Chapter 2

2.0 REVIEW OF LITERATURE

2.1 REPRODUCTIVE SYSTEM IN FEMALE GOATS

The female reproductive system of goats consists of specialized organs for the production of female gametes, the ovary and the duct system.

2.1.1 The Ovaries

The ovaries are paired and have oval shape. Each ovary consists of a central region , the medulla and a thick layer of tissues surrounding this, the cortex. Most of the important activity of the ovary occurs in the cortex. The egg cells (oogonia) are found in the outside layer of the cortex, the germinal epithelium. The oogonia ripen as necessary during the whole breeding life of the animals and this ripening follows a sequence. As the oogonia divide and ripen, they form follicles. Three successive stages of growth are seen in the ovarian follicles. The majority are primary follicles. Primary follicles contain oocytes or potential ova, surrounded by a small number of follicular cells. Some of these primary follicles never develop beyond this stage but those which do become secondary follicles in which the oogonia grow in size and form a zona pellucida membrane. The follicle at this stage become oval in shape and move from the cortex towards the medulla region of the ovary. The final stage of development of the follicle is the tertiary follicle known as graafian follicle (Figure 1). In these follicles, the follicular cells surrounding the oogonium gradually form an antrum or fluid-filled space. The cells lining this space are called the membrane granulosa. The liquid inside the antrum is rich in proteins and

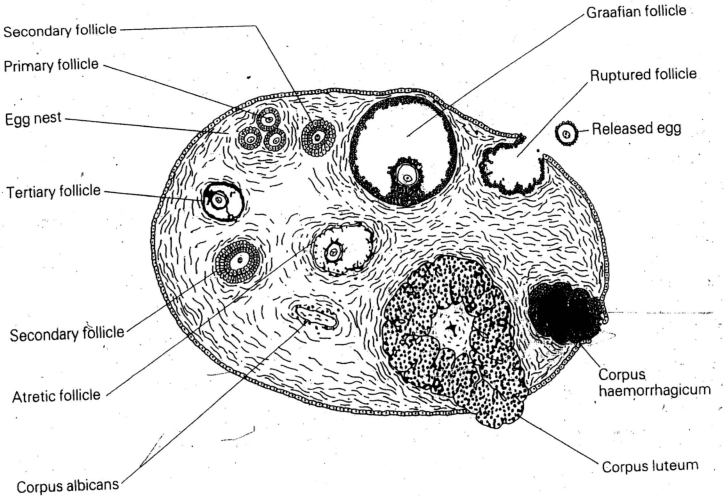

Figure 1. Simplified section through a mammalian ovary

oestrogen. As the follicle grows and become matures, it becomes so big that it occupies the full extent of the cortex of the ovary. Within the follicle, the oogonium is embedded in a number of cells called the cumulus oopherus which protrudes into the antrum on the side opposite to that which will rupture. There is another layer of cells , the corona , which surrounding the whole ovum. The lining of the antrum consists of two layers of cortical cells called thaeca externa and thaeca interna (Figure 2) and it is here that the female hormone, oestrogen is thought to be produced. In addition to the normally developing follicles, there are always many degenerating follicles known as atretic follicles in the ovary. Atresia can affect all the three stages of the development but particularly affects the tertiary follicles. In the process of atresia, the ovum dies first and then the whole follicle collapses. The wastage through atresia is very enormous. At any ovulation, several developing follicles have the potential to produce eggs. But in species like the goat only one or two of these follicles eventually produce eggs. The successful follicles appear to accelerates atresia in the other-follicles by a method which is not yet understood. Injection with certain gonadotropine substances such as the pregnant mares' serum gonatropine (PMSG) can apparently block atresia and many of the follicles reach the stage of maturation and this is known as superovulation.

