ABSTRACT: The association of the 2464G > A SNP found in the promoter region of the rabbit progesterone receptor gene with progesterone receptor (PR) expression was evaluated by Western blot analysis. This SNP was associated with 2 lines divergently selected for uterine capacity, the high line selected to increase uterine capacity and the low line selected to decrease uterine capacity. Two progesterone isoforms were obtained using a commercial monoclonal antibody: the PR-B isoform described previously in rabbits, and the PR-A isoform, not described previously in rabbits. The GG genotype, the genotype more frequent in the high line, showed less PR-B and PR-A expression than the AA genotype in the oviduct (GG/AA PR-B = 0.81 and GG/AA PR-A = 0.73) and uterus (around 0.70 in both isoforms). The GA genotype showed similar PR-A expression in both tissues and also similar PR-B expression in the oviduct to the GG genotype. Conversely, the GG genotype showed less PR-B expression than the GA genotype in the uterus (GG/GA PR-B = 0.79). Similar expression of both PR isoforms was found in the uterus at d 2 and 3 of gestation; meanwhile, an increase of both isoforms was observed in the oviduct. Similar PR-A expression was observed in the ampulla and isthmus; meanwhile, the PR-B expression in the isthmus was double that in the ampulla.

Key words: oviduct, PGR genotype, progesterone receptor expression, rabbit, uterus

INTRODUCTION

Progesterone is required in mammals for maternal support of conceptus, survival, and development. Most physiological effects of progesterone are applied by its interaction with the specific progesterone receptor (PR). In humans, primates, pigs, rodent, and chicken, nuclear PR consist of 2 distinct isoforms, PR-A and PR-B, derived from a single gene independently regulated by separate promoters (Kraus et al., 1993; Duffy and Stouffer, 1995). Up to now, only 1 isoform has been described in rabbits (Loosfelt et al., 1984), which has high homology with the PR-B isoform.

Different functions have been attributed to each PR isoform. In vitro studies revealed that PR-B functions as a strong activator of transcription of several PR-dependent promoters in which PR-A is inactive. In cultured cells, PR-A can repress the activity of PR-B, as well as other nuclear receptors (Vegeto et al., 1993; Hovland et al., 1998). Studies of knockout mice have also provided insight into different physiological functions of each PR isoform for regulating female fertility (Mulac-Jericevic and Conneely, 2004). Selective ablation of the PR-A isoform shows uterine hyperplasia and ovarian abnormalities, whereas ablation of the PR-B protein had no effect on these traits.

Five polymorphic positions were identified in the PR gene (PGR) in rabbits: 1 SNP in the promoter, 3 SNP in exon 1 (5′UTR), and 1 silent SNP in exon 7. The first 4 SNP segregated in 2 haplotypes. The SNP 2464G > A found in the promoter region, the G/G genotype showed 0.5 kits and 0.5 implanted embryos (G/G PR-B = 0.81 and G/G PR-A = 0.73) and uterus (around 0.70 in both isoforms). The GA genotype showed similar PR-A expression in both tissues and also similar PR-B expression in the oviduct to the GG genotype. Conversely, the GG genotype showed less PR-B expression than the GA genotype in the uterus (GG/GA PR-B = 0.79). Similar expression of both PR isoforms was found in the uterus at d 2 and 3 of gestation; meanwhile, an increase of both isoforms was observed in the oviduct. Similar PR-A expression was observed in the ampulla and isthmus; meanwhile, the PR-B expression in the isthmus was double that in the ampulla.
type also showed greater embryo survival (0.36 embryos) and development than the A/A2464 genotype at d 3 of gestation, whereas no effect was observed in these traits at d 2 of gestation (Peiró et al., 2008).

The objectives of this work are to detect differences in PR expression among PGR genotypes in the rabbit oviduct and uterus and to assess when the differences appear.

**MATERIALS AND METHODS**

All experimental procedures were approved by the Polytechnic University of Valencia Research Ethics Committee.

