



## Artificial insemination in camel, a review

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### Abstract

A few studies conducting on artificial insemination in camels, and those that do tend to have inferior results when compared to studies on animals that regularly use artificial insemination and cryopreservation (1). This article is a review to an updating researches and studies that interest in AI in camels. It includes definition and history of AI in camel, advantages and disadvantages of AI, methods of semen collection, methods of AI, time of insemination, semen diluents with deep focusing on the problems facing AI in camels. In conclusion, we noticed that AI in camel develops very slowly comparing to other farm animals due to several difficulties and problems mainly the timing of ovulation in female in relation to AI as the camels are induced ovulation animals. On the other hand, there is a dramatic growing in successful studying the methods that helps to overcoming the problems and difficulties that facing AI in camel. More efforts are needed to develop AI in camel to be easily, widely and globally used.

**Keywords:** Artificial insemination, camel, problems, cryopreservation, camelids.

### Introduction

Due to their significant position in the food chain, camelids are crucial to the world's food security (2,3). This is primarily due to their specific physiological characteristics, which enable them to perform and endure in harsh environments (4). However, camelids have a poor rate of reproduction (5). Due to many technical issues, especially the distinct qualities of this species' semen, camels' use of current assisted reproductive technologies and artificial insemination is less advanced than that of other species (1).

Cryopreservation and artificial insemination are rarely used in camel studies, and those that are tend to produce poor results when compared to

studies on animals that do (1). By advancing efforts and winning farmers' faith in artificial insemination programs, artificial insemination in camelids can advance and develop (6). This review summaries the previous researchers studies and their big efforts to develop artificial insemination technologies in camel in different countries.

### What artificial insemination means?

Artificial insemination (AI) is one of the contemporary reproductive technologies collectively referred to as assisted reproductive technologies (ART). With varying degrees of success, AI is frequently used in various farm animals. It refers to the manual introducing of



sperms into the female genital system through a process other than the natural mating.

AI is the most widely utilized, inexpensive, and highly effective form of assisted reproduction in all species (7, 8). The ability of spermatozoa to survive outside the male after ejaculation, the ability of these spermatozoa to be reintroduced into the female genital tract in a way that gives an accepted conception rate, and the capability of identifying the period of female fertility are the three major milestones that determines the success of AI, and particularly when combined with cryopreservation and sperm sexing, AI seen as a potent reproductive tool (9).

### History of AI in camelidae

The first successful artificial insemination of a camel using frozen semen was reported by Elliott in 1961 (10). From a historical perspective, the primary motivation for using AI was to combat venereal diseases in various animals, especially in bovine (11). AI in camels have many differences than other species due to a number of biological variations (12). The interest in AI and other forms of ART in camels has rapidly expand in recent years (4). However, compared to other domestic species, camel AI development is slower (11).

#### Reproduction in camel

The fact that both male and female camels experience heat during their mating season distinguishes camels from other animals as seasonal polyestrous short-day breeders (2, 13). The camel breeding season typically lasts from November through April (6, 2). However, this time frame could change depending on one's genetic makeup and region (6, 13). Age of male and female camels is a crucial factor to consider when evaluating their future fertility (14). Coitus is currently believed to be the primary

inducer of ovulation in female camels, which are well known for being induced ovulation animals (4, 8). Male camel sexual desire is inhibited for protracted periods of time throughout the year (2).

### Advantages and disadvantages of AI in camel

AI has many benefits for both domestic and zoo animals (9), including improving male animal productivity (15, 8), improving camel male and female reproductive performance (4), conserving rare and endangered species (9), and resolving issues like limited opportunities to improve camel reproduction efficiency due to singleton births, long gestation periods, and the use of traditional reproductive management regimens (16), controlling venereal diseases (17, 7, 11), genetic improvement of camelids globally (16), reduction of the risk of harm to male or female camels during natural mating (18), facilitation of international trade in livestock (11), reduction of stress associated with transporting animals, especially females (18), relatively low-tech and inexpensive technology (11), and rapid spread of the male camel's desirable traits that are quickly passed on to more offspring (18).