When the follicle is fully mature, the wall protruding from the exterior of the ovary breaks down and the whole follicle ruptures. The ovum is then released from the ovary and this process is known as ovulation. Ovulation has cause the walls of the follicle collapse in folds. The follicular cavity once filled with clear fluid, now become filled with blood and lymph. The resulting structure is bright red in appearance and is

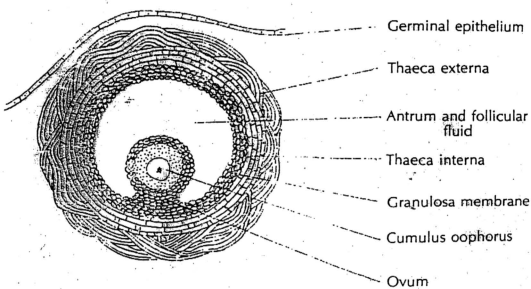

Figure 2. Graafian follicle

called corpus haemorrhagicum. The will be a period of active growth and division of cells which replace the blood and lymph to form a new structure, which has yellow and red in colour depending on age and species, called corpus lutuem (Figure 1). One of the most important functions of the corpus luteum is to produce another hormones called progesterone which has a big influence on the reproductive cycle of the female animals. When the functional activity of the corpus luteum has passed, the lutein cells generate and fat and connective tissues invade the corpus luteum. As the result, it gradually decreased in size and become barely visible as a white scar on the surface of the ovary. At this point the structure is called corpus albicans.

2.1.2 The Duct System

The female duct system of the female animal consists of five important parts: the oviducts, the uterus, the cervix, the vagina and the external genitilia.

2.1.2.1 The Oviducts

They also known as the fallopian tubes. They are paired and have a tubular structure leading from each ovary. They have three distinct regions.

1. The fimbrium. It is also known as the infundibulum or funnel. It is the flared end of the oviduct which forms a trumpet-shaped structure close to the ovary. They are extremely efficient in collecting ova shed from the ovary. Ova which have been deposited from the ovary have been attracted by the frimbria and directed into the fallopian tubes.

2. The ampula. Its special important is that here fertilization of the ovum by sperm takes place. The specialized cells in the wall of the fallopian tubes with hair-like projections or cilia beat away from the ovary towards the uterine end of the tube, propelling the ovum in this direction. At the same time, secretions from the wall of the tube tend to flow towards the ovarian end of the tube and out the fimbria carrying sperm with them.
3. The isthmus. The third region of the fallopian tube, which constitutes the uterine end. It become constricted at the point of union with the uterus. This junction is subject to the action of hormones and by dilating or constricting it can control the speed with which the ovum passes from the tube into the uterus.

2.1.2.2 Uterus

The fertilized ovum called zygote settle down in the uterus to grow into an embryo and a foetus. The uterus has a number of vital roles in the reproductive process. It provides the mechanical support for the developing young and also provides the young animal with nutrient and its waste product removal. The uterus consists of two horns and a body but there are a number of anatomical variations depending on the species. The bipartite uterus which is seen in the ewe, doe and cow has well- defined body to the uterus but has equally well-defined horns (Figure 3). The wall of the uterus consists of three layers. The first layer is a serous membrane inside which lies the myometrium or muscular layer. It is

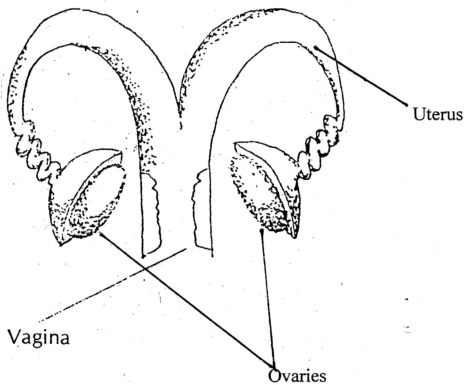

Figure 3. Diagram showing the anatomical forms of the uterus in doe (Bipartite).

capable of extraordinary power of expansion and reformation. The second layer is the myometrium layer. The myometrium contains large numbers of blood vessels which become very significant as the foetus begins to develop. The third lining the uterus is the endometrium. It consists of glandular and connective tissues. The endometrial glands are thought to be responsible for the production of a substance known as 'uterine milk' on which the free floating embryo is thought to survive until it forms a liaison with the mother's blood supply. In goat, sheep and cow, there are specialized areas of the endometrium reserved for the interchange of blood supplies between the foetus and the mother. These oval-shape areas are called cotyledonary areas or caruncles.

