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# ESTROUS CYCLE

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## ESTROUS CYCLE



The term estrus was used for the first time by Heape. The origin of word estrus is from a greek word "Oistros", which means gad fly/ mad desire.



In female cow the estrus behaviour comprised of attractiveness, proceptivity and receptivity.



Estrus is the period during reproductive cycle when female animals become sexually accessible.



Estrous cycle is defined as time interval between two estrus periods.

## **Duration of estrous cycle in different species:**

**Cow/Buffalo: 21 days**

**Mare: 21 days**

**Ewe: 17 days**

**Doe: 21 days**

**Sow: 21 days**

**Bitch: 16-56 weeks**

**Queen: 2-3 weeks (if not mated)**



During estrus, cow show clear cut behavioural signs especially firm footing and allowing herd mate to mount on her, the condition is known as "standing heat" the acceptance of the male by rage animal during estrum is due to the effect of estradiol on central nervous system.



Cervix remains closed except during estrus and secrete cervical mucus which varies with stage of estrous cycle.



It is more at estrus and hangs from vulva as transparent mucus discharge.



It has ferning property (i.E. Arborization/crystallization of mucus) if a drop of cervical mucus is examined under microscope fern pattern is observed.



It occurs due to high chloride present in the mucus under the influence of elevated estrogen hormone. During other stages, it becomes less in amount and thick.



During pregnancy this mucus forms cervical plug and persists till parturition in order to check entry of external agents.


## STAGES OF ESTROUS CYCLE: 4 STAGES

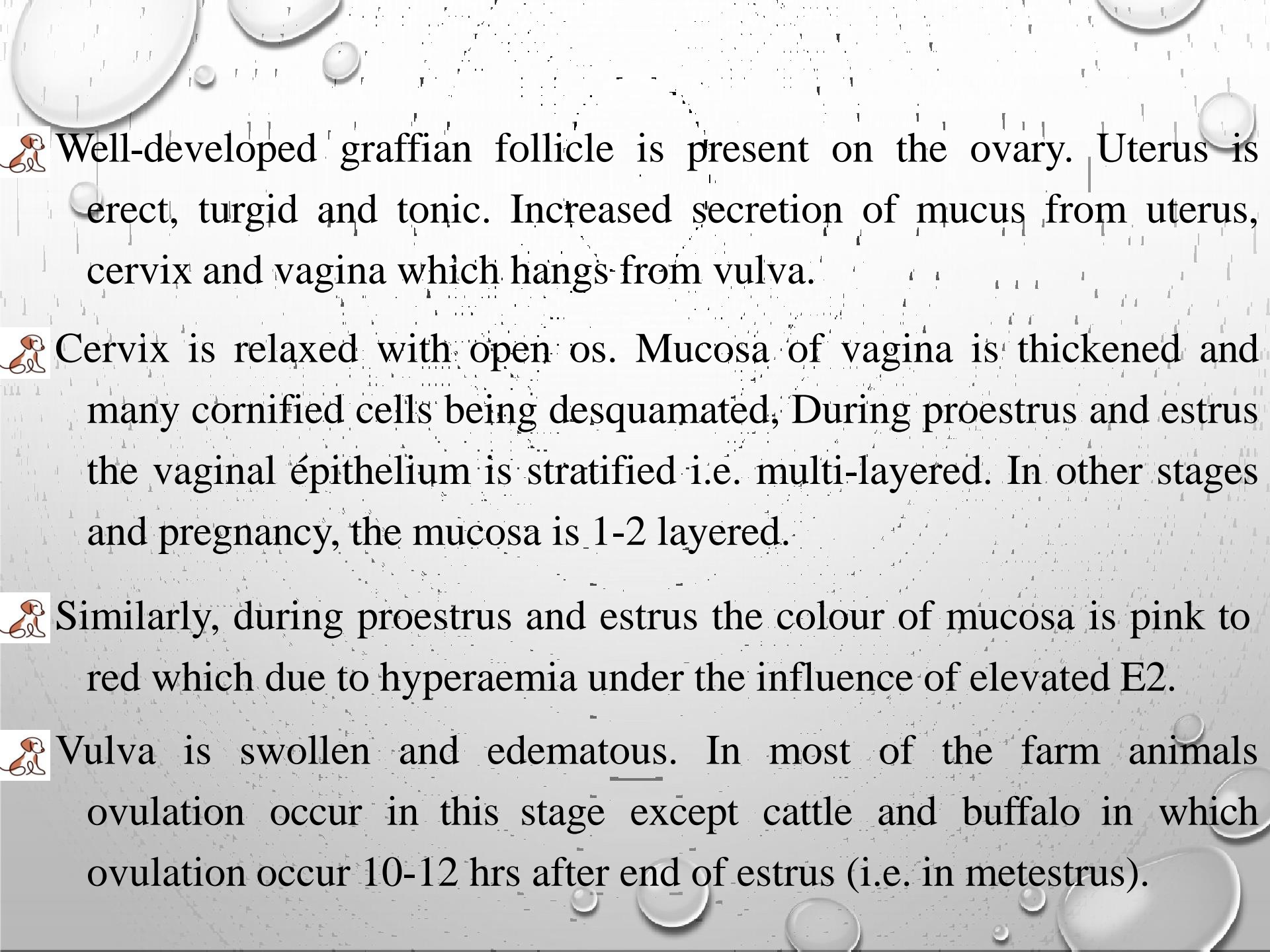
### 1. Proestrus:


