

# Reproductive physiology in alpacas

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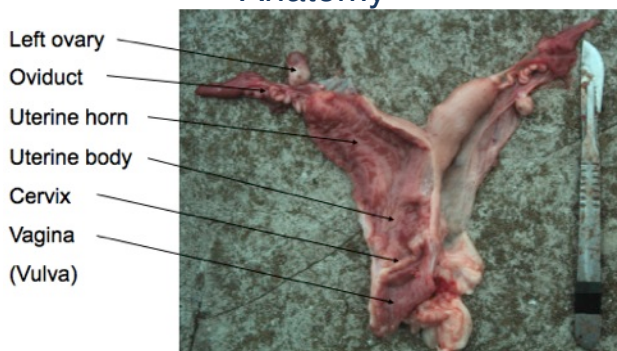


## Females

### Puberty

Nutrition is recognised as a major environmental factor that influences the onset of ovarian activity in young females. Females need to attain approximately 65% of their mature weight in order to ensure a high likelihood of conception, whilst avoiding stunting and birthing difficulties. In Australia, this weight should be easily achievable by 12 months. Good nutrition after weaning together with monitoring of live weight and body condition score are essential for continued reproductive success.

### Anatomy

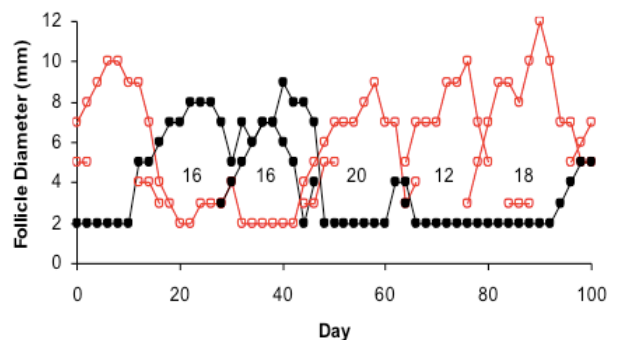


**Figure 1. The reproductive tract of an alpaca, with the left uterine horn opened up to show the endometrial surface. Note the presence of a dominant follicle on the left ovary.**

### Ovarian activity in unmated females

- Ovarian follicular waves involve synchronous emergence of groups of follicles (fluid-filled structure containing the oocyte/egg) on both ovaries.
- One follicle becomes dominant:
  - Growth phase 4-6 days (4-6 mm diam)
  - Mature phase 4-8 days (7-12 mm diam)
  - Regression phase 4-5 days
- Interval between emergence of each new group of follicles ranges from 12 to 20 days.
- Ovarian follicular activity alternates between ovaries randomly.
- Follicle activity is non-seasonal.
- Variation in new wave emergence within and between animals (Figure 2).

- Females that have not been exposed to a male are sexually receptive most of the time, regardless of follicular diameter.



**Figure 2. Ovarian follicular dynamics in a female alpaca observed over 100 days. Red lines refer to activity on the left ovary, black lines refer to activity on the right ovary, numbers indicate interwave interval for the wave with which they are associated (Vaughan 2001).**

### Mating and ovulation

- Alpacas are known as *induced-ovulators* because females require coital stimulation for the egg to be released from the dominant follicle on the ovary.
- Copulation takes place in a sitting position and usually lasts for 15-20 minutes. During copulation, the male penetrates the cervix with his penis, and deposits semen into both uterine horns. Matings that occur in the absence of a dominant pre-ovulatory follicle do not induce ovulation and conceptions do not occur.
- Matings that occur in the presence of a growing or mature follicle ( $\geq 6$ mm diameter) result in ovulation. An ovulation-inducing factor (OIF,  $\beta$ -nerve growth factor) in the semen and neural stimuli from the mating process (orgling noise, cervical penetration) are transmitted to the brain of the female to stimulate a hormone cascade and ovulation.
- Ovulation occurs 26 hours after mating. A corpus luteum (CL) develops at the site of ovulation 2-3 days after ovulation and secretes progesterone. This is the hormone of pregnancy and induces spitting behaviour in females.

- If conception does not occur, prostaglandin (PG) is released from the uterus and induces regression of the CL 9-11 days after mating. Females return to sexual receptivity approximately 12-14 days after mating.
- Follicular activity continues during the luteal phase so if a female ovulates, but fails to conceive, there will be an ovulatable-sized follicle on one ovary as soon as she becomes receptive again (Figure 3).



**Figure 3. Ultrasonograph showing an alpaca ovary (O) with a corpus luteum (CL) and a developing follicle (F).**

### Pregnancy

- The embryonic signal for maternal recognition of pregnancy is unknown, but must be transmitted as early as Day 8-9 after mating in order to 'rescue' the CL of pregnancy. The CL is the major source of progesterone throughout pregnancy and its presence is required to maintain pregnancy.
- 98% of pregnancies occur in the left uterine horn, even though the CL of pregnancy is found equally on the left or right ovary. Therefore, embryos derived from ovulation of the right ovary migrate into the left uterine horn.
- Embryonic death is common in alpacas: 5-10% of embryos may be lost in the first 60 days of pregnancy, possibly due to nutritional constraints, hormonal imbalance or chromosomal aberrations.
- There are approximately 5% foetal losses from Day 60 to full term.
- Gestation length averages 342 days, usually varies from 330 to 350 days but may range from 300-380 days. Gestation tends to be longer in spring than autumn.
- Cria sex distribution is 50% females, 50% males throughout the year.
- Twin ovulations occur approx. 5% of the time, but twins are rare, so there is likely a mechanism of foetal reduction to singleton.
- Epitheliochorial, diffuse placentation.