2.1.2.3 Cervix

The cervix is a thick, muscular sphincter which acts as a barrier between the uterus and its contents and the exterior part of the animal. In goat and sheep the shape of the cervix is highly convoluted and, unless the animal has had a large number of parturitions, it is impossible to penetrate with an inseminating pipette. At the time of copulation the strong muscle of the cervix clamp and retain the glans until the large quantity of semen ejaculated by the boar has been deposited into the uterus. It can be seen that the configuration of the cervix dictates the method which has to be employed when artificial insemination is used. In goat and sheep semen has to be deposited at the mouth of the cervix. The cervix contains a large number of glands which under the influence of hormones, particularly oestrogen, produce large quantities of mucus. The mucus produced in

the cervix flows towards the exterior into the vagina. The quality and the quantity of the mucus exerts an enormous influence on the fertility of the female animal. The mucus at the time of ovulation should be clear and ropey in appearance. The ropey strands are thought to act as guides for sperm swimming up the tract. Of all parts of the genital tract, the cervix is the least hostile to sperm and they may persist there for up to three days. Sperm trapped within and among the strands of mucus are able to escape at a steady rate and flow into the uterus. In this way, sperm deposited in the female vagina many hours before can continue to find its way into the uterus. This allows some leeway between the time of copulation and the time at which the egg is ovulated. In some hormone treatments administered for the synchronization of ovulation and oestrus or for out-of-season breeding, the hormones have been seen to modify slightly the type and quantity of mucus produced. Less and thicker mucus is produced and the ability of sperm to swim through it is impaired with the result that fewer sperm reach the uterus and the chances of fertilizing the egg are diminished. It is possible to determine whether or not a ewe or doe is in oestrus by examining the mucus. Those not in oestrus have thick mucus which is rich in leucocytes. Those in oestrus have transparent ropey mucus in much greater quantities than at any other time. During pregnancy or when the animal is not on heat, the cervix is normally close. It acts as an important barrier for the uterus against infection from the exterior. Like the uterus the cervix is capable of enormous expansion to permit the passage of a whole foetus from the uterus to the exterior at parturition.

2.1.2.4 The vagina

The vagina is the external vestibule of the female reproductive tract. It is there the semen is deposited by the male. The urether which drains the bladder also enters the vagina so that the exterior end of the vagina acts as a common reproductive and urinary duct system. There are no secretory cells in the vagina so that the mucus found there originates from the cervix or sometimes from the uterus.

2.2 REPRODUCTIVE HORMONES IN FEMALE GOATS

There are two distinct sets of hormones controlling the reproductive system of the female animal. There are those originating in the ovary, principally oestrogen and progesterone and another set of hormones which originates in the pituitary gland known as gonadotropins hormones. The pituitary gland which is situated at the base of the brain, is the source of a large number of hormones controlling the animal's function and included among them are the follicle-stimulating hormone (FSH) and the luteinising hormone (LH) which control the activity of the ovary.

2.2.1 Ovarian Hormones

The ovary secretes two main steroid hormones, oestrogens and progesterones. Oestrogens and progesterone are steroids and are fat soluble. Their structure is similar to that of testosterone, the male testicular hormone (Dorfman *et a.l,* 1956; Callow, 1955) (Figure 4). Other oestrogens, oestrone and oestriol are produced from oestradiol (Asdell, 1946). The theca interna cells are considered to be the source of oestrogens.

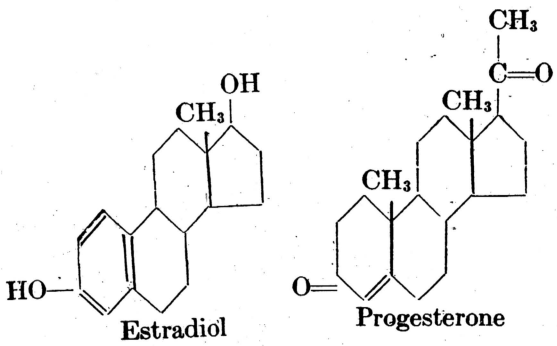

Figure 4. The structure of oestradiol and progesterone

These hormones stimulate growth and differentiation of the female reproductive tract and associated structures and also bring out the secondary sex characteristic of the female animals. These includes changes in the voice, hair growth, mammary development and etc (Mc Donald, 1980). The main source of progesterone is the luteal cells of the corpus luteum. Progesterone is essential for the development of the uterine endometrium, preparing the uterus for implantation of the embryo. Progesterone synergized with oestradiol and causes growth of the milk-secreting alveoli of the mammary glands and producing changes in secondary organs (Asdell,1946 and Zarrow *et al.,* 1964).