It starts with regression of previous CL. In this stage, there is follicular growth. Uterus is slightly tonic, turgid and edematous. Progesterone is low and estrogen is high. Bleeding occurs only in bitch in this phase.


### 2. Estrus:


 it is period of receptivity and the female animal stands for mating.


 Duration of estrus in different species is cattle/buffalo: 12-24 hrs, sheep 24-36 hrs, goat:24-48 hrs: sow 48- 72 hrs; bitch 9-10 days and mare 4-7 days.

A decorative background featuring several translucent water droplets of varying sizes scattered across the page.

 Well-developed graffian follicle is present on the ovary. Uterus is erect, turgid and tonic. Increased secretion of mucus from uterus, cervix and vagina which hangs from vulva.

 Cervix is relaxed with open os. Mucosa of vagina is thickened and many cornified cells being desquamated, During proestrus and estrus the vaginal epithelium is stratified i.e. multi-layered. In other stages and pregnancy, the mucosa is 1-2 layered.

 Similarly, during proestrus and estrus the colour of mucosa is pink to red which due to hyperaemia under the influence of elevated E2.

 Vulva is swollen and edematous. In most of the farm animals ovulation occur in this stage except cattle and buffalo in which ovulation occur 10-12 hrs after end of estrus (i.e. in metestrus).



High levels of E and low level of pa (always  $< 1$  ng/ml) in cattle, buffalo, sheep, goat, mare and bitch ovulation occur spontaneous where as in cat, camel and rabbit ovulation is coitus induced (neuro-endocrine reflex).



Absence of male in induced ovulators may prolong estrus to 7-10 days.

**3. Metestrus:** is period after estrus for about 3 days wherein CL is formed (except cattle, buffalo). In some cattle and buffalo bleeding occurs in this phase due to sudden withdrawal of E<sub>2</sub> leading to rupture of capillaries (K/a **Metestrual bleeding**).




Bleeding is not an indication of conception or conception failure. This bleeding indicates that ovulation has already occurred and generally artificial insemination is not advised after this event.




**4. Diestrus:** period when CL is fully functional this phase starts from day 5 till 17-18th day of cycle. Fully developed CL is present on 7-8<sup>th</sup> day of diestrus. Also known as progestational phase because of high P4 conc.).