**Animals**

An F1 rabbit population was generated from the reciprocal cross of the high (H) and low (L) lines of a divergent selection experiment on uterine capacity (UC) described by Argente et al. (1997). Both lines were derived from a synthetic line (V line) selected for 12 generations by litter size (LS) at weaning (Estany et al., 1989). The H and L lines were selected for 10 generations, and then the selection was relaxed until the 17th generation. Uterine capacity was estimated as LS in unilaterally ovariectomized females by removing the left ovary of the doe before puberty via midventral incision between 14 and 16 wk of age (Blasco et al., 1994). An F2 population was constituted by crossing the divergent lines. The process is described in Peiró et al. (2008). The F2 population was reared at the experimental farm of the Universidad Miguel Hernández (Orihuela, Spain), whereas the H and L lines and the F1 population were reared at the experimental farm of the Polytechnic University of Valencia. Animals were fed a commercial diet, and the photoperiod used was 16 h light: 8 h dark.

**Genotyping of the Progesterone Receptor Gene**

Blood samples, at least 3 mL, were collected from the marginal ear vein by venipuncture. Genomic DNA was extracted from whole blood following the protocol of the ABI PRISM 6100 Nucleic Acid PrepStation (Applied Biosystems, Foster City, CA). A PCR-RFLP was developed for further testing. Using the rabbit PGR gene sequence (GenBank accession No. X06623), the designed primers were forward 5′-GAA GCA GGT CAT GTC GAT TGG AG-3′ and reverse 5′-CGC CTC TGG TGG CAA GTG TC-3′. These were used with 50 ng of genomic DNA in a 25-μL PCR, 0.5 μM each primer, 200 μM dNTP, 1.5 mM MgCl2, 1 × Taq reaction buffer, and 0.6 U of AmpliTaq Gold (Applied Biosystems). Conditions were 95°C for 10 min, followed by 35 amplification cycles of 95°C, 30 s; 66°C, 60 s; and 72°C, 90 s. The program ended with a 15-min extension at 72°C. The PCR fragment was digested with the restriction enzyme Eco31I (Fermentas, Barcelona, Spain), and the products were separated on 2% agarose gels to confirm a 558-bp product. The PCR-RFLP assay yielded 2 bands of 416 and 142 bp (genotype GG), a single 558-bp band (genotype AA), and all 3 bands (genotype GA).

**PR Expression**

A total of 49 pregnant intact F2 does were slaughtered at d 2 or 3 of gestation. From 7 to 9 does were analyzed per genotype and day of gestation. Does were euthanized by intravenous injection of sodium thiopental in a dose of 50 mg/kg of BW (Thiobarbital, B. Braun Medical S. A., Barcelona, Spain) at least 1 mo after their 4th parity, when does were not lactating. After euthanasia, the entire reproductive tract was removed.

The oviduct and uterus were flushed with 5 and 10 mL of 150 mM ammonium bicarbonate buffer, respectively. Oviducts were split into ampulla and isthmus, removing the middle piece and fimbriae. Uteri were opened at the mesometrial side, and the endometrium was sampled by scraping off the surface tissue. Oviductal, as well as uterine, samples were submerged in 1.5 mL of 0.15 M ammonium bicarbonate buffer and snap-frozen in liquid nitrogen. Samples were stored at −20°C before analyses. Protein content was determined by DC Protein Assay (Bio-Rad, Munich, Germany) according to Lowry et al. (1951). One hundred five and 60 μg of protein were used in the oviductal and uterine samples, respectively, diluted in loading buffer [5% (vol/vol) β-mercaptoethanol; 30 mM Tris, pH 6.8; 1.5 M urea; 7.5% (vol/vol) glycerol; 0.5% (wt/vol) SDS; 0.05% (wt/vol) Bromophenol Blue]. Samples were heated to 100°C for 3 min and subjected to 1D SDS-PAGE using 5% stacking gels and 7.5% resolving gels under reducing conditions. For size determination, a prestained molecular weight marker (PageRuler, Fermentas) was used. After electrophoretic separation, the proteins were transferred to a polyvinylidene difluoride membrane (Millipore, Schwalbach, Germany) by semidry blotting (Kyhse-Andersen, 1984) for 30 min at 100 mA. After transfer, the membrane was blocked for 1 h with 5% (wt/vol) milk powder in Tris-buffered saline (TBS)/Tween-20 (0.1% wt/vol) at room temperature. A primary antibody against mouse PR was used (mouse anti-rabbit progesterone receptor; hPRA-1, Dianova, Hamburg, Germany) at a concentration of 33 pg of protein per μL of TBS containing 5% milk powder. The monoclonal antibody recognized an epitope present in both PR isoforms. The blot was incubated at 4°C for 12 h. After 3 washes in TBS/0.1% Tween, the second antibody was added and left at room temperature for 1 h. After 3 washes, detection of the second antibody [goat anti-mouse horseradish peroxidase (HRP), DAKO, Hamburg, Germany; 1:200] was performed using enhanced chemiluminescence; ECLplus (Amersham, Little Chalfont, UK) for ampulla and isthmus samples and enhanced chemiluminescence (ECL)
reagents (Amersham) for uterine samples. The blot was exposed to x-ray film (X-Omat UV Plus, Kodak, New York, NY) for 1 min. The intensities of the immunoreactive bands were converted into digitalized signals using a computerized densitometry system and quantified by a gel documentation program (Image Master 1D, Amersham). Signal intensities of PR isoforms were normalized to those of β-actin and positive control (T47D cells) as ratios to produce arbitrary densitometry units (ADU) of relative abundance. The protocol for the detection of β-actin was as follows: monoclonal anti β-actin (Clone AC15, Abcam Limited, Cambridge, UK: 1:50,000 in TBS/0.1% Tween; goat anti-mouse HRP 1:5,000; ECL).