2.2.1.1 Oestrogen

Oestradiol is a steroid hormone which circulate predominantly by weakly bound to the binding globulin (SSBG). Oestradiol is the primary oestrogen, with oestrone and oestriol representing other metabolically active oestrogen. The naturally secreted oestradiol is oestradiol -17ß (Mc Donald, 1980). In female animals oestradiol is secreted principally by the growing ovarian follicles under the influence of FSH and LH. During the second half of the follicular phase, most of the oestradiol is produced by the thaeca interna of the ripe follicle. There remains some doubt regarding the exact precursor of the oestrogens, although there is well-documented evidence that both acetate and cholesterol may serve these purpose (Dorfman, 1956). The thaeca interna cells have the necessary enzymes for the production of oestradiol -17ß from cholestroles. Cholesterol, a 27-carbon steroid, becomes prenenolone (20 carbon) when its side chain is cleaved. Pregnenolone is subsequently converted to progesterone,

which in turn converted to oestrogens. It also secreted by the adrenals, corpus luteum, placenta and in male animals, by the testes. Of all the steroids, oestrogens have the widest range of physiologic functions. Some of these functions are:

1) Oestrogen acts on the part of the brain associated with the behavioural oestrus (CNS) to induce heat in the female. However small amounts of progesterone with oestrogen are needed to induce oestrus in some species such as the ewe and cow
2) Oestrogen also controls a number of changes in the female genitilia tract. The production of the mucus in the cervix to some extent, are oestrogen -dependent , which can often be a good indicator that the animals is on heat.
3) Oestrogen also plays important roles in the uterus changes in its metabolic activity (water and nitrogen retention and also the arte of cell division). All of these can be considered to be the preparation of the uterus to receive ovum and sperm.
4) Physical development of female secondary sexual characteristics
5) Stimulate duct growth and cause the development of mammary gland ·
6) Exert both negative and positive feedback controls on LH and FSH release through the hypothalamus.
7) In ruminant, oestrogens also have a protein anabolic effect to increase body weight gain and growth by stimulating the pituitary to release more growth hormone.

2.2.1.2 Progesterone

Progesterone is also known as the pregnancy hormone. Progesterone plays important role in the physiology of animal reproduction. The rise in the progesterone levels prepare the uterus for pregnancy by developing the endometrium for

implantation. Progesterone is the most prevalent, naturally occurring progestogen and is secreted by the luteal cells of the corpus luteum, the adrenal gland and the placenta. In goats, the secretion of progesterone from the corpus luteum maintains pregnancy of the animals. Progesterone is transported in blood by a binding strongly to transcortin. LH primilary stimulates progesterone secretion. Progesterone is synthesized from cholesterol to pregnenolone form and then rapidly metabolized to pregnanediol form. This process is happening, for the most part, in the liver. But a small amount is also synthesized by the adrenal cortex in both male and female animals. A major fractions of progesterone may undergo reduction by 20_{α}-hydroxysteroid dehydrogenase (20_{α}HSD) to form 20_{α}-dihydroprogesterone, a steroid that in most of the species appears to be biologically inactive unless reoxidized to progesterone. Progesterone performs the following functions:

1) Prepare the endometrium for implantation and maintenance of pregnancy by increasing activity of secretory glands in the endometrium and by inhibiting the motility of the myometrium
2) Act synergistically with oestrogens to induce behavioural oestrus
3) Develops the secretary tissue (alveoli) of the mammary glands
4) Inhibits oestrus and the ovulatory surge of LH at high levels. Thus, progesterone is important in the hormonal regulation of the oestrous cycle
5) Inhibits uterine motility
6) Synthetic progestogens are available to synchronize the oestrous cycles of ruminants. The progestogens act by inhibiting LH secretion from the pituitary.

When the hormone is inserted into the vagina, the animals will display oestrus and ovulate 48 to 72 hours later.

