

## **Estrous cycle in domestic animals**

At puberty, the female shows a rhythmic pattern of physiologic events which induce detectable morphologic changes in the reproductive system and behavioral changes in the female . these changes can be called or named **Estrous cycle**.

These changes are **cyclic** and repeated overtime , unless normally interrupted by pregnancy and abnormally by a variety of pathologic conditions. Behavioral changes are easier to detect than physiologic changes within the reproductive organs.

Its customary to use the period of **sexual receptivity** of the female for mating called **estrus or heat** , as the standard for the cyclic changes . Because there is only one period of estrus in each cycle. Conventionally the sequence of events that occur between two successive estruses is termed as **Estrous cycle**.

Ovulation occurs during estrus in most of the domestic species , or shortly after estrus as in cow.

According to the periodicity of appearance of estrous cycles , the domestic animals can be classified as **mono estrous** or **polyestrous**.

Monoestrous species have only one estrus cycle per breeding season , such as Bitch ( some bitches have two breeding seasons per year ).

Polyestrous species, are those that in the absence of mating or when mate with a sterile male have several estrous cycles during a year.

These can be further classified as **seasonally polyestrous** , or seasonal breeders , such as the ewes , goat , and mare , and **continuously polyestrous** or non seasonal breeders , such as cow and sow.

The seasonally polyestrous breeders present several cycles but only during a particular season of the year .

The length of the estrous cycles in different species is

In ewe 16 to 17 days .

In cow and sow 20 to 21 days .

In mare 20 to 24 days.

**The phases of estrous cycle** ; traditionally the estrous cycle is divided into a number of phases which are:

**Pro-estrus**; this phase is immediately preceding estrus. Its characterized by a marked increase in activity of reproductive system. There is ovarian follicular growth and regression of corpus luteum of the previous cycle ( in polyestrous species ). The uterus enlarges slightly; the endometrium becomes congested and edematous , and its glands show evidence of increased secretory activity. The vaginal mucosa becomes hyperemic ; the number of cell layers of the epithelium starts to increase , and superficial layers become cornified (in bitch).

The bitch shows external evidence of pro-estrus within vulval edema , hyperemia , and a sanguineous vulval discharge . **In bitch this phase lasts for 7 to 9 days , while it lasts for 2 to 3 days in other domestic animals and it is not as clinically evident or distinguishable .**

**Estrus ;** The period of acceptance of the male , the onset of the phase is only accurately measurable point in the estrus cycle , and hence is used as the baseline for determining cycle length.

The female usually seeks about the male and stand for him to mate her. The uterine , cervical and vaginal glands secrete increased amounts of mucus , the vaginal epithelium and endometrium become hyperemic and congested ; the cervix is relaxed. Ovulation occurs during this phase of the cycle in all domestic species , with the exception of the cow , where it occurs about 12 hours after the end of estrus. During pro-estrus and estrus , there is follicular growth in the absence of functional corpora lutea , the main ovarian hormones produced being estrogens. Pro-estrus and estrus are frequently referred to collectively as the **follicular phase** of the estrus cycle .

**Metestrus ;** The phase succeeding estrus , the granulose cells of the ovulated follicle give rise to the luteal cells which are responsible for the formation of the **corpus luteum** .

There is reduction in the amount of secretion from uterine , cervical , and vaginal glands.

It is a transitional period between ovulation and full development of corpus luteum .

For most domestic species such as mare , ewe , goat , and bitch , that ovulate before end of estrus , the period of metestrus is either partially or totally included within the phase of estrus. For species that ovulate after the end of estrus ( like a cow ) , this phase forms a part of the diestrus phase ( luteal phase ) .

**Diestrus ;** The period of corpus luteum, the uterine glands undergo hyperplasia and hypertrophy , the cervix becomes constricted and the secretions of the genital tract are scant and sticky ; the vaginal mucosa becomes pale , the corpus luteum is fully functional during this phase and secretes large amount of progesterone .

The period of the estrus cycle when there is a functional corpus luteum is sometimes referred to as **luteal phase** of the cycle . The duration of this phase depends on the occurrence or non occurrence of pregnancy. In non pregnant animal, diestrus is the longest phase of the cycle , lasting from 13 to 16 days for most the domestic species.

In non mated animals or in those in which conception did not occur , the corpus luteum ( CL ) regresses at the end of diestrus , and followed by either pro-estrus and subsequent estrus cycle in continuously polyestrus animals , and seasonal poly estrus species during breeding season. In monoestrus species , diestrus is followed by a period of sexual inactivity ( anestrus ) .

**Anestrus :** The prolonged period of sexual rest , during which the genital system is mainly quiescent . The follicular development is minimal ; the corpora lutea, although identifiable , have regressed and are non functional . Secretions are scanty and tenacious, the cervix is constricted, and the vaginal mucosa is pale. Anestrus is a normal stage in prepubertal and aged animals of all species, and pregnancy is the most cause of anestrus in poly estrous species.