**Statistical Analyses**

The model used to analyze PR expression in the oviduct sample was

\[ y_{ijkl} = \mu + D_i + G_j + T_k + (D \times G)_{ij} + (G \times T)_{jk} + (D \times T)_{ik} + e_{ijkb} \]

where \( y_{ijkl} \) is the ADU of each PR expression, \( D_i \) is the effect of the time of gestation (with 2 levels: d 2 and 3 of gestation), \( G_j \) is the effect of \( PGR \) genotype (with 3 levels: GG, GA, and AA), and \( T_k \) is the effect of tissue (with 2 levels: ampulla and isthmus). The expression of PR in the uterus sample was analyzed using the same model excluding the effect of the tissue.

The analysis was based on Bayesian methods. To compare levels of effects, we estimate the value of their ratio using the posterior median of this ratio (median). If the median is >1, this shows that the level in the numerator is greater than the other level, and the opposite is true when the ratio is <1. To evaluate uncertainty, we calculate the probability (P) of this ratio being >1 when its posterior median is greater than 1 and the probability of this ratio being <1 when its posterior median is less than 1. Bounded flat priors were used for all unknowns. Marginal posterior distributions of all unknowns were estimated by Gibbs sampling. After some exploratory analyses, we used 1 chain of 100,000 samples, discarding the first 20,000 and saving every 10 thereafter. Convergence was tested using the Z criterion of Geweke and Monte Carlo sampling errors were computed using time-series procedures described by Geyer (1992).

**RESULTS**

The expression of 2 PR isoforms, PR-B and PR-A, was observed in the oviduct and uterus of pregnant rabbits at d 2 and 3 of gestation. The 2 isoforms where distinguished by their different sizes, 110 kDa (PR-B) and 81 kDa (PR-A; Figure 1). The PR-B expression in the uterus was greater (\( P < 0.05 \)) than that of PR-A (Table 1).

Features of the estimated marginal posterior distributions of ADU ratios for both PR isoforms in the oviduct and uterus are presented in Tables 2 and 3, respectively. Marginal posterior distributions were approximately symmetrical, and all Monte Carlo sampling errors were less than 0.005. Lack of convergence was not detected by the Geweke test in any chain.

**PR Isoforms in the Oviduct**

An increase of both isoforms from d 2 to 3 was observed in the oviduct because the median for the d2/d3 ratio was less than 1 (Table 2; \( P = 100\% \)). The PR-B expression at d 3 of gestation was 2.4 times the expression at d 2 of gestation, and the PR-A expression was 1.6 times greater. In the oviduct, the PR-B expression

<table>
<thead>
<tr>
<th>Item</th>
<th>PR-B</th>
<th>PR-A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>M</td>
</tr>
<tr>
<td>Oviduct</td>
<td>98</td>
<td>0.63</td>
</tr>
<tr>
<td>Uterus</td>
<td>46</td>
<td>3.32</td>
</tr>
</tbody>
</table>

Table 1. Number of samples, and raw means (M) and SD for arbitrary densitometry units of progesterone receptor (PR)-B and PR-A in the oviduct and uterus

![Figure 1](https://jas.fass.org/)
in the isthmus was twice that in the ampulla. Similar PR-A expression was found in both tissues.

