A study on the evolution of sexual receptivity and plasma estradiol-17beta levels throughout the lactation period, in rabbits

Ubilla E., Rebollar P.G.

in

Baselga M. (ed.), Marai I.F.M. (ed.).
Rabbit production in hot climates

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 8

1994
pages 377-381

A STUDY ON THE EVOLUTION OF SEXUAL RECEPTIVITY AND PLASMA ESTRADIOL-17β LEVELS THROUGHOUT THE LACTATION PERIOD, IN RABBITS.

Ubilla,E. & Rebollar,P.G.

Departamento de Producción Animal, E.T.S.Ingenieros Agrónomos, Universidad Politécnica, Ciudad Universitaria s/n, 28040 Madrid, Spain.

ABSTRACT

This study was designed to determine the evolution of plasma estradiol 17-β(E_2) levels and sexual receptivity(S.R.), from days 1 to 30 of the lactation period in rabbits. E_2 and S.R. were measured daily in 12 lactating doe rabbits of the California x New Zealand breed with 7-10 pups/litter. E_2 levels were determined by immunoassay (ELISA), and S.R. by means of the turgidity and color of the vulva. High means of plasma E_2 concentrations were found on days 1, 5 to 7, and 23 to 30 of the post-partum period(P.P.),($p< 0.001$), and low E_2 levels on days 13 to 23 of the P.P.($p< 0.05$), when comparing to the general mean E_2 level (11.7 ± 0.3pg/ml). 75% of the does showed high S.R. on day 1 after parturition ($p< 0.001$). High and medium S.R. was observed in most of the females (80%) on days 2, and 25 to 30 of the P.P.($p< 0.05$). Mean plasma E_2 levels differed in does with high S.R. compared to animals with medium or low S.R.(15.2 ± 0.13pg/ml vs. 11.4 ±0.10pg/ml and 11.5 ± 0.12pg/ml, respectively; $p< 0.05$). Correlation of plasma E_2 concentrations with S.R. was not significative.

The results suggest the presence of at least three high plasma E_2 concentrations intervals, and two periods of increased S.R. in lactating non-pregnant rabbits throughout the postpartum days. Mean plasma E_2 levels differed in does with high S.R. compared to animals with medium and low S.R. Sexual behaviour appeared to be influenced by the lactation period, probably via prolactin levels.

Key words: rabbits, estradiol 17-β, sexual receptivity, lactation period.

INTRODUCTION

Steroid hormones are involved in rabbits reproductive behaviour. Reproductive activity is stimulated by estrogen and inhibited by progesterone in ovariectomized does (Hudson, et al.,1990). Sexual receptivity (S.R.) tends to be related to the serum estradiol levels in pseudopregnant does (Caillol, et al.,1983), and a direct relation between plasma E_2 mean levels and high or low S.R. rabbits during the post-partum period(P.P.), has been reported (Elsaesser. 1980). The failure of mating on day 14 postpartum is related to low estradiol-17β levels, when comparing with rabbits that ovulated (Lamb, et al.,1991). The data available on evolution of E_2 concentrations during the postpartum period (P.P.) are widely variable and suggest days 1 and 9 of the P.P., as favorable for insemination (Rebollar, et al., 1992). Scanty information related on the S.R. variations throughout all the lactation period is available.
This study was designed in order to observe the evolution of plasma E_2 levels and S.R. in doe rabbits with similar lactation level from day 1 to 30 of the lactation period.

MATERIALS AND METHODS

Blood samples were daily obtained from the margin ear vein, using sterile heparanized tubes, in 12 multiparous lactating rabbits of the California x New Zealand breed, with 7 - 10 pups/litter, on days 1 to 30 of the P.P. Animals were housed in individual cages with controled light/dark cycles (16h/8h) and fed ad libitum with a commercial pelleted diet (Visan - Madrid, Spain). Plasma obtained after centrifugation was stored at -30ª Celsius until analyzed. Plasma E_2 concentrations were measured by immunoenzymatic assay (ELISA) (Munro and Stabenfeld, 1984). The sensivity of the assay was 0.9 pg/well. The intra-assay coefficient of variation(CV) of a doe rabbit plasma sample containing a mean of 22.5pg/ml E_2 was less then 7% . The inter-assay CV was less then 13.8% (n=11).