Proestrus+estrus - follicular phase and metestrus+diestrus =luteal phase

## **HORMONAL REGULATION OF ESTROUS CYCLE**

 The estrous cycle is controlled by hypothalamo-pituitary-gonadal axis). Progesterone is the main hormone regulating the estrous cycle.

During luteal phase P4 level is high, due to its negative feedback on hypothalamus and pituitary it inhibits release of gonadotrophins i.e FSH and LH. Regression of CL occurs by PGF2alpha from endometrium.

 As CL regress P4 falls and the negative feedback plug is removed which is followed by GnRH release from hypothalamus. GnRH which acts on anterior pituitary and FSH, LH are released. FSH act on ovary, cause growth of follicles.




When follicle becomes large, estrogen is released from preovulatory follicle which causes preovulatory surge of LH. Subsequently, LH is released from anterior pituitary and ovulation occurs. CL is formed and if animal is non pregnant, it regresses on day 17-18.



The regressed CL is k/a CL albicans. If animal becomes pregnant CL persists and k/a CL verum.



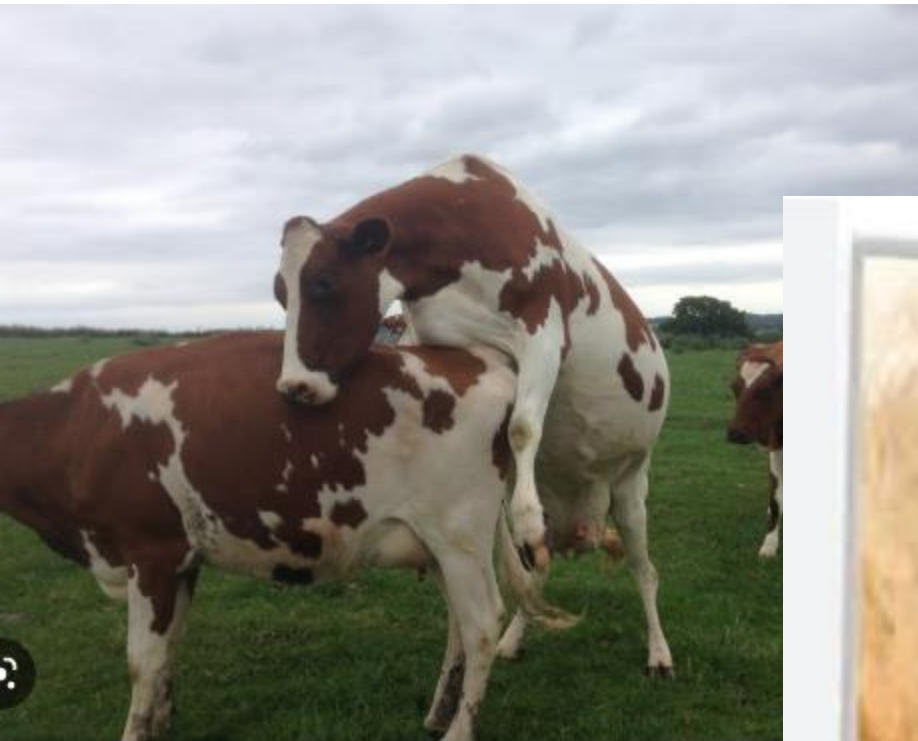
Clonic/Surge/Preovulatory FSH, LH control centres in hypothalamus: 1). Preoptic nuclei 2). Suprachiasmatic nuclei 3) Anterior hypothalamic nuclei

 Tonic FSH, LH secretion control centres: 1) Ventro-median nucleus  
2). Arcuate nucleus 3). Median eminence

## **SIGNS OF ESTRUS IN DIFFERENT SPECIES**

**Cattle and Buffalo:** Bellowing, reduced milk yield, reduced appetite, frequent micturition, mount to other animals or accept to be mounted during standing heat, cervico-vaginal discharge (more in cattle than buffalo), swollen and congested vulva and increased roaming activity.

