International Journal of Multidisciplinary Research and Development
www.allsubjectjournal.com
ISSN Online: 2349-4182
Received: 24-02-2026, Accepted: 26-03-2026, Published: 10-04-2026
Volume 13, Issue 2, 2026, Page No. 159-161

Female reproductive physiology and clinical management in elephants

B Vigneshwaran[1], R Divya[2], A Thangamani[1], A Sabarinathan[3], V Prabaharan[4*], A Elango[5]
[1] Assistant Professor, Department of Veterinary Gynaecology and Obstetrics, Veterinary College and Research Institute, Salem, TANUVAS, Tamil Nadu, India
[2] Veterinary College and Research Institute, Salem, TANUVAS, Tamil Nadu, India
[3] Assistant professor, Veterinary Clinical Complex, Veterinary College and Research Institute, Salem, TANUVAS, Tamil Nadu, India
[4] Professor and Head, Department of Veterinary Gynaecology and Obstetrics, Veterinary College and Research Institute, Salem, TANUVAS, Tamil Nadu, India
[5] Dean, Veterinary College and Research Institute, Salem, TANUVAS, Tamil Nadu, India

Abstract
Elephants have a unique reproductive system with prolonged gestation (20-22 months) and complex endocrine regulation. The female reproductive tract has distinct anatomy, and the estrous cycle features dual LH surges. Diagnostic approaches like hormonal profiling and ultrasonography aid reproductive monitoring. Understanding these processes is crucial for conservation, breeding programs, and veterinary care, ultimately supporting species sustainability. Their reproductive biology is shaped by anatomy, endocrinology, and behavior, requiring specialized approaches for effective management.

Keywords: Elephant reproduction, estrous cycle, gestation; ultrasonography, progesterone, reproductive anatomy

Introduction
Elephants are characterised by a slow reproductive rate, long lifespan, and complex social organisation, all of which influence their reproductive biology. Female reproductive physiology in elephants is particularly unique due to specialised anatomical structures, extended estrous cycles, and prolonged gestation periods (Fontes, 2017) [4]. These features are closely linked to their evolutionary strategy of producing fewer but highly developed offspring (Chelliah and Sukumar, 2015) [3]. Understanding elephant reproduction is vital for both in situ conservation and ex situ management. Declining populations due to habitat loss and poaching have increased the importance of effective reproductive monitoring and assisted breeding programmes (Umapathy, 2017) [14]. This review explores the anatomy, physiology, and clinical aspects of female elephant reproduction, with emphasis on practical veterinary applications.

Female Reproductive Anatomy
External and Internal Structures
The female reproductive anatomy of elephants differs markedly from that of most domestic mammals. The vulvar opening is positioned between the hind limbs, approximately one metre below the anus in adult individuals. This anatomical placement facilitates horizontal delivery of the calf, reducing the risk of injury during parturition (Fowler & Mikota, 2006) [5]. In nulliparous females, a well-developed hymen separates the vagina from the urogenital canal, often containing multiple small openings, although typically only one is functional. This structure may persist even after mating, posing challenges for artificial insemination (Hermes *et al*., 2000) [6]. The vagina in multiparous females can reach lengths of up to 50 cm, while the cervix is characterised by longitudinal folds similar to those observed in equids. The uterus consists of a relatively small body and elongated horns measuring approximately 0.5–0.7 metres. The ovaries are located near the distal ends of the uterine horns, and the oviducts are comparatively short (Hildebrandt *et al*., 2006) [8].

Functional Implications
The unique anatomical configuration influences reproductive processes significantly. During mating, sperm is deposited in the cranial urogenital canal rather than directly into the vagina. Consequently, sperm must travel over one metre to reach the site of fertilisation, which may impact fertilisation efficiency (Hermes *et al*., 2000) [6]. The persistence of the hymen and the complexity of the reproductive tract also complicate assisted reproductive techniques, necessitating specialised approaches in veterinary practice.

Puberty and Sexual Maturity
Puberty in female elephants occurs between 8 and 12 years of age, although this range varies depending on nutrition, environmental conditions, and social hierarchy (Lee & Moss, 2012) [10]. The onset of puberty is marked by the initiation of estrous cycles, which are often irregular during early reproductive life. Full sexual maturity is typically reached between 12 and 14 years, at which point females are capable of successful conception and gestation. Factors such as body condition and herd dynamics play a crucial role in determining reproductive readiness (Brown, 2014). Early reproduction is associated with improved reproductive health, whereas delayed breeding may predispose females to uterine pathologies.

Estrous Cycle and Hormonal Regulation
Cycle Characteristics
The estrous cycle in elephants is unusually long, lasting approximately 14–16 weeks. The follicular phase extends over 6–8 weeks and is characterised by two distinct luteinising hormone (LH) surges (Hodges *et al*., 1997) [9].

The first LH surge (LH1) induces partial luteinisation of several follicles, while the second surge (LH2) triggers ovulation of a dominant follicle approximately 19–23 days later. Ovulation typically occurs 12–24 hours after the LH2 surge.

Hormonal Dynamics and Estrous Behaviour

Progesterone concentrations rise following ovulation and remain elevated for 10–14 weeks before returning to baseline levels. This prolonged luteal phase is essential for maintaining reproductive readiness (Brown *et al*., 2004) [2]. Repeated estrous cycles without pregnancy have been associated with uterine pathologies. For instance, Asian elephants commonly develop leiomyomas, whereas African elephants are more prone to endometrial cysts, likely due to prolonged oestrogen exposure (Hermes *et al*., 2004) [7]. Estrous behaviour in elephants is relatively subtle but includes increased restlessness, urine dribbling, tail raising, and mild vulvar swelling. Females also release pheromones that signal reproductive status to males (Rasmussen & Krishnamurthy, 2000) [12]. Males detect these chemical cues through olfactory mechanisms and often exhibit the flehmen response. Receptive females allow mounting, marking the peak of fertility. The estrus phase itself is brief, lasting only 2–7 days within the longer cycle.