2.2.2 Pituitary Gland Hormones

The anterior pituitary gland secretes three gonadotrophic hormones, namely FSH, LH and prolactin. The production and release of these LH and FSH are regulated by specific releasing hormones from the hypothalamus, known as luteinizing hormone-releasing hormone (LHRH) and follicle-stimulating hormone releasing hormone (FSHRH). These releasing hormone themselves regulated by many factors such as age, environment and hormones that influence the oestrous cycle (Sawyer, 1963; Hansel et al., 1970). LH and FSH are water-soluble protein (Morris, 1955). These hormones (LH and FSH) that act on the gonads (ovaries and testes) are collectively called gonadotropins. The follicle-stimulating hormone stimulate the growth of ovarian follicles. It is considered to be the initiator of the oestrous cycle because oestrous cycle activity does not occur until growing and maturing follicles appear in the ovaries (Asdell, 1946; Hammond, 1955). The LH is essential for ovulation, which initiates the growth of luteal tissue and stimulate function of the hormone progesterone in corpus luteum. LH also maintains the corpus luteum in a functional state after the luteal tissue has been formed.

2.3 ENDOCRINE REGULATION OF OESTROUS CYCLE

The reproductive cycles of goats are governed by the complex interplay of hormones secreted by hypothalamus, pituitary glands and the gonads (Figure 5). We

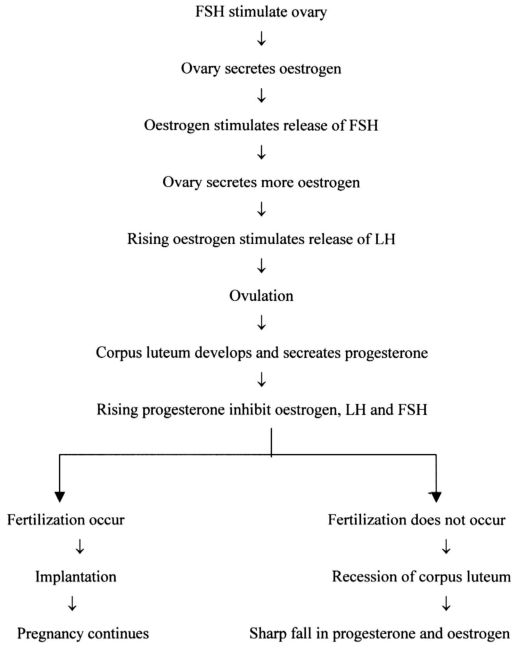

Figure 5. Summary of hormonal control of oestrous cycle.

begin the description of the cycle at the stage where the tertiary follicle begins to develop. The ovary is under the influence of secretions from the pituitary gland but it is not known what factors are originally responsible for the activation of the pituitary–ovarian axis. It has been postulated that very low levels of oestrogen, coming from the immature follicles or extragonadal sources, may stimulate the pituitary to augment its release of FSH. The FSH concentration is high during the early stage of follicle development and started to decrease after ovulation (Hafez, 1987). As the follicles develop they begin actively secreting oestrogen which has a wide range of functions. When the level of oestrogen in the blood become high, indicating that the ovarian follicles are fully-grown, its acts to prevent a greater release of FSH and to promote an augmented release of LH. A large quantity of LH appears as a peak which rises from basal levels very rapidly and falls again all within four to six hours. The presence of this LH peak in the circulation is the signal to the now highly-developed follicle to complete the process of ovulation (Evans and Maxwell, 1987) . The peak of oestrogen level occurs just before the onset of the oestrous and the preovulatory LH surge commences in oestrous and is followed by ovulation 18 to 24 hours later (Evan and Maxwell, 1987). After ovulation, there is an immediate fall in the oestrogen levels. The rupture follicle becomes transformed into a corpus haemorrhagicum and then the corpus luteum develop so that progesterone becomes the principal hormone secreted from the ovary. The effect of progesterone on the pituitary is to minimize its secretory activity and the animal is said to be in a state of dioestrus. If fertilization does not occur and the animal does not become pregnant, the corpora lutea remain functional for only a short period. The signal for the destruction of the corpus luteum come from

the uterus and is provoked by the absence of a conceptus. Prostaglandin is produced by the uterus and under its influence the corpus luteum breaks down very rapidly and ceases to secrete progesterone. This then sparks off a new wave of follicular development and the cycle recommence. The process of follicular development, ovulation and formation of corpus luteum will repeat itself at regular interval. The period between successive ovulation is called the oestrous cycle.