Homosexual behaviour is quite frequent in cattle than buffalo.





Temporary engorgement of teat (observed in buffaloes prior to onset of real heat and is commonly known as Doka. Doka is used as an important tool for detection of incoming heat by buffalo owners in non-pregnant animals. Duration of TET is normally 3 days. Sometimes it is also associated with early pregnancy (Gabh doka).

**Mare:** Mare is long day breeder and it comes in heat from March to July when days are longer. The estrus signs include: Restlessness and irritable animal; animal frequently adopts the micturition posture and voids urine with repeated exposure of the clitoris (called as winking of clitoris).



In the presence of stallion mare raises the tail to one side and leans her hind quarter and the vulva is edematous with mucoid discharge. Ovulation takes place on penultimate or last day of heat.

**Sheep:** Restless, tail wagging and move it laterally, vulva swollen and congested, clear vaginal mucous discharge and receptive for ram. Ewes seek the ram and together form a following harem. The ram tries members of this group for receptivity by pawing with a forefoot, rubbing his head along the ewe's side and nipping her wool. Several rams run with a flock. a hierarchy is established and the dominant male gets the opportunity.

**Goat:** the detection of heat in a doe is difficult in the absence of a buck. Edematous and hyperaemic vulva, tail wagging from side to side and up and down, restless, mounting behaviour; reduced milk yield and appetite; and vocalization(frequent and peculiar type of (bleating)

**pig:** vulva swollen and congested, repetitive grunts, restlessness, by pressing the loin of the sow with the palms of both hands; the estrus sow will stand motionless **breeding/ mating stance/back pressure test) with cocked ears**, however, an objection will be made by sow those are not in heat. The pro-estrus female noses the testicles and flank of boar and may mount him but refuses to be mounted.



**Bitch:** Swollen and edematous vulva with sanguinous discharge in pro-estrus, bitch is attractive to male at proestrus and receptive at the time of estrus.

### **Important facts:**



Mounting on other animals (early heat).






Mucus discharge flows as string from vulva to the floor and breaks (early heat).







Mucus discharge hangs from the vulva to hock and then breaks off (mid heat).