With the aim of predicting receptivity of the female to the male, sexual receptivity(S.R.) was determined daily in this group of animals according to the turgidity and colour of the vulva. It has been established that mating acceptance in the rabbit, is directly related to the turgidity and colour of the vulva (Pla, et al.,1984; Gosalvez, et al.,1985), as well as, colour of the vulva is directly related to fertility (McNitt and Moody, 1989). According to this information rabbits were categorized in three S.R. levels: with high S.R.(S.R.3), medium S.R.(S.R.2), or low S.R.(S.R.1),(Rodriguez, et al., 1989).

Statistical analysis of the effect of the postpartum day on the variables studied was carried out using a nonparametric procedure (Categorical Data Modeling: CATMOD), and means were compared using the Contrast Procedure. Correlation between E_2 and S.R. were analized using the General Linear Model Procedure(GLM), (SAS,STAT,1985).

RESULTS

Plasma estradiol 17-β concentrations and sexual receptivity level evolutions, are presented in Figure 1. High means plasma E_2 concentrations were found on days 1, 5 to 7, and 23 to 30 of the P.P. ($p< 0.001$), and low E_2 levels from day 13 to 23 of the P.P.($p< 0.05$), when comparing to the global mean E_2 level (11.7 ± 0.3pg/ml). 75% of the doe rabbits showed high S.R. on day 1 after parturition ($p< 0.001$). High and medium S.R. was observed in most of the females (80%) on days 2, and 25 to 30 of the P.P.($p< 0.05$). Mean plasma E_2 levels differed in animals with high S.R. compared to rabbits with medium and low S.R.(15.2 ± 0.13pg/ml vs. 11.4 ±0.10pg/ml and 11.5 ± 0.12pg/ml, respectively; $p< 0.05$). Correlation of plasma E_2 levels with S.R. was not significative.

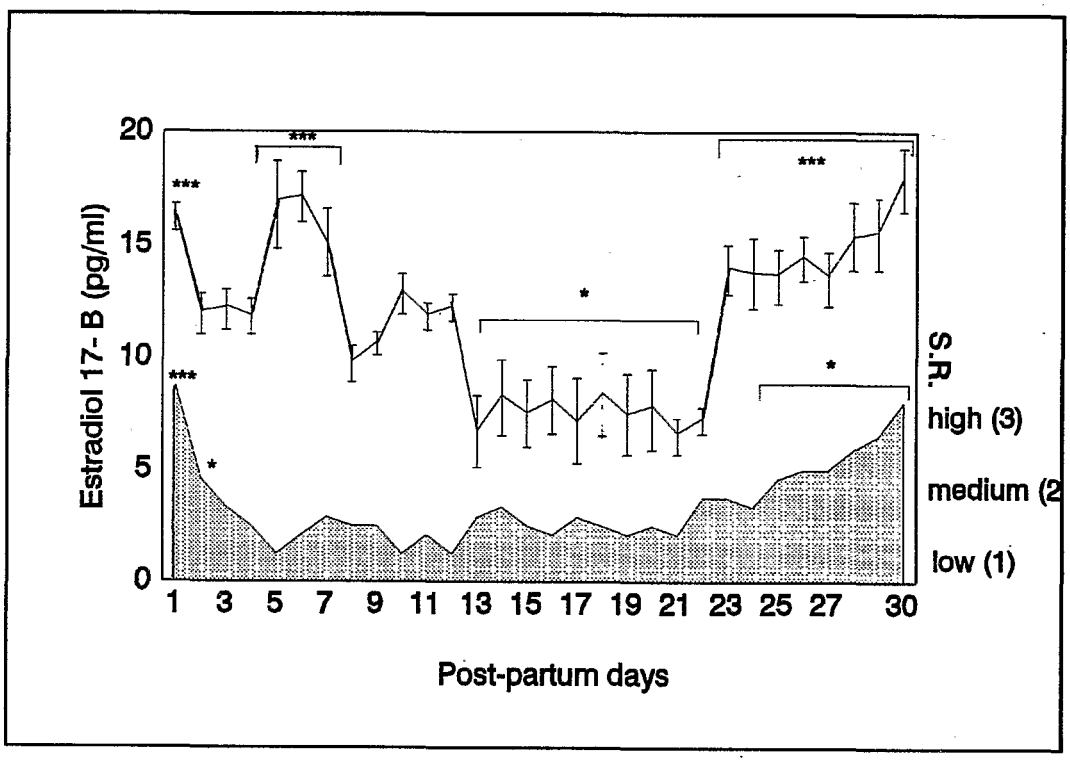

Fig.1

Mean (± S.E.M.) plasma estradiol-17β (E_2) concentrations during post-partum days in lactating non-pregnant rabbits. Each point (± S.E.M.) represent the mean of 12 samples. E_2 levels were higher on days 1, 5 to 7, and 23 to 30 (*** $p< 0.001$), and lower on days 13 to 23 of the post-partum period (* $p< 0.05$), compared to the general mean E_2 level (11.7 ± 0.3pg/ml).
Area represent the evolution of sexual receptivity (S.R.) in the same rabbits. S.R. was higher on days 1 (*** $p<0.001$), 2, and 25 to 30 of the post-partum period (* $p< 0.05$).

