Relation of the oocyte nucleus and oocyte diameter (µm) in ovaries of prenatal buffaloes

It was observed that there was proportionate growth of all the components of the follicle in the ovaries of prenatal buffaloes.

References

Copenhaver WM, Kelly DE and Richard LW 1978. Bailey's Textbook of Histology. 17th Edition. William and Wilkins Co. Baltimore, pp 629-30.

El-Sheikh AS and Abdelhadi HA 1970. Anatomy and histology of reproductive tract in the Egyptian buffalo. Indian J. Animal Sci. **40**: 213-22.

Goswami R K 1985. Histomorphological and histochemical observations on ovary in Murrah buffaloes. M V Sc Thesis, Haryana Agricultural University, Hisar, India (unpublished).

Guraya SS 1985. *Biology of Ovarian Follicles in Mammals*. Springer Verlag, Berlin.

Hadek R 1958. Morphological and histochemical studies on the ovary of sheep. Amer. J. Vety. Res.**19:** 873-81.

Harrison RJ and Wier BJ 1977. Structure of Mammals. In The Ovary (Ed.) Lord Zuckerman and Barbara J Wier, Vol. I pp 113-218. Academic Press, New York.

Hartman CG 1926. Polyovular ova and polyovular follicles in the opossum and other mammals with special reference to the problems of fecundity. Amer. J. Anatomy **37**:1.

Leeson CR and Leeson TR 1970. *Histology*. WB Saunders Co. Philadelphia.

Lussier JG, Matton P and Dufour JJ 1987. Growth rates of follicles in the ovary of the cow. J. Reprod. Fertility **61**: 301-08.

Muglia U, Vizza E, Germana G and Ciraco E 1989. Smooth muscle component in the developing ovarian follicle of the sheep and other mammals. Prog.Clinical Biol. Res.**296**: 103-09.

Priedkalns J 1987. Female reproductive system. **In**: Textbook of Veterinary Histology. (Eds.) HD Dellmann and EM Brown, Lea and Febiger, Philadelphia, pp 309-95.

Rajakoski E 1960. The ovarian follicular system in sexually mature hiefer with special reference to seasonal, cyclic and left-right variations. Acta Endocr. Copenhagen. Suppl. No. 52, pp 68.

Singh PP 1993. Morphological, histochemical and biochemical studies on the ovarian follicles of water buffalo (*Bubalus bubalis*). Ph D Thesis, Punjab Agricultural University, Ludhiana (unpublished).

Stott GG 1970. Changes with age in the canine female genitalia: histomorphological study. Ph D Dissertation, Iowa State University, Ames, Iowa.

Talukdar SR, Bordoloi CC and Ahmed S 1991. Histological and histochemical studies of atretic follicle in ovary of Assam local goat (*Capra hircus*) in early post natal life (0-90 days). Indian Vety. J. **69**: 245-49.

Turnbill KE, Braden AWH and Marrner PE 1977. Biology of ovarian follicles in mammals. Ed. SS Guraya, Springer Verlag, Berlin.

VIR SOFTECH