### Parturition

- Watch normal births to learn what is normal.
- Do not use the same paddock as a maternity paddock long-term as parasites, protozoa, bacteria and viruses build up and put crias at higher risk of infection.

- Alpacas do not often show external signs of impending delivery *so be observant*.
- Most births occur between 7am and 2pm so *never let the sun set on an alpaca trying to give birth*.
- Stage 1: Preparation for birth 1-4 hours
- Stage 2: Passage of foetus 30-45 minutes
- Stage 3: Passage of placenta 1-4 hours
- Foetus covered in epidermal membrane.
- Dams do not lick newborn or eat placentas.

### Receptivity after unpacking

The interval from parturition to resumption of ovarian follicular activity is 5-7 days in alpacas and females can be ready to ovulate by 10 days post-partum. The uterus only takes about 20 days to involute, probably because of the diffuse nature of placentation.

### Difficulties getting females pregnant during lactation?

Some lactating females struggle to conceive if mated > 3-4 weeks post-partum. Females generally conceive easily once their cria has been weaned because:

- Certain hormones produced during lactation may reduce/inhibit ovarian function.
- Peak lactation occurs approximately 3-4 weeks post-partum. This is the most metabolically demanding time for alpacas, and nutrients are diverted preferentially to the udder, possibly to the detriment of ovarian function.

## Males

### Puberty

Alpacas are born with adhesions between penis and prepuce (sheath) and cannot exteriorise their penis for mating until they approach puberty and secrete higher levels of testosterone. Adhesions breakdown and sperm production begins in:

- 10% of 1 year-old males
  - 60-80% of 2 year-old males
  - **All males should be fertile by 3 years of age**
- Puberty is influenced by genetics and body weight.

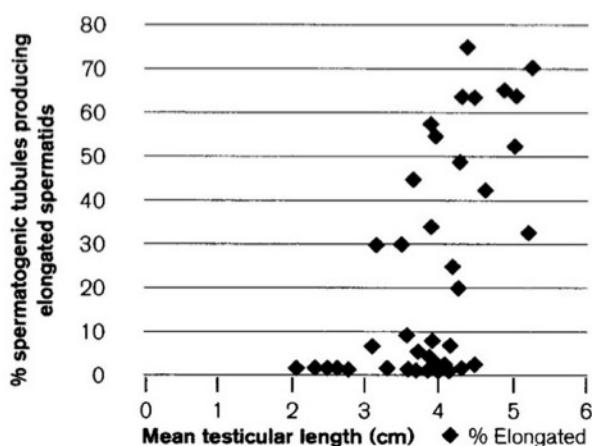
### Anatomy

Male alpacas have a fibro-elastic penis that is 1-2 cm in diameter and 35-40 cm long. There is a pre-scrotal sigmoid flexure to retract the penis into the prepuce in the non-erect state. The tapering tip of the penis ends in a curved, fibro-cartilagenous projection (Figure 4). The urethra is at the base of the process.



**Figure 4. Fibrocartilagenous tip of the penis, used to penetrate the cervix during copulation.**

Testes are small and non-pendulous. They are present in the scrotum from birth. Testicular size is measured as *mean testicular length* (average of length of left and right testes, in cm). Males with a mean testicular length < 4 cm are unlikely to be producing any/many sperm and if over 3 years of age should be culled from the breeding herd due to in/sub-fertility (Figure 5).



**Figure 5. Percentage of spermatogenic tubules producing elongated spermatids (the final stage prior to mature spermatozoa) with increasing testicular size (Galloway 2000).**

- Small testes result in low sperm concentration (30-300 sperm/mL).
- Lack of seminal vesicles results in low ejaculate volume (av. 1 mL).
- The bulbo-urethral glands add mucin to seminal plasma making semen very viscous, and currently precludes successful preservation for AI.
- An ovulation-inducing factor (OIF,  $\beta$ -nerve growth factor) in seminal plasma is absorbed across the uterine lining of the female after copulation to induce ovulation.

USE GOOD HUSBANDRY TECHNIQUES. KEEP GOOD RECORDS. WRITE DOWN TREATMENTS/MATING DATES/MEAT WITHHOLDING TIMES.

NO PRODUCTS ARE REGISTERED FOR USE IN ALPACAS. CONSULT YOUR VETERINARIAN AND ALWAYS READ THE LABEL BEFORE USING ANY OF THE PRODUCTS MENTIONED. NEVER USE ANY PRODUCT IN ALPACAS THAT IS NOT REGISTERED FOR USE IN FOOD PRODUCING ANIMALS.

FOR ANY SIGNS OF UNUSUAL OR SERIOUS ANIMAL DISEASE, RING THE DISEASE WATCH HOTLINE: 1800 675 888.



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