Anestrus ( after puberty ) is normal in monoestrous species and normal in seasonal poly estrus species in non breeding season and for lactating female of some species .

In all domestic species , anestrus may occur as pathological conditions caused by a variety of factors including :

Nutritional deficiencies .

Diseases of ovaries and uterus .

Infectious diseases causing early embryonic death .

### **Estrus cycles , Estrus , and ovulation in some farm animals**

	Length of estrus cycles ( in days )	Duration of estrus ( in hours )	Time of ovulation
<b>Ewe</b>	16-17	24-36	30-36 hours from beginning of estrus.
<b>Cow</b>	20-21	18-19	10-12 hours after end of Estrus .
<b>Mare</b>	20-24	4-8 days	1-2 days before end of estrus

#### **Estrus cycle in cows**

In majority of young cattle the estrus associated with the first ovulation is silent .

In heifers , the average length of the estrus cycle is 20 days , and in cow is 21 days .

**The average duration of estrus is about 18-19 hours** , with a range of 2-30 hours .

The ovulation is spontaneous and occurs on average 12 hours after the end of estrus .

#### **Signs of estrus :**

There are great variation amongst individual cattle in the intensity of estrus signs .

Signs tend to be more marked in heifer than in cow.

The estrus cow is restless, and there is reduction in the time spent eating , resting and ruminating . and frequently a reduction in milk yield .

During estrus period , and just afterwards the cow will attempt to mount other cows, sometimes there are signs of a vulval discharge of transparent mucus whose elasticity cause it to hang in complete clear strands from the vulva to the ground .

The vulva may be slightly congested and swollen , the tail may be slightly raised, and the hair of the tail head is often ruffled and the skin sometimes becomes excoriated due to mounting by other cows . For the same reason the rear of animal may be soiled with mud .

The cow will be bellowing if its isolated from the herd , and if she is put with the bull the two animals lick each other , and the cow often mounts the bull before standing to be mounted by him. For a short time after service , cow raised her tail with arched back , this situation indicates that the mating has occurred.

About 48 hours after estrus , irrespective of service , heifers and many cows show a bright red sanguineous discharge , the blood coming mainly from the uterine caruncles.

**Note : Between 24-48 hours after estrus , the uterine caruncles show petechial hemorrhage , and these give rise to the metestrus vaginal discharge of blood (metestrus bleeding).**

#### **Cyclic changes in vagina :**

During estrus , the anterior vagina epithelium becomes greatly thickened , copious secretion of mucus by cervix , and anterior vagina increases , mucus is transparent and flow readily.

hyperaemia of mucosa of vagina and cervix is progressively during pro-estrus and estrus.

cervix is tumefied and relaxed , so one or two fingers can be inserted into the os cervix.

pH of vagina decreases or fell from 7.0 to 6.7 one day before behavioral signs of estrus and at the start of estrus fell again to 6.5.

#### **Cyclic changes of uterus :**

During estrus , the uterus is congested , the endometrium is suffled with edematous fluid .

The muscularis of uterus is contractile , and when uterus is palpated per rectum it conveys a high characteristic tonic turgidity to the palpating fingers , the horns feel erect and coiled . this tonicity is present the day before and the day after estrus , but is at its maximum during estrus.

#### **Cyclic changes in the ovaries :**

Usually one follicle ovulates and one ovum is liberated after each estrus .

**About 60% of ovulations are from right ovary .**

On the rectal palpation , of the ovaries during estrus is usually to detect the ripening follicle as a slight bulging , smooth soft area on the surface of one of them . Ovulation may occur from any aspect of the ovarian surface. After ovulation , the corpus luteum (CL)

develops ,which enlarged rapidly and by 48 hours of ovulation it has attained a diameter of about 1.4 cm , at this stage CL is soft , its color is dull cream .

CL attained its maximum size by the seventh or eighth day of diestrus ; its shape varies from oval ( in majority ) to irregular square or triangle , yellow to yellow- orange in color .

The dimension of fully developed CL varies from 2.0 to 2.5 cm .

### **Estrus during pregnancy :**

Occurrence of estrus during pregnancy has been observed in all species , but has been Most studied in cows . During pregnancy placenta produces estrogen , which may cause the occurrence of sexual receptivity during pregnancy . Natural breeding or copulation has no adverse effect on the pregnancy , but the artificial insemination , of the pregnant cow using rigid pipette should be avoided .

### **Postpartum estrus :**

The first standing estrus in cow usually occurs 40-50 days after parturition, but first ovulation occurs 25 to 30 days postpartum , that means the first ovulation accompanied by silent estrus .