2.4 REGULATION OF REPRODUCTION IN FEMALE GOATS

2.4.1 Oestrous Cycle

Oestrous cycle may be defined as a well-marked function rhythm in a female reproduction system in most species of animals (Dukes. 1942). All female reproductive system has in most species a well-marked functional rhythm. Although each species has its own peculiarities, yet there is an essential similarity in all female mammals. Goats, sheeps and cattle are polyoestrous, that is they have a number of oestrous cycle one after the other unless pregnancy intervenes. Goats and sheeps are more correctly termed as seasonal polyoestrous, that is they have a series of oestrous cycle at certain season of the year. The duration of oestrous cycle depend on the development of the corpus luteum (Asdell ,1946). The age of the animal does not influence the duration of oestrus cycle (Hulet *et al.,* 1962) but some researcher found that the duration of oestrus cycle for the older animals are longer than the young animals (Symington and Oliver ,1966). It was reported that there are different in the duration of oestrous cycle for different genotype of goats (Prasad, 1980; Sahni, 1979). The longest oestrous cycle for Pigmi goats is 24 day (Jarosz *et al.,* 1971) and the

shortest is 8 days for the Scician goats (Corteel, 1977). For the Katjang goats the average value of the oestrous cycle is about 21.67 $\pm$ 0.82 days (Sharifah Nazari, 1989). However, there are also differences in the duration of oestrous cycle in the same genoytpe of goats. It was reported that the duration of oestrous cycle in Pigmi goat is 20.4 days (Kirkpatrick and Akindela, 1974) but the other researchers reported that the duration of oestrous cycle for the similar genotype of goat is 24 days (Otchere and Nimo, 1975). Research done by many researchers reported that data collected from the temperate region of the world gave the average value of about 21 and 22 days with range of from 18 to 25 days (Asdell, 1946; Chapman *et al.*, 1937). The other researchers also found that the average duration for oestrous cycle is between 18 and 21 days (Shelton, 1960; Davendra, 1990; Holdsworth and Davies,1979; Ott, 1980). However the duration of oestrous cycle for the milking goats is shorter than other goats (Phillips *et al.*, 1943).

The structural aspects of the oestrous cycle have been very carefully determined for the common laboratory and domestic mammals. Oestrous cycle in mature female goats is controlled by the interaction between the reproductive hormones such as progesterone (P_4) and oestradiol (E_2) from the ovary with the gonadotroph hormones such as follicle stimulating hormone (FSH), luteinizing hormone (LH) and prolactin from the pituitary (Asdell, 1946). During the oestrous cycle, there are ovarian changes such as the slow growth of follicle a day or so before the oestrus, a spurt in folliclar growth during and after oestrus, and the rupture of one follicle after oestrus. During oestrous cycle, there are also changes in the rest of the reproductive tract. Near and during oestrus, the vulva may be redden, swollen and

moist, in contrast to its dry, wrinkle appearance at other times. The complete oestrous cycle is divided into four well-marked phases and the timing of events associated with the cycle is summarized in Table 1.

1. Proestrous

It is the period just before oestrus. It is characterized by functional involution of the pevious corpora lutea and the preovulatory swelling of the follicle (Figure 6); oestrogen secretion started at this stage. During the late phase of proestrous, the graafian follicle within the ovary is growing. During this stage the female animal is showing interest in the male goat but still refuse any sexual activity.

2. Oestrus

The next stage is oestrus. This period is particularly well marked in the domestic animals. This is the period of heat and copulation is permitted only at this time. It is stage where the animal is showing sexual receptivity. Oestrus is defined as a short portion during the oestrous cycle where the female animals is sexually receptive of the male animals (Hafez, 1987). Oestrus is also defined as a sexual and fertile period of the female animals (McDonald, 1980). Under the influence of follicle stimulating hormone (FSH), ovarian follicles grow rapidly; oestrus is thus a period of heightened oestrogen secretion. Oestradiol is secreted from theca around the follicle into the blood stream and is then transferred to the animal's brain to cause the oestrus in female animals (Esslemont *et al.*, 1985). When the level of oestrogen in the blood become high, it also acts to promote the release of LH. The effect of this increased in LH are shown in the period following oestrus, during which LH aids in bringing about

Table 1. Summary of timing of events in the oestrous cycle (day of oestrous cycle)

Events	Cow	Ewe	Sow	Mare
Proestrus	0-1	0-1	0-2	0-12
Oestrus	1-3	1-2	2-4	12-14
Metoestrus	4-16	4-14	4-15	14-26
Dioestrus	17-21	15-17	15-21	26-28