The AA genotype had greater (P = 94% and P = 98%, respectively) expressions of both PR than the GG genotype. The PR-B expression in the AA genotype was 1.2 times the expression in the GG genotype, and the PR-A expression was 1.4 times. The GG and GA genotypes showed similar (P = 55% and P = 66%, respectively) amount of both isoforms in the oviduct. Differences among genotypes were similar at d 2 and 3 of gestation for expression of both PR in the oviduct (Figure 2). However, an interaction between the day of gestation and different parts of the oviduct was found. Differences between d 2 and 3 of gestation were greater in the isthmus than in the ampulla (Figure 4). Thus, similar differences in PR-A expression between the ampulla and isthmus were obtained through gestation.

**PR Isoforms in the Uterus**

Similar expression for each PR isoform was found from d 2 to 3 in the uterus, although in both cases the estimates had low precision (Table 3). Expression of both PR for the AA genotype were approximately 1.4 times greater (P = 100% and P = 97%, respectively) than the expression for the GG genotype. Comparing the GG and GA genotypes, different results for each isoform were observed. The PR-B expression in the GA genotype was 1.3 times the expression in the GG genotype (P = 0.92); meanwhile, similar PR-A expression was obtained between the GG and GA genotypes, although the estimate had low precision.

**Table 2.** Features of the estimated marginal posterior distributions of the arbitrary densitometry unit (ADU) ratio between day of gestation (d 2 and 3), tissue [ampulla (A) and isthmus (I)], and genotypes of 2464G > A SNP in the promoter region of the progesterone (PR) receptor gene (GG, GA, and AA) for the PR-B and PR-A isoforms

<table>
<thead>
<tr>
<th>Item</th>
<th>Median1</th>
<th>HPD95% 2</th>
<th>P,3 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR-B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d2/d3</td>
<td>0.42</td>
<td>0.29, 0.53</td>
<td>100</td>
</tr>
<tr>
<td>A/I</td>
<td>0.50</td>
<td>0.38, 0.61</td>
<td>100</td>
</tr>
<tr>
<td>GG/AA</td>
<td>0.81</td>
<td>0.58, 1.02</td>
<td>94</td>
</tr>
<tr>
<td>GG/GA</td>
<td>1.02</td>
<td>0.74, 1.33</td>
<td>55</td>
</tr>
<tr>
<td>GA/AA</td>
<td>0.79</td>
<td>0.59, 1.03</td>
<td>95</td>
</tr>
<tr>
<td>PR-A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d2/d3</td>
<td>0.61</td>
<td>0.45, 0.80</td>
<td>100</td>
</tr>
<tr>
<td>A/I</td>
<td>1.05</td>
<td>0.86, 1.29</td>
<td>70</td>
</tr>
<tr>
<td>GG/AA</td>
<td>0.73</td>
<td>0.51, 0.98</td>
<td>98</td>
</tr>
<tr>
<td>GG/GA</td>
<td>0.93</td>
<td>0.66, 1.30</td>
<td>66</td>
</tr>
<tr>
<td>GA/AA</td>
<td>0.78</td>
<td>0.56, 1.05</td>
<td>95</td>
</tr>
</tbody>
</table>

1Median: posterior median of the ADU ratio.
2HPD95%, highest posterior density region at 95% of probability.
3P: P(ratio >1) when median >1 or P(ratio <1) when median <1.

**Table 3.** Features of the estimated marginal posterior distributions of the arbitrary densitometry units (ADU) ratio between day of gestation (d 2 and 3) and genotypes of 2464G > A SNP in the promoter region of the progesterone receptor (PR) gene (GG, GA, and AA) for the PR-B and PR-A isoforms in the uterus