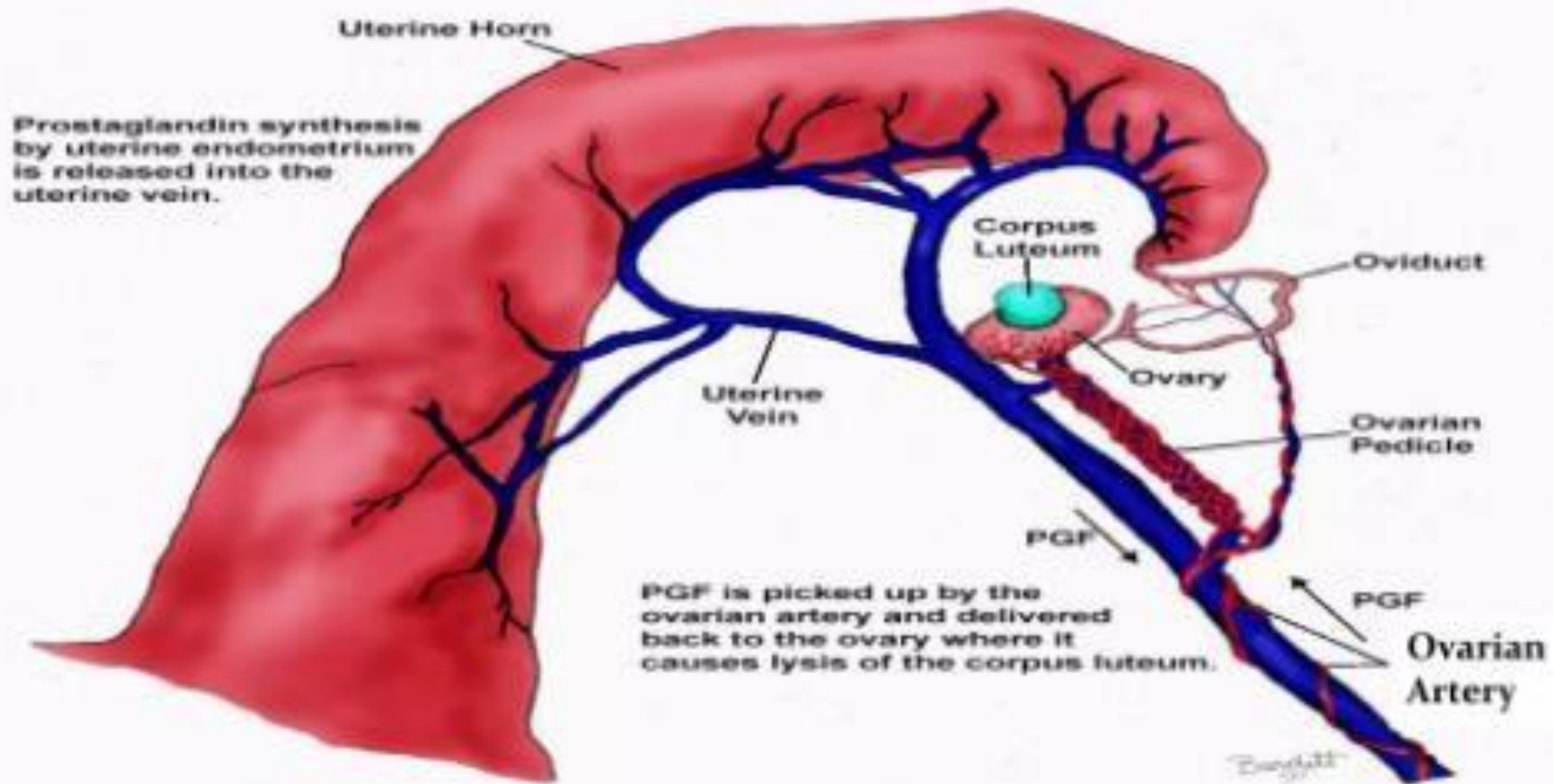


Mucus string hangs only 25-30 cm long (late heat).

-  Within two days of service there is occasional yellowish-white vulval discharge of mucus containing leucocytes from the uterus.
-  Sheep and goat are short day breeder and exhibit estrus during October-February.
-  Left uterine horn is longer than the right in camel.

## MECHANISM OF LUTEOLYSIS

-  Luteolysis is the degradation of the corpus luteum (just opposite to luteinisation - the formation of the corpus luteum).
-  Luteolysis occurs at the end of the luteal phase. The process of luteolysis is initiated under estrogen priming by oxytocin (secreted by the corpus luteum) and prostaglandin in domestic animals.
-  Initially the oxytocin appears to have no effect, however after day 16 oxytocin receptors begin to form in the endometrium in ruminants.
-  When these oxytocin receptors present in endometrium are stimulated by the oxytocin secreted by the corpus luteum; then prostaglandin F<sub>2</sub>α synthesis and secretion by the endometrium is stimulated.



This mechanism is specific to certain species;




PGF<sub>2</sub> synthesized in endometrium is drained through utero-ovarian vein. Close proximity of ovarian artery and utero-ovarian vein is important since at these points of approximation the walls of these two vessels are thinnest, there is no anastomosis.




This allows leakage of PGF<sub>2</sub> from utero-ovarian vein into ovarian artery by a counter current mechanism through the walls of the vessels. It is fairly well evaluated in ewe and cattle than other species. In **mare** no local effect and systemic transport of PGF<sub>2</sub>, takes place.


## PATTERNS OF ESTROUS CYCLE



The duration of estrous cycle in buffalo is similar to that in cattle, ranging from 17 to 25 days with a mean around 21 days. In majority of cases the normal cycles in cattle and buffalo lies between 20-24 days.



