

## REPROBIOL SPRL

Why FSH-LH treatment does not systematically provoke a superovulation response in cows:

FSH treatment does not systematically cause superovulation in cows for several reasons, some of which are explored in recent studies:

1. **Variability of ovarian response** : The ovarian response to FSH can vary considerably between cows, influenced by factors such as age, breed, body condition, and stage of the estrous cycle at the time of treatment ( Bó & Mapletoft, 2014).



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2. **Progesterone concentration** : A negative correlation was observed between the increase in progesterone concentration observed 2 days after the start of superovulation treatment and the percentage of transferable embryos collected ([Tamboura, Chupin, & Saumande, 1985](#)).



## Superovulation in cows: A relationship between progesterone secretion before ovulation and the quality of embryos

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### Abstract

Superovulation was induced in 28 cyclic cows by treatment with FSH and milk progesterone concentrations were studied from the initiation of treatment to oestrus. A negative correlation ( $r = -0.66$ ;  $P < 0.001$ ) was observed between the increase in progesterone concentration observed 2 days after the beginning of treatment and the percentage of transferable embryos collected. During this sampling period progesterone secretion was not related to ovulation rate and number of embryos.



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3. **Half-life of FSH** : Due to the relatively short half-life of FSH, superovulatory treatment requires numerous injections, which may affect the ovarian response ( [Demoustier et al., 1988](#) ).

## Determination of porcine plasma follitropin levels during superovulation treatment in COWS

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### Abstract

Porcine follicle stimulating hormone (pFSH) and porcine luteinizing hormone (pLH), are widely used to induce superovulation in cows. An advantage of this treatment is that the LH:FSH ratio can be varied to optimize the growth of the ovarian follicles. However, due to the relatively short half-life of FSH, the superovulatory treatment requires numerous injections.

A performant radioimmunoassay system (sensitivity=0.2 ng/ml plasma) was used to determine plasma pFSH levels in cows that were superovulated with 2 daily injections of 4 Armour Units (A.U.) of pFSH for 4 d. From plasma profiles, the half-life and the disappearance of pFSH were estimated at 5 h and at 10 to 12 h, respectively, confirming the necessity of using two daily injections.



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4. **Influence of endogenous gonadotropins** : The cow's natural hormonal profile, including levels of endogenous gonadotropins such as anti-Müllerian hormone (AMH), can influence the response to FSH. AMH levels correlate with the number of antral follicles and can predict the ovarian response to superovulation ([Rico et al., 2009](#)).

**Anti-Müllerian Hormone Is an Endocrine Marker of Ovarian Gonadotropin-Responsive Follicles and Can Help to Predict Superovulatory Responses in the Cow<sup>1</sup>**

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**ABSTRACT**

The major limitation to the development of embryo production in cattle is the strong between-animal variability in ovulatory response to FSH-induced superovulation, mainly due to differences in ovarian activity at the time of treatment. This study aimed to establish whether anti-Müllerian hormone (AMH) was an endocrine marker of follicular populations in the cow, as in human, and a possible predictor of the ovarian response to superovulation. Anti-Müllerian hormone concentrations in plasma varied 10-fold between cows before treatment and were found to be highly correlated with the numbers of 3- to 7-mm antral follicles detected by ovarian ultrasonography before treatment ( $r = 0.79$ ,  $P < 0.001$ ) and the numbers of ovulations after treatment ( $r = 0.64$ ,  $P < 0.01$ ). Between-animal differences in AMH concentrations were found to be unchanged after a 3-mo delay ( $r = 0.87$ ,  $P < 0.01$ ), indicating that AMH endocrine levels were characteristic of each animal on a long-term period. The population of healthy 3- to 7-mm follicles was the main target of superovulatory treatments, contained the highest AMH concentrations and AMH mRNA levels compared with larger follicles, and contributed importantly to AMH endocrine levels. In conclusion, AMH was found to be a reliable endocrine marker of the population of small antral gonadotropin-responsive follicles in the cow. Moreover, AMH concentrations in the plasma of individuals were indicative of their ability to respond to superovulatory treatments.

*AMH, assisted reproductive technology, follicular development, granulosa cells, ovary*



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5. **Effects of Stress and Handling** : Stress and handling associated with superovulation treatment can also negatively affect cow response. Less invasive and stressful methods to administer FSH could improve the response ([Sakaguchi et al., 2018](#)).

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## Effect of a single epidural administration of follicle-stimulating hormone via caudal vertebrae on superstimulation for *in vivo* and *in vitro* embryo production in Japanese black cows

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**Abstract.** Here, we describe a simplified procedure for embryo production in the Japanese black cow that uses a single caudal epidural injection of follicle-stimulating hormone (FSH). First, we compared the efficiency of superovulation for *in vivo* embryo production between conventional multiple FSH treatment (control, n = 10) and single epidural administration (epidural, n = 5). The number of transferable blastocysts was similar between control and epidural groups ( $4.7 \pm 3.5$  and  $9.0 \pm 6.0$ , respectively). Next, we compared *in vitro* embryo production by ovum pick-up and *in vitro* fertilization (OPU-IVF) between control (n = 12) and epidural groups (n = 12). The rate of development to transferable blastocysts was higher in the epidural group than in the control (23.3 vs. 10.5%,  $P < 0.001$ ). In conclusion, a single epidural administration of FSH can induce follicular development comparable to that of the conventional superovulation protocol and may improve the productivity of OPU-IVF.

