

STAGES OF ESTROUS CYCLE

Follicular phase - Proestrus+Estrus

Luteal Phase - Metestrus+Diestrus

Luteal Phase

CL – Progesterone - negative feedback on hypothalamus and pituitary it inhibits release of gonadotrophins

Endometrium - PGF_{2α} - Regression of CL (day 17-18) – P4 level down - negative feedback cease

Follicular Phase

GnRH - acts on anterior pituitary - FSH, LH

FSH – ovary - growth of follicles – large follicle – **estrogen** - LH surge
– ovulation – formation of CL

Proestrus

- It starts with regression of previous CL.
- follicular growth will be there.
- **Uterus - tonic, turgid and edematous.**
- **Progesterone is low**
- **estrogen is high.**
- **Bleeding in bitch**

Estrus:

- Well-developed graffian follicle
- Uterus is **erect, turgid and tonic** and Increased secretion of mucus
- Cervix is relaxed (open)
- **Mucosa of vagina is thickened - cornified cells**
- during proestrus and estrus the **colour of mucosa is pink to red.**
- Vulva is swollen and edematous.
- **ovulation** occur in this stage except **cattle and buffalo in which ovulation occur 10-12 hrs after end of estrus (in metestrus).**
- **High levels of E₂ and low level of P₄ (always < 1ng/ml).**

- **spontaneous ovulation** - Cattle, buffalo, sheep, goat, mare, bitch
- **induced ovulation** - Cat, Camel and Rabbit (Absence of male may prolong estrus)

Duration of estrus

- Cattle/Buffalo: 12-24hrs
- Sheep 24-36 hrs
- Goat: 24-48 hrs
- Sow 48-72 hrs
- **Bitch 9-10 days**
- Mare 4-7 days.

Metestrus

- after estrus for about 3 days
- **CL is formed (except cattle, buffalo).**
- **Metestrual bleeding** - In some cattle and buffalo due to sudden **withdrawal of E₂** leading to rupture of capillaries. Bleeding is **not an indication of conception or conception failure.**

Diestrus - 5 to 17-18th day of cycle

- CL is fully functional - lutein cells - **large amounts of progesterone**
- **uterine glands - hyperplasia and hypertrophy**
- **CL has the greatest blood supply per unit tissue of any organ.**

SIGNS OF ESTRUS IN DIFFERENT SPECIES

- Homosexual behaviour
- reduced milk yield

Mare - Long day breeder (March to July)

- **winking of clitoris** - repeated exposure of the clitoris

Sow

- stand motionless (breeding/ mating stance/ back pressure test)
- **pro-estrus female may mount but refuses to be mounted**

Sheep and goat - short day breeder (October-February)

MECHANISM OF LUTEOLYSIS - oxytocin (by corpus luteum) and $\text{PGF}_{2\alpha}$ (endometrium)

- day 16 **oxytocin receptors** begin to form in the endometrium in ruminants
- corpus luteum – oxytocin - oxytocin receptors - stimulates **cyclo oxygenase enzyme (Cox)** results in - **arachidonic acid get converted into prostaglandin**
- $\text{PGF}_{2\alpha}$ is drained through utero-ovarian vein.
- **Close proximity of ovarian artery and utero-ovarian vein**
- **counter current mechanism** - leakage of $\text{PGF}_{2\alpha}$ into ovarian artery - Luteolysis

uterine infection - significant synthesis and release of $\text{PGF}_{2\alpha}$ - premature luteolysis - short estrous cycles (pathognomonic)

Mare – **double ovulation** – 30% chances

Split estrus

- **I Half - False estrus in bitch** – no ovulation (follicles regress) – first heat of life- upto proestrous – show all signs of heat
- **After 2 to 10 weeks**
- **II half – True ovulation** (new growth of follicles)

Primiparous: calving first time

Pleuriparous: calved for more than one time.

Nullipara/Nulliparous: never calved.

Superfecundation - multiparous/polytocus (long heat)

- female ovulating **two or more ova** during **one estrus** and copulating with **two or more males** during that estrus with ova being **fertilized by spermatozoa from each male**

Superfetation – multiparous/polytocus - sow, bitch

- **pregnant female** carrying one or more **live fetuses** comes in **estrus**, is bred again a **second conception** occurs in uterus

Methods of estrus detection

- Visual Observation
- Rectal examination
- Kamar Heat-Mount Detector
- Chin-ball markers on vasectomised bulls
- Activity monitors (Pedometer) - restlessness and consequently spend more time to walk
- vaginal fluids
- Progesterone concentrations - **decreased during estrus period - less than 1ng/ml**
- fern pattern

GnRH – decapeptide (10aa) - **half-life is 7 minutes**

- synthesized - **hypothalamus**.
- controls the function of anterior pituitary
- **Receptal, Fertagyl, Ovulanta, Gynarich**
- causes release of FSH and LH
- Dose: 10- 20 ug

Oxytocin - nonapeptide (9 aa) - **Half life of 3-5 minutes**

- synthesized – **hypothalamus and CL**
- stored and **released by** posterior pituitary
- **Gynotocin, Pitocin, Biotocin, Syntocin**
- Contraction – uterus, oviduct, milk secretion, luteolysis
- **Dose: 10-15 IU**

FSH - glycoprotein hormone - half life 2-4 hours.

- Superovulation

LH/ICSH (Interstitial cell stimulating hormone) - glycoprotein hormone
- Half-life - 30 minutes

- Used for treatment of follicular cyst.
- luteotropic hormone
- **Stimulate Theca cells**

Prolactin - polypeptide hormone

- Similar to Growth hormones
- Lactogenesis and induces maternal behaviour

PLACENTAL HORMONES

hCG (Human chorionic gonadotropin)

- excreted in urine of pregnant women
- functions are **similar to LH & some FSH activity**
- Chorulon- 1500 I.U. in delayed ovulation and 3000 I.U. in follicular cyst

PMSG/eCG (equine chorionic gonadotropin) –

- **in blood** of pregnant mare broadly **between days 40-140 of gestation** & produced by endometrial cups
- half life is about 7 days
- **functions are similar to that of FSH**
- secondary CL or accessory CL - In pregnant mare it causes growth of follicles which either ovulate or become luteinized (without ovulation CL is formed) – maintain pregnancy
- Folligon 1000 I.U

In mare - placenta - production of progesterone after regression of accessory CL

- **Same in ewe after 55days of gestation**

Relaxin: polypeptide - produced by **CL of pregnancy**

- Causes relaxation of uterus, cervix & vagina during parturition

Progesterone: 21 carbon steroid hormone

- secreted by CL & **also by placenta** & adrenal cortex
- Proluton depot, Duraprogen, P-depot (in the 2 and 3 ml containing 500 mg and 750 mg, respectively)

Estrogens: 18 carbon steroid hormone

- mainly produced by the ovary & in small amount by placenta & adrenal cortex.
- For the synthesis of estrogen there are **two cells two gonadotrophin hypothesis**

Prostaglandins - 20-carbon unsaturated fatty acids

- Precursor - **Arachidonic acid & linolenic acid**
- **causes regression of CL**
- **Contraction of myometrium – pyometra**
- Synthetic (Cloprostenol) e.g. Vetmate, Metrum, Pragma, Repragna -
2ml vial (500µg)

Repeat Breeding

1. normal cyclic female
2. normal genitalia
3. mated in **three or more consecutive** estruses with fertile bull or inseminated artificially with fertile semen
4. fails to conceive

Male factors: High sperm abnormalities, Low sperm motility or Venereal diseases/infections