<table>
<thead>
<tr>
<th>Item</th>
<th>Median1</th>
<th>HPD95% 2</th>
<th>P,3 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR-B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d2/d3</td>
<td>0.91</td>
<td>0.70, 1.12</td>
<td>80</td>
</tr>
<tr>
<td>GG/AA</td>
<td>0.70</td>
<td>0.53, 0.95</td>
<td>100</td>
</tr>
<tr>
<td>GG/GA</td>
<td>0.79</td>
<td>0.54, 1.05</td>
<td>92</td>
</tr>
<tr>
<td>GA/AA</td>
<td>0.87</td>
<td>0.68, 1.17</td>
<td>78</td>
</tr>
<tr>
<td>PR-A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d2/d3</td>
<td>1.12</td>
<td>0.76, 1.53</td>
<td>74</td>
</tr>
<tr>
<td>GG/AA</td>
<td>0.69</td>
<td>0.48, 1.02</td>
<td>97</td>
</tr>
<tr>
<td>GG/GA</td>
<td>1.10</td>
<td>0.59, 1.70</td>
<td>65</td>
</tr>
<tr>
<td>GA/AA</td>
<td>0.63</td>
<td>0.38, 0.95</td>
<td>99</td>
</tr>
</tbody>
</table>

1Median: posterior median of the ADU ratio.
2HPD95%, highest posterior density region at 95% of probability.
3P: P(ratio >1) when median >1 or P(ratio <1) when median <1.

Figure 2. Posterior median values of arbitrary densitometry units (ADU) of progesterone receptor (PR)-B and PR-A isoforms at d 2 and 3 of gestation for each genotype (GG, GA, and AA) in the oviduct.

Figure 3. An interaction between the day of gestation and different parts of the oviduct was found only in the PR-B isoform. Differences between d 2 and 3 of gestation were greater in the isthmus than in the ampulla (Figure 4). Thus, similar differences in PR-A expression between the ampulla and isthmus were obtained through gestation.

**PR Isoforms in the Uterus**

Similar expression for each PR isoform was found from d 2 to 3 in the uterus, although in both cases the estimates had low precision (Table 3). Expression of both PR for the AA genotype were approximately 1.4 times greater (P = 100% and P = 97%, respectively) than the expression for the GG genotype. Comparing the GG and GA genotypes, different results for each isoform were observed. The PR-B expression in the GA genotype was 1.3 times the expression in the GG genotype (P = 0.92); meanwhile, similar PR-A expression was obtained between the GG and GA genotypes, although the estimate had low precision.
In the uterus, an interaction between the genotypes and day of gestation was found. The GA genotype showed different PR-A and PR-B expression patterns with respect to the homozygous genotypes, although the estimates had low precision (Figure 5).

**DISCUSSION**

**PR Isoforms**

We found 2 PR isoforms in the rabbit reproductive tract, as in other species. To our knowledge, this study is the first to describe the rabbit PR-A isoform. The bands found in this experiment had around 110 and 81 kDa, showing a molecular weight similar to other species of 110 and 79 kDa in chickens (Tora et al., 1988), 116 and 82 kDa in humans (Kastner et al., 1990), 115 and 83 kDa in mice (Schott et al., 1991), 120 and 90 kDa in primates (Duffy et al., 1997), and 116 and 92 kDa in cows (Ulbrich et al., 2003).

The different isoforms, termed PR-B and PR-A, have been described in rodents, chickens, primates, and humans. These isoforms are expressed from a single gene as a result of transcription from 2 alternative promoters and translation initiation at 2 different AUG start codons. Two different AUG codons also exist in the rabbit *PGR* gene. Based on the *PGR* gene rabbit sequence (GenBank accession No. X06623), a second AUG codon is found 165 AA after the first one; meanwhile, in human and mice the second codon is located 164 AA after the first one and in chicken 128 AA after the first codon (Tora et al., 1988; Schneider et al., 1991; Schott et al., 1991), showing that not all species have the same protein length. In rabbits, only the PR-B isoform was previously found by Gutierrez-Sagal et al. (1993) at 110 kDa, although 3 other bands were also obtained at 65, 72, and 79 kDa, the last band having almost the same molecular weight as the PR-A isoform found in this study.

**PR Expression**

**PR Isoforms in the Reproductive Tract.** The intensity of the staining allowed semiquantitative estimation of the protein expression. In the oviduct, an increase of both PR isoforms expression was found from d 2 to 3 of gestation. At d 3 of gestation, the majority of the embryos are in the isthmus (Tsutsumi and Hafez, 1974). When the expression of both PR isoforms was analyzed in the ampulla and isthmus, no differences in the PR-A expression between tissues were found, whereas the PR-B expression in the isthmus was double that in the ampulla. A similar result was found by Anzaldúa et al. (2007); they found that the PR-B expression in the isthmus was greater than in the ampulla in the first days of gestation. Several results indicate that

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**Figure 3.** Posterior median values of arbitrary densitometry units (ADU) of progesterone receptor (PR)-B and PR-A isoforms in different parts of the oviduct for each genotype (GG, GA, and AA).