DISCUSSION

Plasma E_2 leves found in our study are in agreement with those bserved in non-pregnant lactating rabbits (Stouffeld and Caillol., 1988). The increased plasma E_2 levels on day 1 after parturition, and on day 5 to 7 of the P.P. are probably related to the follicular growth and increase of the follicle steroidogenic activity that occurred between the last days of pregnancy, and the first day after parturition (Osteen and Mills.,1980), and between day 5 to 9 of the P.P. (Diaz, et al., 1987), as well as, to the high plasma FSH levels observed around day 5 after parturition in lactating rabbits (Ubilla, et al., 1992). In this study, the mean plasma E_2 levels observed on day 1 of the P.P. could be related to the final stage of the first follicular growth wave. Our results suggest the presence of another follicular growth wave between days 23 to 30 of the P.P. in non-pregnant lactating rabbits. It is interesting to point out that the increased E_2 levels found on day 1, and days 23 to 30 after parturition, practically coincides with the rise of S.R. on days 1,2, and 25 to 30 of the P.P.(Fig.1).

Nevertheless, this relation cannot be explained by the correlation of plasma E_2 levels with S.R. found in our study. The high S.R. showed by the rabbits on these days, could be due to the involvement of folicular estrogen in the induction of S.R. (Hudson, et al.,1990; Lefebre and Caillol.,1978). High folicular estradiol-17β concentration, as well as, low atresia rate were observed in rabbits that accept mating (Lefebre and Caillol,1978). Furthermore, the increase of S.R. during the first and last days of the lactation period, occured under the low plasma prolactin levels, wich is implicated in the S.R. inhibition (Theau-Clement and Roustan.,1992; Ubilla et al.,1992).

A high proportion of our rabbits, showed low S.R. during the second interval of increased plasma E_2 levels (days 5 to 7 of the P.P.; Fig.1). This decrease in the reproductive behaviour takes place when lactation in does with 7-10pups/litter is well established(Torres et al., 1979; Chekke, et al., 1982), and is probably related to the depression effect of lactation on receptivity, described in nursing rabbits (Theau-Clement, et al., 1990). This effect could be caused by the antagonism between the increase of plasma prolactin concentrations during this period (Ubilla, et al., 1992), and the estrogenic effect on S.R. described (Hudson, et al.,1990).
The low S.R. observed from day 7 to 24 of the lactation period could be a result of various factors such as, the low plasma E_2 concentrations observed in this study, the depress effect of lactation (Theau-Clement, et al.,1990), and the increased plasma prolactin concentrations (Ubilla, et al.,1992). Increased amounts of prolactin in plasma were associated with high levels of prolactin in antral fluid and a marked reduction in FSH accumulation. These follicles appeared with a reduced number of granulosa cells able to produce estradiol (McMatty, 1979).

The results suggest the presence of at least three high plasma E_2 concentration intervals, and two periods of increased S.R. in lactating non-pregnant rabbits during the postpartum days. Mean plasma E_2 levels differed in rabbits with high S.R. compared to animals with medium or low S.R. No correlation of plasma E_2 levels with S.R. was found. Sexual behaviour appeared to be influenced by the lactation period, probably via prolactin concentrations. A long low S.R. interval (from day 3 to 24 of the P.P.) in lactating rabbits with 7-10pups/litter is observed. A decrease in the ovulation rate could be expected during these P.P. days, and hormone induction of oestrus appears to be necessary.

ACKNOWLEDGEMENT

This study (A-9331) was financially supported by the Politechnical University of Madrid, Spain.

REFERENCES

Caillol,M., Dauphin-Villemant,C., and Martinet,L.,1983. Oestrus behaviour and circulating progesterone and oestrogen levels during pseudopregnancy in the domestic rabbit. J.Reprod.Fertil., 69: 179-186.

Cheeke,P.R., Patton,N.M., and Templeton,G.S.,1982. Rabbit Production. The Interstate Printers & Publishers.INC. Danville, Illinois, 328pp.