The estrous cycle below 17 days is termed as short cycle and may either be due to luteal insufficiency and aberrations in the endocrinological regulation and secretion of hormones.



The estrous cycle length more than 25 days is termed as long cycle. Long cycles may be of two types:

a) Multiple of normal estrous cycles: It is due to missed heats either due to silent or weak estruses. This may also because of poor heat detection practices. So double, triple of normal cycles will be the estrous length e.g. 34, 36, 38, 40, 42, 44, 46, 48 days etc.

b) Irregular Long estrous cycles: The estrous cycle length prolongs, if the death of embryo takes place after the mid of normal estrous cycle i.e. on day 9-10. If the embryo dies before day 9- 10 of estrous cycle the estrous cycle length is not prolonged.

## **Important facts:**



Interval between two heats is 7-8 days: Acute endometritis.



Interval between two heats is 13-17 days: Endometritis.




In non-pregnant large domestic animals, inflammation of the endometrium due to bacterial infection can result in significant synthesis and release of PGF<sub>2</sub>, leading to premature luteolysis and shortening of the estrous cycle. Thus, short estrous cycles are pathognomonic signs of uterine infection.





The luminal space around the external os of cervix is known as Fornix vagina. Fornix vagina is absent in sow.



The reason for 'silent' first estrus of pubertal animals is because CNS requires to be primed with progesterone and animal coming in heat first time lacks source of progesterone.

 The first ovulatory cycle has been shown to be short in pubertal heifers and the first CL not only has a shorter than normal life span. But also smaller in size because the dominant follicle, from which the first ovulation arises, has already entered the static phase of growth.

 The cl of pregnancy after parturition is progressively invaded by scar tissue and remains throughout the cow's life. On post mortem examination, presence of this corpus albicans serves to distinguish the cow from heifer and in cow the number of corpus albicans gives the number of calves born.

 The time required for postpartum uterine involution varies from 4 to 6 weeks. (cattle and buffalo).





In large animals after parturition, the ovulation usually occurs from the ovary opposite to uterine horn which had fetus.

## **Multiple ovulation and twinning in mare**



Double ovulations occur in up to 30% of estrous cycles depending upon breed and type of mare (thoroughbreds have higher rate than ponies)



Twinning is highly undesirable first because very often results in abortion, and second even if fetus survive is carried to term and many are dysmature, resulting in dystocia (difficult birth)/neonatal mortality.



## **Split estrus (false estrus in Bitch)**

Most commonly in the first estrus bitch develop vulvar swelling and a serosanguineous discharge of a short duration. However, ovulation doesn't occur, follicles regress and signs of proestrus disappear. A normal proestrous and estrus with spontaneous ovulation follows several weeks later. The recognition of split estrus is important to ensure that mating is achieved at the correct time in relation to ovulation.



**Superfetation:** occur when a pregnant female carrying one or more live fetuses comes in estrus, is bred again a second conception occurs in uterus already containing at least one live fetus. This is seen in multi tocus (sow, bitch) and rarely in unipara.



**Superfecundation:** occur when a female ovulating two or more ova during one estrus and copulating with two or more male during that estrus with ova being fertilized by spermatozoa from each male. It is observe commonly in multiparous/polytocus especially dogs and cats because multipara regularly ovulate 2 or more ova, have long heat periods and opportunity for services by different males are greater than in unipara. Occasionally reported in unipara.



**Telogy:** It is a misconception that a pure bred animal mated accidently by a mongrel may never breed true again.



**Primiparous:** Female animals which are calving first time



**Pleuriparous:** Female animals which have calved for more than one time.



**Nullipara/Nulliparous:** Female animal, which have never calved.



Multiparous, polyparous, multitocus and polytocus are synonyms



Uniparous, unipara and Monotocus are synonyms



**Uniparous:** animals producing one offspring in a gestation



**Polyparous:** animals producing more than one offspring in a gestation



Thank you