The ability of AI in camels to inseminate numerous females with a single ejaculate, especially from super males (14, 11), is another significant benefit. This ability allows the camel herd to have fewer males overall (11).

On the other hand, there are numerous disadvantages to using artificial insemination in camels, including the loss of genetic variation brought on by concentrating on specific individuals (9), the widespread dispersal of genetic flaws when they appear in an AI sire (11) and the possibility of infection spread



during AI due to some AI sires shedding viruses in their semen without showing any symptoms of illness (9).

### **Semen diluents in camel**

Semen diluents have a crucial role in maintaining spermatozoa and their functional activity while semen is stored at various temperatures (17). A protein that protects sperms from cold shock, a buffering system, an energy source like fructose or glucose, and antibiotics are all required ingredients in sperm diluents (15). To optimize the right semen dosage in camels, various extenders have been investigated (4), and conflicting results were obtained.

Prior to insemination, it is advisable to allow the camel semen to liquefy in order to improve the semen's mixing with the diluent and provide a more precise assessment of the concentration and motility (15). According to (19), camel sperm extended with 11% lactose or laciphose mixed with 20% egg yolk resulted in a 50% pregnancy rate, and pregnancy rates can be improved by increasing the sperm concentration to 150–600 10<sup>6</sup> sperm/ml when the semen is either fresh or chilled (20). Poor pregnancy rates have been observed in numerous studies using chilled or stored sperm from camel species, including dromedary camels (21), alpacas (22), and llamas (23), indicating -for unknown reasons- that the diluting and storage of sperm affects the ability of the spermatozoa of the camel species to fertilize, even when the in-vitro sperm quality appears to be good (24).

Successful extension of camel semen held at 5°C was achieved using a diluent of tris-egg yolk-fructose enriched with 500 IU/ ml catalase (17). Some researchers suggest using glucose-milk diluent or sucrose-sodium citrate, lactose

sucrose, and glycerol (6) for the cryopreservation of camel semen. However, other researchers have confirmed that 72% of pregnancy rates can be achieved in camels using 1.5-3.5 ml of semen with a concentration of 150 x 10<sup>6</sup> spermatozoa/ ml diluted with Green buffer augmented with 20% egg yolk (25).

The use of Tris-Lactose diluent with 3% glycerol after centrifugation to remove the viscosity of the seminal plasma appeared efficient for decreasing the viscosity of the male camel's semen, and increased the survival rate of sperms to 73.3% and the motility to 45.8% but without pregnancy (4). However, a study of (24) reported 62% pregnancy rate following insemination by frozen-thawed semen after 30 hours of ovulation induction treatment, but the details on the sperms dosage and the site of insemination in uterus were not provided in this study, so such results should be taken with caution when compared with the other results that reported difficulties in recording good pregnancy rates after insemination by frozen-thawed semen.

### **Methods of semen collection in camel**

The careful and clean collecting of semen is one of the most crucial components of AI in any species (26). Semen can be removed from camels using an artificial vagina, an electroejaculator, or by saline solution flushing of the epididymis (6, 10, 27, 8), however the first two techniques are the most common (15, 10, 8). Other techniques for collecting camel sperm include urethral fistulation, intravaginal sponges or pessaries, and postcoital vaginal aspiration (28). Semen from male camels can also be extracted via artificial vagina utilizing a female camel dummy that is positioned similarly to the female during mating (4).



Methods of artificial insemination in camel  
A disposable AI pipette with 42 cm length and 0.9 cm outside diameter is used for uterine or deep vaginal insemination in camels (6). Cervical insemination is also performed on camels using an inseminating pipette and a visual endoscope to place sperms at the utero-tubal junction (15). Similar to how artificial insemination is performed in mares, cervical insemination can also be performed by identifying the cervix and guiding the insemination gun transrectally or transvaginally (29). For camels using frozen semen, a number of regimens are employed, including LH injection/single AI, 100 IU hCG injection/single AI, and single AI with double dosage (6). If the sperm are released near the Utero-Tubal Junction, left or right, depending on the position of the preovulatory follicle, at least 24 hours after ovulation stimulation, a lesser dose may be just as beneficial for achieving pregnancies (30).