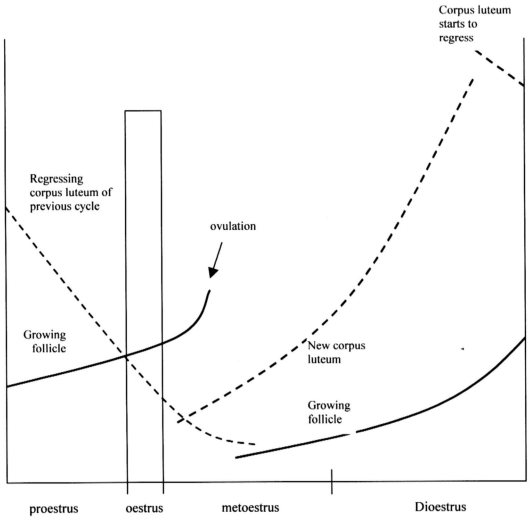

Figure 6. Changes in the follicle and corpus luteum during the four phases in oestrous cycle

ovulation and in forming the corpus luteum. The female animals will exhibit its sexual interest that varies from mild excitation to sexual receptiveness. Behavioural changes including secretion from the vagina, frequent wriggling of the tail and behavioural patterns, such as sexual receptivity and interest in the male goat. If the female animal does not conceive, the oestrus is repeated every 19 to 22 days for Katjang and Jermasia goats and this repeated activity is known as oestrous cycle (Thangavellu, 1987; Shariffah, 1989; Badariah, 1993).

3. Metoestrus

This occurs shortly after ovulation and is intermediate between oestrus and dioestrus. Mating is usually not permitted. The ovaries contain corpus lutea. It prevents the further maturation of further graafian follicles, thus preventing the occurrence of further oestrus periods for a time. Progesterone levels started to increase although the lutuem tissue is not completely develop.

4. Dioestrus

During this hours functional regression of the corpus lutea occurs. The corpus luteum started to decrease in size and lost its function in the oestrous cycle; it is stage where the animals refuse sexual activity and do not show any interest in the male goat. It is the longest stage in oestrous cycle.

2.5 FACTORS AFFECTING BREEDING EFFICIENCY IN GOATS

There are many factors that influence the breeding efficiency of the goat. It includes the age of the animals, anestrus, temperature, level of production, nutrition

and hormone activity. The abnormal oestrous cycle will affect the breeding efficiency of the female animal.

2.5.1 Age of the Female Animals

The effect of age on prolificacy has been reported by many researchers (Miller *et al.,* 1981; Branton *et al.,* 1956; Patrick *et al.,* 1957; Olds *et al.,* 1952, Erb *et al.,* 1958). It appear from many studies done by the researcher that fertility in the goat increases up to about five to six years of age and after this age the conception rates will declined gradually (Davendra *et al.,* 1970).

2.5.2 Nutrition

Both undernutrition and overnutrition can affect the capacity of the animal to reproduce satisfactory (Widdowson, 1981). The effects vary from one species to another species and from one part of life and stage of reproduction to another. The static effect of nutrition is represented by the combination of body condition, live weight and the size of the animal. Body condition described the utilizable energy reserves possessed by an animal irrespectively of its physical size and is determined by the total nutritional pattern during the whole period. Chronic undernutrition reduces fertility in farm animals (Robinson, 1951; Robertson *et al.,* 1951). Overnutrition may also interfere with normal mating behaviour. Female animals that have become very fat refuse to mate even though they exhibit a normal oestrous cycle (Bruce and Kennedy, 1951). It has also been suggested that the fat blocks the production of progesterone (Hammond, 1949). Despite many differences in details, all the available

results confirm the highly significant effects of the different nutritional pathway on the ovulation rate (Doney and Gunn, 1974; Lindsay, 1976; Ducker and Boyd, 1977; Cumming, 1977).

2.5.3 Hormones Activity

It has been reported the effect of thyroidal hormone in animal reproductive system of the female animals (Reineke and Soliman, 1953). An imbalance in the hormonal mechanism did not necessarily lead to reproductive failure but it will effect the fertility of the animals adversely. The data obtain by these researchers showed that there is a reciprocal balance between the hormones of the pituitary, the ovary and the thyroid. The abnormal oestrous cycle in the female animal may be as a result of unsynchronous interactions between the reproductive hormones (Abdullah and Nazari, 1992).

