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Short communication

Oestradiol concentration as a predictor of ovarian response in FSH stimulated ewe-lambs

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Abstract

We investigated the prediction of ovarian response using oestradiol determination, in 37 gonadotrophin stimulated Karagouniko ewe-lambs. Ovarian stimulation was induced by serial FSH administrations, and laparoscopic follicular aspiration (OPU) was conducted 12 h after the last FSH injection. Oestradiol concentration was assessed in six blood samples collected prior to each FSH injection and in one sample collected prior to follicular aspiration. According to ovarian response, ewe-lambs were allotted in three groups: good, L1 ($n = 17$); moderate, L2 ($n = 10$); and poor, L3 ($n = 10$). Based on the data obtained from 28 (75%) randomly selected animals, a statistical model was designed and tested on the remaining nine lambs for its ability to predict the probability of good ovarian response. From the 2nd sample, oestradiol concentration was constantly higher in group L1 in comparison with L3 lambs (all p-values for the contrasts were ≤ 0.02), while this difference between L1 and L2 lambs was significant only in the 6th and 7th sample (both $p < 0.005$). Using as criterion the oestradiol concentration of the 6th sample, the statistical model predicted all lambs that did not belong to group L1 and three of four lambs that belonged to group L1. Our results indicate that the moderate- and poor-donors could be safely predicted on the basis of oestradiol concentration 12 h prior to the scheduled follicular aspiration. Moreover, poor-donors could be identified—and rejected from further manipulations—on the basis of their inability to exhibit increased oestradiol levels in response to gonadotrophin stimulus.

Keywords: Oocytes pick-up; Oestradiol; FSH; Superovulation; Ewe-lambs

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1. Introduction

We have recently shown that in ewe-lambs, oocyte pick-up can be consecutively applied without affecting either the health status and/or the future reproductive performance of the donor animals (Valasi et al., 2006). It is well documented that ovarian follicles of ewe-lambs increase in number and size in response to exogenous gonadotrophin stimulus, and these follicles secrete oestrogens in a way similar to that of adult ewes (Trounson et al., 1977; Worthington and Kennedy, 1979; Tassell and Kennedy, 1980). However, both in adult and prepubertal donors, the variable and unpredictable ovarian response to superovulatory regimes appears as the most limiting factor in assisted reproduction programmes (Cognié et al., 2003). Thus, the prediction of the ovarian response is of paramount importance; first for the welfare of the donors, because unnecessary operations in valuable animals could be precluded, and second for the total cost of the procedure which will be substantially reduced.

Gonadotrophin treatment activates granulosa cell aromatase enzyme systems and therefore, increases oestradiol production (McNeilly et al., 1991). Moreover, oestradiol is a good marker of follicle health (Campbell et al., 1995) and therefore, it could be used as a predictor for follicular health status. Our hypothesis was that the assayable amount of oestrogens is the resultant of the contribution of each oestrogenically active follicle; hence, the larger the number of the follicles developed in response to FSH administration, the higher the oestradiol concentration in the donor. To this end, we studied the variation of oestradiol concentration during FSH treatment in ewe-lambs. Subsequently, based on oestradiol concentration we devised a statistical model to predict the follicular development before the scheduled OPU.

2. Materials and methods

2.1. Animals and treatments

The experiment described herewith was carried out under a special license issued by the Hellenic Ministry of Rural Development and Food (license number 1520/14-4-2003).

Thirty-seven lambs of Karagouniko breed aging 8–16 weeks and weighing 15–39 kg were housed in a shed and maintained on good quality nutrition throughout the experiment. All the animals were initially (day 0) treated with 25 mg of progesterone (Proluton Depot, Schering AG, Germany). A second progesterone dose was given on day 3 and on the same day ovarian stimulation regime was initiated comprising 3.25 mg of ovine FSH (Ovagen, Bondinco BV, Holland) administered i.m. in six equal doses on a a.m.–p.m. basis. Twelve hours after the last FSH injection laparoscopical follicular aspiration was performed under general anesthesia, with the animals being deprived of food and water for 24 and 12 h, respectively, as previously described (Valasi et al., 2006). At the time of laparoscopic observation the follicular population on the ovarian surface was evaluated according to the number and follicular diameter. As small follicles were considered, those having diameter $\leq$2 mm and as large follicles, those having diameter >2 mm.

According to the ovarian response (number of large follicles) at the end of hormonal stimulation, lambs were divided into three groups that was group L1 (good follicular development, number of large follicles $\geq$6), L2 (moderate follicular development, number of large follicles 2–5) and L3 (no follicular development, number of large follicles $\leq$1).

Seven blood samples were collected from each animal, one sample prior to each FSH injection and one sample before OPU. Blood samples were left for 3 h to clot at 4 °C, serum was then separated and stored at −20 °C until assayed for oestradiol (E2).