**Key words:** Epidural administration, Follicle-stimulating hormone (FSH), Ovum-pick up, Superovulation  
(*J. Reprod. Dev.* 64: 451–455, 2018)

6. One study found a negative correlation between increased progesterone concentration two days after initiation of FSH treatment and the percentage of transferable embryos collected from cyclic cows. This increase was, however, not linked to the ovulation rate and the number of embryos ([Tamboura, Chupin, & Saumande, 1985](#)).

## Superovulation in cows: A relationship between progesterone secretion before ovulation and the quality of embryos

[D. Tamboura, D. Chupin, J. Saumande](#)

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7. Another study examined the use of FSH dissolved in polyvinylpyrrolidone (PVP) to reduce the number of treatments needed to induce superovulation in cows. The results suggested that PVP is a suitable solvent to prolong the absorption of FSH administered in a single injection, thus providing a more practical approach (Yamamoto, Ooe, Kawaguchi, & Suzuki, 1994).



## Superovulation in the cow with a single intramuscular injection of FSH dissolved in polyvinylpyrrolidone

M. Yamamoto<sup>2</sup>, M. Ooe<sup>2</sup>, M. Kawaguchi<sup>1</sup>, T. Suzuki<sup>2</sup>

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### Abstract

It is desirable to reduce the number of treatments required to induce superovulation in cows. In this study we examined whether dissolving FSH in polyvinylpyrrolidone (PVP) would reduce the rate of absorption of FSH and allow it to be administered in a single dose for superovulation. In Experiment 1, 10 cows each received a single dose of FSH which contains 0.6% luteinizing hormone (FSH-R; 30mg i.m.) dissolved in 30% PVP (10ml) or in saline. In Experiment 2, a single injection of 30mg FSH-R dissolved in 30% PVP was given to 25 cows, and 32 cows were injected twice daily in declining doses to receive a total of 28mg FSH-R dissolved in saline. Prostaglandin F<sub>2α</sub> was given to all the cows 48h after the first FSH treatment. Embryos were collected on Day 7 or 8 post insemination. In Experiment 1, the effect of FSH dissolved in PVP was compared with that dissolved in saline (number of recovered ova and embryos; 9.4±4.1 vs. 0). In Experiment 2, the rate of transferable embryos by single injection of FSH-R in PVP were significantly higher (P<0.05) than that of treatment of multiple injection groups. Progesterone concentration measured in serum collected 4 times from estrus (Day-0) to the day of embryo collection, indicated similar patterns in the 2 treatment groups. These findings suggest that PVP is a suitable solvent for prolonging the absorption of FSH given in a single injection thus providing a more practical approach of FSH administration.



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8. One study showed that a superovulatory response of the ovaries in buffalo cows was observed with the use of FSH at 40 mg over four days, suggesting that superovulation protocols may require species-specific adjustments ([Karaivanov et al., 1987](#)).

### [Superovulation induction in buffalo cows (*Bubalus bubalis*) with follicle-stimulating hormone (FSH)].

👤 K. Karaivanov, K. Vlahov, M. Petrov + 2 more authors

📅 1987

#### Abstract

A total of 19 buffalo cows were used to induce superovulation following a pattern that included the use of FSH at the rate of 40 mg in the course of four days, applied twice a day and of Oestrophan at 48 hours after the beginning of treatment. Fifteen animals manifested estrus and were twice inseminated. The superovulation response of the ovaries was 4.3 +/- 0.8 yellow bodies and 0.5 +/- 0.24 follicles greater than 8 mm. A nonsurgical method was employed to obtain 24 embryos of high quality and an unfertilized ovum from 8 buffalo cows.



9. The hormonal profiles of FSH, LH, estradiol and progesterone in cows treated with a porcine FSH preparation to induce superovulation showed significant changes compared to a normal estrous cycle, with partial suppression of preovulatory FSH peaks, although LH surges were not always suppressed ([Kaneko et al., 1989](#)).

### Suppression of the Preovulatory Surge of FSH in Superovulating Cattle Pretreated with Porcine FSH

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Keywords: FSH, LH, ESTRADIOL, PROGESTERONE, SUPEROVULATING CATTLE

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#### Abstract

Changes in plasma concentrations of FSH, LH, estradiol and progesterone were examined in cows treated with porcine FSH preparation to induce superovulation. The results were compared with those in the normal estrous cycle prior to FSH treatment in the same cows. The number of ovulations in each cow was from 5 to 7. Plasma levels of estradiol before ovulation and of progesterone after ovulation were much higher those in the normal oestrous cycle. During the period of superovulation, mean concentrations of preovulatory peaks of FSH were suppressed to 61% of normal controls, though, LH peaks were not always suppressed. These results indicate that a partial suppression of the preovulatory FSH surge occurred in cattle when superovulation was induced by exogenous gonadotropin treatment.



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