#### **Time of insemination in camel**

Rectal palpation and/or ultrasonography may be the only realistic ways to tell when a she-camel must mate (10, 8). Since camelids are well recognized to be induced ovulator species, hormonal ovulation induction techniques must be used as a backup plan when AI technology is required (14). hCG or GnRH are the hormones employed in this process (15, 8). It is ideal to inseminate a she-camel within 24 hours of hormonal treatment when the chances of conception are high (14, 8) because the ovulation occurs 28–36 hours after hormonal treatment with the aforementioned hormones (15). After the first day of estrous, some researchers claim that using double inseminations with frozen semen, separated by

24 hours, is sufficient to guarantee ovulation-inducing variables (6). The most crucial factor for artificial insemination in camelids may be the timing of insemination in respect to ovulation time (14).

#### **Problems of AI in camels**

Due to a variety of difficulties, AI trials in camelids may be uncommon. These difficulties include difficult semen collection, handling, and evaluation (15, 14), the high viscosity of camel semen (9, 4), which makes sperm motility assessment extremely difficult and extremely variable (15), and the reality that this viscosity is generated by mucopolysaccharides secreted by the prostate or bulbourethral glands, and the degree of viscosity depends on the individual male camel as well as the quantity of the gel fraction in the ejaculate (31). The viscosity of camel semen has been successfully reduced using a variety of techniques, firstly it can partially liquefy if stored in a waterbath at 25°C - 37°C for 10 - 20 minutes according to some authors (32), but other studies show that it can take up to 8 hours (33), enzymatic treatments such as collagenase, trypsin, chymotrypsin was used for liquefaction also (31), mechanical methods using centrifugation, density gradient centrifugation, vortexing and gentle pipetting have been investigated to reduce viscosity, and gentle pipetting was the most successful as it did least damage to the spermatozoa (34).

The requirement to induce ovulation in the female camel prior to artificial insemination due to she-camels being induced ovulators is another problem with artificial insemination in camels (14, 35). There are also few studies being done to find out the best ways to get she-camels to ovulate (36). According to (37)



ovulation rates rise to 85% if the follicles measure between 10 and 19 mm in diameter and decrease to 12.5% when the follicles measure between 20 and 29 mm. The follicles are unable to ovulate when their diameter exceeds 30 mm, and they are also unable to ovulate while in the regression phase. Only follicles that reach 10 mm in diameter are able to ovulate. When the follicles are in the proper range between 13 and 18 mm (30), an intravenous injection of either 20 mg of Buserelin or 3000 IU of hCG can effectively induce ovulation. Ovulation will then take place 24 to 36 hours following the injection (38). The timing of AI in camels in relation to female ovulation is the most crucial issue and the main challenge (6, 10), also bacterial contamination of camel semen even when all hygienic precautions are taken due to the prolonged semen collection method (during sitting position) (39), and poor semen freezability with low post-thawing motility is a decreasing fertility problem (4). Another issue facing AI in camels is the nature of oestrous in she-camels, which is often silent save for the acceptance of the male (11). Another issue is the nature of camel reproduction in deserts and a lack of awareness of the benefits of AI (6).

### Conclusions

In conclusion, we noticed that AI in camels develops far more slowly than other domesticated animals due to a number of challenges and issues, including the timing of ovulation in females in connection to AI. On the other side, there has been a sharp increase in successful research into techniques that aid in overcoming the challenges of AI in camels, particularly those that concentrate on

techniques for ovulation induction in she-camels and lowering the viscosity of camel semen. For camel to be used simply, widely, and internationally, more work needs towards developing AI.

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