Gestation and Fetal Development

Duration and Significance

Elephants have the longest gestation period among terrestrial mammals, lasting approximately 20–22 months. This extended duration supports the development of large, well-formed calves capable of immediate mobility (Moss, 2001) [11].

Physiological Basis and Evolutionary Perspective

The prolonged gestation is linked to advanced neurological development. The elephant brain, weighing up to 5 kg in adults, undergoes significant development during fetal life, necessitating extended intrauterine growth (Shoshani *et al*., 2006) [13]. Hormonal regulation, particularly sustained progesterone secretion, ensures a stable uterine environment. The placenta supports nutrient transfer and fetal growth throughout gestation (Hildebrandt *et al*., 2006) [8]. Elephants follow a K-selected life-history strategy, characterised by low reproductive rates and high parental investment. Females typically produce a single calf every 4–6 years, emphasising the importance of each reproductive event (Sukumar, 2003).

Pregnancy Diagnosis

Hormonal Analysis and Ultrasonography

Hormonal monitoring is a reliable and non-invasive method for pregnancy diagnosis. Progesterone levels remain elevated throughout gestation, while estrone sulphate serves as a marker of fetal presence (Brown, 2000) [1]. Prolactin levels increase during mid to late pregnancy, indicating preparation for lactation. These hormonal markers can be measured in blood, urine, or faecal samples, making them suitable for both captive and wild populations. Ultrasonography allows direct visualisation of the reproductive tract and developing fetus. Early pregnancy can be detected as early as 30–40 days post-ovulation, with fetal heartbeat visible by 45–60 days (Hildebrandt *et al*., 2006) [8]. As gestation progresses, ultrasonography provides valuable information on fetal growth, placental health, and amniotic fluid levels. It is considered one of the most effective diagnostic tools in elephant reproduction.

Rectal Palpation

Rectal palpation remains a useful technique for assessing uterine size and ovarian structures. However, it requires considerable expertise and is less effective for early pregnancy detection. It is often used in combination with other diagnostic methods to improve accuracy (Fowler & Mikota, 2006) [5].

Parturition and Perinatal Behaviour

Parturition in elephants is regulated by hormonal changes, including a decline in progesterone and an increase in oestrogen and prostaglandins. These changes initiate uterine contractions and cervical dilation (Hodges *et al*., 1997) [9]. Behaviourally, females may seek secluded areas for calving. In social groups, experienced females assist in the birthing process, a behaviour known as allomothering. This cooperative care enhances calf survival. Labour typically lasts a few hours, and calves are usually able to stand within an hour of birth. Early suckling is critical for acquiring colostrum and establishing immunity.

Clinical and Conservation Implications

Understanding reproductive physiology is essential for managing elephant populations, particularly in captivity. Challenges such as low fertility rates, uterine pathologies, and difficulties in artificial insemination require specialised veterinary interventions. Advances in reproductive technologies, including hormone monitoring and ultrasonography, have improved breeding success. However, continued research is needed to optimise these techniques and address knowledge gaps, such as sperm lifespan and optimal insemination protocols.

Conclusion

Female elephants have unique reproductive traits, like complex hormones and long gestation (20-22 months), to produce advanced offspring. This strategy boosts survival chances. Understanding these processes helps conservation and veterinary care, supporting elephant survival amidst threats.

References

1. Brown JL. Ovarian steroid hormone dynamics in elephants. Animal Reproduction Science,2000:60–61:633–642.
2. Brown JL, *et al*. Reproductive endocrine monitoring of elephants. Zoo Biology,2004:23:321–334.
3. Chelliah K, Sukumar R. Interplay of male traits male mating strategies and female mate choice in the Asian elephant Elephas maximus. Behaviour,2015:152(7–8):1113–1144.
4. Fontes SADJ. Reproductive management in captive elephants. ,2017.
5. Fowler ME, Mikota SK. Biology medicine and surgery of elephants. Blackwell Publishing,2006.
6. Hermes R, *et al*. Anatomy of the elephant reproductive tract. Theriogenology,2000:54:109–122.
7. Hermes R, *et al*. Uterine pathology in elephants. Biology of Reproduction,2004:71:169–175.

8. Hildebrandt TB, *et al*. Ultrasonography in elephant reproduction. Theriogenology,2006:66:343–351.
9. Hodges JK, *et al*. Endocrine patterns in elephant estrous cycles. Journal of Reproduction and Fertility,1997:109:215–223.
10. Lee PC, Moss CJ. Wild female reproductive strategies in elephants. Behavioural Ecology and Sociobiology,2012:66:115–127.
11. Moss CJ. The demography of an African elephant population. African Journal of Ecology,2001:39:1–8.
12. Rasmussen LEL, Krishnamurthy V. Chemical communication in elephants. Chemical Senses,2000:25:475–482.
13. Shoshani J, *et al*. Elephant brain and cognition. Brain Research Bulletin,2006:70:124–157.
14. Umapathy G. Conservation of endangered animals based on genetic polymorphism studies and assisted reproduction. Central Zoo Authority of India Ministry of Environment,2017.