2.5.4 Level of Production

Lactation suppressed the ovarian activity in the rat and the sow (Hammond, 1957). However, many lack of agreement in the research about this matter between the researcher due to the use of different criteria to measure breeding efficiency.

2.5.5 Anoestrus

Anestrus is defined as a lack of expression of estrus. It may be due to complete suppression of ovarian activity or the condition in which the ovary is undergoing cyclic activity without external manifestation of oestrus or it may be cause

by the failure of estrus observation. Failure of observation may be due to short estrus period which occur between observations. Research done in numerous dairy herds in Louisiana have shown that anoestrus cause a major problems of the reproduction difficulties in the dairy herds (Branton *et al.*, 1956; Lank, 1955). It is also said that the failure to detect the signs of estrus resulted in cycling cows being considered anoestrus by dairy farmer in New York.

2.5.6 Season

Several mammalian species such as sheep, goats and deer are known to have definite breeding seasons. They are more correctly termed as seasonal polyoestrous. They have a series of oestrous cycle at certain season of the year and then their reproductive activity ceases for a period of time. This is to make sure that their offspring would be born in the most favourable nutritional and climatic environment. But sometimes domestication and rigorous selection has modified the sharpness of the breeding season in many species. But in most tropical goats, oestrus occurs all the year round, whilst in temperate regions goats are seasonally polyoestrus. In tropical region where there is little variation in day length, there is no breeding season for goats. The periodicity of the breeding season is being influence by many factors such as nutrition, temperature and light (Brody, 1945; Willett, 1956)

2.5.7 Temperature

It is shown that the fertility in cows (Norton, 1952; Patrick *et al.*, 1957) and also the semen quality in bulls (Green, 1953; Kellgren, 1956) declined markedly

during hot and humid summer. This is because the temperature had been reported to depress the thyroidal activity (Reineke and Soliman, 1953). Research done with dairy cows in Louisiana has shown a similar effect of temperature on thyroidal activity (Johnston *et al.*, 1958; Johnston *et al.*, 1956).

2.6 OESTRUS SYNCHRONIZATION

Developments in the use of drugs to improve reproduction and embryo production have focused on oestrus and ovulation synchronization protocols and embryonic survival. Protocols for synchronization of ovulation eliminate the need for detection of oestrus and allow timed insemination of all animals involved. It also allows for efficient application of reproductive technologies in commercial livestock operation. The value of oestrus synchronization is really important in goats because the duration of oestrous cycle as well as duration of oestrus is variable and oestrus detection cannot be accomplished safely without the use of bucks (Arriola, 1936; Jarosz *et al.*, 1971; Jainudeen and Hafez, 1987). Application of oestrus synchronization methods results in increased profit through earlier production of milk and also kids, reduction of perinatal mortality and it is necessary for application of artificial insemination (AI). Several implants used for oestrus synchronization are available world-wide and the drugs were used to synchronized follicle development, CL regression and induction of ovulation. The methods that we used for oestrus synchronization for the goats is by extending the length of the luteal phase of the oestrous cycle using a vaginal progesterone implant (CIDR-G, Pharmacia and Upjohn Limited Company, Auckland, New Zealand).

2.6.1 Progesterone Containing Sponge (CIDR-G)

The CIDR-G are 'T' shape silicon elastomer devices containing a natural hormone, progesterone. The progestagen is distributed within a plastic foam sponge which permits a slow released. Once they were inserted into the vagina, it will slowly released the progesterone through the vagina walls. The progesterone hormone modify the normal pattern of endogenous progesterone release thus preventing oestrus and ovulation in the treated animals and consequently forming a new corpus luteum. The ovulation is inhibited until progesterone treatment is withdrawn. On removal the level of the progesterone in the blood stream falls which stimulates a visible heat. Nearly all animals exhibit oestrus within 3 to 6 days after the removal of the CIDR implant (Zimbleman, 1966). However, the conception rate of animals undergoing a synchronized oestrus is generally lower than that of normally cycling animals (Zimbleman, 1966). Attempts to overcome the lowered conception rate have resulted in the refinement of the methods used to synchronized oestrous cycle. One way was to combine a progestogen implant with an oestrogen injection. The combined treatment reduced the time involved, gave good synchrony and normal fertility. The method used have been reported to be successful with a single, timed insemination, resulting in comparable fertility with control animals (Manns *et al.*, 1976).