# SUPER OVULATION


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## M.SC SEMESTER III CC 02

Superovulation is a critical requirement for successful assisted reproduction technology. Management techniques to optimize fertility have been limited by mares ovulating only one follicle per cycle. Induction of multiple ovulations in the mare would increase the number of oocytes available for fertilization. Consequently, increasing the ovulation rate of sub fertile mares or of normal mares bred to subfertile stallions may increase the probability of establishing a pregnancy.

Most other mammals, the fetal or neonatal female produces thousands of ooeytes which are never fertilized. Development of ways to harvest and fertilize these effi- ciently and to culture and transfer them would offer many potential advantages.

These include the possibility of

a) de- creasing the generation interval,

b) progeny testing females,

c) using superior females as donors,

d) increasing the number of progeny per female through controlled multiple births,

e) transporting embryos with selected genetic characteristics to distant places,

f) conducting special genetic experiments, as the formation of chimeras,

g) isolating prenatal maternal effects,

h) investigating requirements for opti- mum fertility and normal development and

i) studying effects of a variety of stresses on initiation and continuation of pregnancy.

Superovulation also may enhance embryo collection rates from donor mares, increasing the efficiency of embryo transfer programs. Finally, stimulation of multiple large follicles may increase the collection

efficiency of oocytes/ which can be used for in vitro fertilization (IVF), gamete intra fallopian transfer (GIFT), and intracytoplasmic sperm injection (ICSI).

**Superovulatory hormones and their usage**

**FSH:** This hormone is called as follicle stimulating hormone and produced in gonadotrope cells located in the anterior lobe of the pituitary gland. FSH is necessary for follicle development, antrum formation and estrogen release. FSH stimulates the release of primarily β-estradiol and other estrogens from theca interna and granulosa cells of growing follicles. FSH and LH act together to make follicles release estrogen. FSH and LH act synergistically until ovulation. Estrogen hormone helps FSH in follicle development. As blood estrogen level increase FSH release decreases and LH becomes effective.

**PMSG**: PMSG is known as pregnant mare serum gonadotropin but recently it is more called as eCG (Equine chorionic gonadotropin) in terminology. It is a placenta originated gonadotropin which is obtained from serum of pregnant mare. It mostly has FSH-like effects and besides has LH-like effects as well.

**hMG**: This hormone was named as hMG (human menopausal gonadatrophin) which was obtained from urine of a woman with menopause upon idea of it may use for the superovulation. Researchers reported that there was no positive and sufficient result in studies about hMG in contrast to studies about FSH and PMSG.

**hCG or LH usage for stimulation of ovulation:** hCG is released by cincitiotrophoblas cells in chorionic villus of the pregnant woman. It reaches peak level in the 70th day of pregnancy and decreases gradually until birth. LH is known as luteinizing hormone. It is synthesized by gonadotroph cells in the anterior lobe of pituitary gland and released.

**Hormones that used together with superovulatory hormones**

**GnRH:** Depending on period of cycle and follicular growth in ovary (follicular waves), GnRH hasten growth of young follicles, ovulated follicles which are rich in estrogen (antral follicles) and luteinizing big or old follicles.

**Estradiol 17-β:** Estrus signs are sometimes weak in cows administered superovulation. Therefore, 10 mg estradiol 17-β may inject one day before expected estrus. However, estradiol administration which is a

mostly used for synchronization of follicular wave occurrence for superovulation cannot be used in many countries due to side effects and the negative influence on human health of estrogens.

**Prostaglandins:** The major development in embryo transfer technology was start of using prostaglandins which have strong luteolytic effect. Prostaglandins are used to increase the efficiency of superovulation in donor animals, and to provide sexual synchronization between donor and recipient animals. Single injection of PGF2α for the animals in diestrus phase is done in order to synchronize the sexual cycles.

**Anti-PMSG:** It can be obtained from animals such as turkey, rabbit, sheep and goat and used to remove PMSG residues present in serum. Residual PMSG has the adverse effect on the number of transferable embryos. Thus, antiPMSG may be administered 18-24 hours after the beginning of estrus in order to neutralize the residual quantity of PMSG.

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**Gestagens:** Progesterone restricts the release of GnRH hormone from the hypothalamus and reduces FSH and LH release from the anterior lobe of pituitary gland. The absence of ovulation during pregnancy is explained by the decrease in LH release. It is possible to shorten superovulation intervals by using progestogenic agents. Its two main purposes are

• To increase the number of embryos in good quality obtained upon use of progestogenic agents together with prostaglandins. PRID or other implants can be used for this.

• To prevent dominant follicle formation by modifying endocrinological composition to be stable to that during luteal phase.

**Inhibin:** FSH release from the pituitary gland is inhibited and serum FSH level drops immediately after inhibin injection. Thus, it has been concluded that inhibin is effective in the regulation of FSH release and production.

**Limitations of Superovulation**

Inconsistency in the response to superovulation.

Expensive

Requires intensive monitoring

Drug treatment not always available

**SUMMARY**

Development of a superovulation technique is successful, safe, and commercially available would revolutionize the equine breeding industry. However, the reality is that ovulation rates for mares following existing superovulatory treatment are much lower than for cattle. This dichotomy has been attributed to the relatively limited area available in the ovulation fossa for ovulation to occur, combined with the large size of the equine preovulatory follicle. In addition, the number of ovulations in the mare may be limited physiologically by the size of the follicular cohort that may be rescued by administration of gonadotropins. Clearly, additional research effort is necessary to optimize superovulation treatment regimens in the mare.