Superovulation of Japanese Black Heifers Treated with FSH-P and FSH-R
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ABSTRACT. The effects on superovulation in beef heifers of two kinds of porcine FSH preparations with different LH content, FSH-P and FSH-R, were compared. Forty-two heifers of the Japanese Black Breed received a total dose of 28 AU of FSH-P containing 6.5% LH or FSH-R containing 0.58% LH intramuscularly, in a descending manner for four days. The mean numbers (±SD) of obtained ova/embryos and transferable embryos were 4.9 ± 2.3, 1.5 ± 0.9 and 11.2 ± 2.4, 4.8 ± 1.4, respectively. FSH-R treatment yielded a significantly greater number of ova/embryos and transferable embryos than FSH-P treatment (P<0.05).—KEY WORDS: heifer, porcine-FSH, superovulation.

Porcine FSH has been used in many attempts to obtain a maximum number of transferable embryos through superovulation in cows [2, 4, 7]. Commercially available porcine FSH preparations differ greatly in LH content [1, 3, 10]. This makes it difficult to evaluate the effect of superovulation in cattle. The objective of this study is to compare the effect on superovulation in beef heifers by using two kinds of porcine FSH preparations with different LH content, FSH-P and FSH-R.

Forty-two Japanese Black Heifers were used as embryo donors. The age of these heifers averaged 22.2 ± 5.4 (x±SE) months and their body weight averaged 375 ± 35 kg. They were kept in a commercial dairy farm in Hiroshima under uniform feeding conditions. Superovulation treatments consisted of intramuscular injections of each of two kinds of so-called porcine FSH preparations (Denka Pharmaceutical Co., Ltd., Japan), FSH-P containing 6.5% LH and FSH-R containing 0.58% LH, with descending doses for four days. It started with 5 Armour Units (AU), and a total dose of 28 AU (5.5; 4.4; 3.3 and 2.2 AU, a.m. and p.m.) was administered. Heifers received 30 mg of prostaglandin F2α (Pronalgon F, Upjohn Co., Kalamazoo, Michigan, U.S.A.) on the third day of the FSH treatment. They were artificially inseminated with frozen semen twice with a 12-hour interval following the onset of estrus (Day 0). Embryos were recovered on Day 7 or Day 8 after the first artificial insemination (AI) by the technique previously reported by the present authors [9].

The data were analyzed by Student's t-test. A probability (P) of <0.05 was considered to reflect a significant difference.

No significant difference was observed in the embryo recovery rate among the donors treated with FSH-P and FSH-R. However, FSH-R treatment resulted in a significantly greater number of total embryos and transferable embryos than FSH-P treatment (P<0.05) (Table 1). In donors treated with FSH-P a considerable number of un-ovulated follicles remained in the ovaries on Day 7 after AI, and despite the active ovarian response the number of transferable embryos recovered was comparatively low. This might be due to ovarian over-stimulation by FSH-P.

The superovulatory effect of FSH-R was significantly superior to that of FSH-P. Such a difference in inducing successful superovulation by the two FSH preparations could be attributed to the difference between FSH-R (0.58%) and FSH-P (6.5%) in LH content. A former experiment by Donaldson and Ward [3] on 423 cows showed the beneficial effects of reduced LH concentrations and this has led to the development of a reduced LH type FSH preparation (FSH-P; Schering Corp., Kenilworth, NJ, U.S.A.). Similar inhibition by greater amounts of LH among lots of FSH preparations has been reported by Chupin et al. [1].

Murphy et al. [8] also reported that the ovulatory

Table 1. Superovulatory responses of Japanese Black Heifers treated with two kinds of porcine FSH preparations

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. of donors treated</th>
<th>No. of recovered embryos (%)</th>
<th>Average No. of embryos recovered (Mean±SD)</th>
<th>Average No. of transferable embryos (Mean±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSH-P</td>
<td>19</td>
<td>16 (84.2)</td>
<td>4.9 ± 2.3(i)</td>
<td>1.5 ± 0.9(i)</td>
</tr>
<tr>
<td>FSH-R</td>
<td>23</td>
<td>19 (82.6)</td>
<td>11.2 ± 2.4(ii)</td>
<td>4.8 ± 1.4(ii)</td>
</tr>
</tbody>
</table>

a), b); P<0.05

FSH-P: Porcine FSH preparation containing 6.5% LH given by Denka Pharmaceutical Co., Ltd., Kawasaki, Japan.
FSH-R: Porcine FSH preparation containing 0.58% LH given by the same company. Each donor received FSH-P or FSH-R, a total dose of 28 Armour Unit(AU) intramuscularly, 5.5, 4.4, 3.3, and 2.2 AU, a.m. and p.m., starting from Day 10 of the estrus cycle. And also 30 mg of PGF2α (Pronalgon F, Upjohn Co., Kalamazoo, Michigan, U.S.A.) was given i.m on the third day of FSH treatment.
response in superovulation treatment of cattle was reduced as the LH/FSH ratio increased. When the ratio was maintained at the level of one fifth throughout the course of the superovulation treatment, there was only a minor and insignificant decline in the number of ovulations. Likewise, Herrler et al. [6] showed that 0.423 IU LH/40 AU FSH may yield a significantly improved superovulatory response in dairy cows. And they also reported that, when the LH/FSH ratio was increased, there was a reduced ovariatory response. The addition of LH to FSH in the superovulatory regimen also resulted in a reduced fertilization response. They suggested that LH supplementation may exert its effects mainly on follicular and oocyte maturation during the period prior to luteolysis. Although the mechanism of this inhibitory effect is not well known. It may be that the increase in LH can disrupt the balance between androgen and estrogen production necessary for the prevention of atresia in follicles [5].

In conclusion, the present authors' experiments revealed that FSH-R treatment yielded a significantly greater number of ova/embryos and transferable embryos than FSH-P treatment (P<0.05).

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REFERENCES