Diaz,P., Rodriguez,J.M., Gosalvez,L.F., and Roman,M.R., 1987. Cyclic ovarian activity in post-partum rabbits. J.Appl.Rabbit Res. 10:122-125.

Elsaesser,F.,1980. Effects of active immunization against estradiol-17β, testosterone or progesterone on receptivity in the female rabbit and evaluation of specificity. J.Reprod.Fert., 58: 213-218.

Gosalvez,L.F.,1986. Actividad ovárica de la coneja doméstica después del parto. Tesis Doctoral, E.T.S.I.Agrónomos de Madrid, 269pp.

Hudson,R., González-Mariscal,G. and Beyer,C., 1990. Chin marking behaviour, sexual receptivity, and pheromone emission in steroid-treated, ovariectomized rabbits. Horm.Behav., 24: 1-13.

Lamb,I.C., Strachan,W., Henderson,G., Atkinson,T., Lawson,W., Partridge,G.G., Fuller,M.F., and Racey,P.A., 1991. Effecting in reducing the remating interval after parturition on the fertility and plasma concentrations of luteinizing hormone, prolactin, oestradiol-17β and progesterone in lactating domestic rabbits. J.Reprod.Fert.,92:281-289.

Lefevre,B. and Caillol,M.,1978. Relationship of oestrus behaviour with follicular growth and sex steroid concentration in the follicular fluid in the domestic rabbit. Ann.Biol.Anim.Bioch.Biophys.,18: 1435-1441.

McNatty,K.P.,1979. Relationship between plasma prolactin and the endocrine microenvironment of the developing human antral follicle. Fertil. Steril.,32:433-438.

McNitt,J.I and Moody,G.L.Jr.,1989. The use of vulva color as a breeding tool in the rabbitry. J.Appl.Rabb.Res.,12:33-35.

McNitt,J.I., 1992. Endocrinological approaches for commercial rabbit production. J.Appl.Rabbit Res.,15:363-397.

Munro,C. and Stabenfeld,C.,1984. Development of a microtitre plate enzyme-inmmunoassay for the determination of progesterone. J.Endocr.,101: 41-49.

Osteen,K.G. and Mills,T.M.,1980. Changes in the size, distribution and steroid content of rabbit ovarian follicles during early pseudopregnancy. Biol.Reprod.,22: 1040-1046.

Pla,M.,1984. Modelos biológicos de caracteres reproductivos en el conejo de carne. Tesis Doctoral. E.T.S.I.Agrónomos de Valencia, 285pp.

Rebollar,P.G., Ubilla,E., Alvariño,J.M.R., Illera,J.C. and Silván,G., 1992. Influencia del nivel de receptividad sexual sobre el estradiol plasmático y la respuesta ovulatoria durante el postparto en la coneja. Rev.Esp.Fisiol. 48(1) : 13-18.

Rodriguez,J.M., Agrasal,C. and Esquifino,A., 1989. Influence of sexual receptivity on LH, FSH and prolactin release after GnRH administration in female rabbits. Anim.Reprod.Sci., 20:57-65.

Statistical Analytical System Institute (SAS), 1985. SAS User's guide: Statistics. SAS Inst., Inc., Cary, NC, 956 pp.

Stouffled,I. and Caillol,M., 1988. Relation between circulating sex steroid concentrations and sexual behaviour during pregnancy and postpartum in the domestic rabbit. J.Reprod.Fert., 82: 209-218.

Theau-Clément,M. and Roustan,A., 1992. A study on relationships between receptivity and lactation in the doe, and their influence on reproductive performances. J.Appl.Rabbit Res. 15: 412-421.

Theau-Clement,M., Poujardieu,L., and Bellereaud,J., 1990. Influence des traitements lumineux, modes de reproduction et états physiologiques sur la productivité de lapines multipares. 5èmes Journ. de la Rech.Cunic. en France, Paris, Tome I, Comm.7.

Torres,A., Fraga,M.J. and de Blas,C., 1979. Producción de leche y mortalidad de los gazapos en la raza Neozelandesa. An.Inia.Ser.Prod.Anim. 10: 25-30.

Ubilla,E., Alvariño,J.R.M., Esquifino,A. and Agrasal,C., 1992. Effect of induction of parturition by administration of a prostaglandin $F_2\alpha$ analogue in rabbits: possible modification of prolactin, LH and FSH secretion patterns. Anim. Reprod. Sci., 27: 13-20.