**Figure 4.** Posterior median values of arbitrary densitometry units (ADU) of progesterone receptor (PR)-B and PR-A isoforms in different parts of the oviduct at d 2 and 3 of gestation.
there was selective modification of the histomorphological characteristics and protein secretions of the different regions of the oviduct. These changes could be due to fetal-maternal crosstalk because pseudopregnant rabbit females did not show these changes (Harper, 1994; Anzaldúa et al., 2002).

The PR exhibits a differential expression pattern in the oviduct and the uterus during early pregnancy in rabbits (Anzaldúa et al., 2002). The 2 PR isoforms have shown to be similar at d 2 and 3 of gestation in the uterus. Previous results showed that PR-B expression was not detected in the uterus at 4 h after mating, although it was detected at d 1, with an increase at d 2, followed by a decrease at d 3, and complete disappearance at d 5 of gestation (Gutierrez-Sagal et al., 1993). The PR-B expression found in uterine epithelium and stromal cells by Anzaldúa et al. (2007) also showed a decrease from d 2 until d 3 of gestation. Both results should be taken with caution because the number of animals used was small. The differences in embryo survival and development between homozygous genotypes increased through gestation (Peiró et al., 2008), although we did not find an interaction between genotype and day of gestation.

**PR Expression Among Genotypes.** The progesterone receptor gene was proposed as a candidate gene to explain differences in embryo survival between 2 divergent lines selected for UC (Peiró et al., 2008). The SNP located in the promoter region, which co-segregates with 3 SNP in exon 1 (5'UTR) and 1 silent SNP in exon 7, was associated with these lines; the GG genotype was the most frequent genotype in the H line, selected for high UC, whereas the AA genotype was most frequent in the L line, selected for low UC. Litter size and its components were studied in the F2 population, showing that the GG genotype had 0.5 more kits than the GA and AA genotypes. The difference in LS between homozygous genotypes was due to greater early embryo survival at d 3 and 7 and also to greater embryonic stage of development (Peiró et al., 2008). The difference found in the first days of gestation in early embryo survival and development among genotypes could be related to different PR expression.

The GG genotype showed fewer PR expressions than the AA genotype in the oviduct and also in the uterus at 48 and 72 h of gestation. It seems that PR expressions were inversely related to early embryo survival and development in homozygous genotypes.

Because a similar pattern of both isoforms PR-B and PR-A has been observed, we cannot associate a particular isoform with early embryo survival and development. Taking into account that the SNP found in the PGR gene is located in the promoter region of the PR-B isoform, it seems that the PR-B isoform could be the isoform responsible for the differences in early embryo survival and development between homozygous genotypes. There is no information in rabbits about the relationship between PR-B and embryo survival. In sheep, less PR-B expression in the oviduct and uterus was related to greater embryo survival at d 4 and 7 of gestation in synchronous females compared with asynchronous females (García-Palencia et al., 2007). Besides, it is known that PR is downregulated by progesterone in the uterus of the rabbit and other mammalian species (Brenner et al., 1979, 1990; Camacho-Arroyo et al., 1998; Bouchard, 1999; Ulbrich et al., 2003). Then, decreased PR expression should be associated with greater progesterone concentration. Indirect evidence about the relationship between PR expression and embryo survival is provided by experiments in which progesterone was supplemented in the first stages of gestation. Progesterone supplementation in the first stages of gestation was related to improvement of embryo survival and development in different species [Sheridan et al. (1986) in pigs; Proctor et al. (2006) in humans; Mann et al. (2006), Carter et al. (2008), and Morris and Diskin (2008) in cows; Ghaemi et al. (2008) in mice].

To summarize, there are 2 different PR isoforms in rabbits as in human and mice. Both isoforms are expressed in the oviduct and uterus in the first stages of gestation. The AA genotype showed greater expression of both PR isoforms than the GG genotype in the oviduct and uterus at 48 and 72 h of gestation, which could be related to the reduced survival observed in rabbits with the AA genotype vs. the GG genotype.
LITERATURE CITED


