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HORMONE THERAPY TO INDUCE ESTRUS AND OVULATION IN SHEEP DURING THE ANESTROUS SEASON

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Hormone Therapy to Induce Estrus and Ovulation in Sheep during the Anestrous Season

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SUMMARY

This study was conducted at the Central Sierra of Peru (12° South latitude, 76° West longitude, 3,800 m elevation) with 21 Junin and 21 Criollo sheep grazed on native pasture. About half of the ewes of each breed were synchronized to induce estrus and ovulation using subcutaneous silicone rubber implants (375 mg of progesterone) or intravaginal sponges (40 mg FGA) and 400 or 700 IU of PMSG (IM). Fertile males were introduced into the female flock on day 9 through day 19. The ovaries of all ewes were observed via the laparoscope during the estrous cycle they were bred to observe the incidence and rate of ovulations. The incidence of estrus was significantly higher ($P < 0.05$) in Criollo (85.7%) than in Junin (57.1%). Fertilization failure and/or embryo fetal loss in ewes receiving FGA in sponges was higher (78.7%) than those receiving progesterone in implants (56.8%). All other responses to main effects (incidence of ovulation, ovulation rate, fertility and lambing rate) did not

differ statistically ($P > 0.05$). An interaction existed between breed and level of PMSG for ovulation rate, with the Criollo showing a higher response to the higher level of hormone.

TERAPIA HORMONAL PARA INDUCIR EL ESTRO Y LA OVULACION EN OVINOS DURANTE LA EPOCA DE ANESTRO.

RESUMEN

Este estudio fue conducido en la Sierra Central del Perú (12° Latitud sur 76° Longitud oeste, 3,800 m de elevación) con 21 ovejas Junín y 21 ovejas Criolla mantenidas en pradera nativa. Aproximadamente, la mitad de las ovejas de cada raza fueron asignadas a cada tratamiento para inducir el estro y la ovulación utilizando esponja intravaginal (40 mg FGA) o progesterona en implante (375 mg) y 400 o 700 UI de PMSG (intra muscular). Los machos fértiles fueron introducidos en el rebaño de hembras desde el día 9 hasta el día 19 (día 0 = día de inicio de la aplicación de la esponja intravaginal o el implante). Los ovarios fueron observados via laparoscopia, durante el ciclo estrual en que las ovejas fueron servidas, para determinar la incidencia y la tasa de ovulaciones. La incidencia de estros en las ovejas Criollas (85.7%) fue significativamente superior ($P < 0.05$) que en las ovejas Junín (57.1%). La falla de fertilización y/o pérdida embrionaria o fetal en ovejas que recibieron FGA fue mayor (78.7%) que en ovejas que recibieron progesterona en implante (56.8%). La incidencia de ovulación, tasa de ovulación, fertilidad y la prolificidad en respuesta a los efectos

principales no fueron estadísticamente significativas ($P > 0.05$). Hubo una interacción significativa entre raza y nivel de PMSG para la tasa de ovulación en la raza Criolla, mostrando mayor respuesta a niveles altos de PMSG.

Introduction

The use of hormone therapy to control reproductive activity in sheep was initiated approximately 50 years ago. The main goal of using hormones is to induce and synchronize estrus and ovulation in ewes, to shorten the lambing interval and increase the lambing rate.

In the regions where sheep are seasonal breeders, additional lambings per year can be realized only if matings occur during the anestrous season or when the incidence of estrus and ovulation are the lowest.

The control of estrus and ovulation in ewes using progestogens provide an artificial corpus luteum function with a complete withdrawal at the end of 14 days treatment (Robinson, et al., 1968). During anestrous season it is also essential to apply gonadotropins (FSH activity) near the time of progesterone withdrawal to induce the occurrence of estrus and ovulation. PMSG is generally used for this purpose (Gordon, 1983).

Sheep fertility, prolificacy and fecundity in the Peruvian altiplano are low (Vivanco et al., 1986). Many factors seem to be involved. High frequency of fertilization failure, and/or

embryo-fetal losses have been reported (Vivanco et al., 1986). However, no single factor has been shown to be responsible for this reproductive wastage.

Research conducted in the Bolivian altiplano (Cardozo & Foote, 1969), in Central Sierra (Vivanco et al., 1986) and Southern altiplano (Bravo, et al., 1986) of Peru, showed that ovulation of sheep in these regions occurs primarily during January to August and incidence of estrus primarily from February to September. These parameters varied according to the genotype of sheep. The Criollo sheep demonstrated a more extended breeding season than the Junin or the Corriedale breeds.

The purpose of this study was to establish the effectiveness of hormonal induction and synchronization of estrus and ovulation and resulting fertility of Junin and Criollo sheep in the Central Sierra of Peru.

Materials and Methods

This study was conducted in the Central Sierra of Peru (12° South latitude and 76° West longitude, 3.800 m elevation). The experimental design is shown in Table 1.

All ewes were managed together on native pasture. The progestogens, silicone rubber implants containing 375 mg (10%) progesterone or vaginal sponges containing 40 mg fluorgestone acetate, were applied on November 17, 1983 (day 0) and remained in the animals for 14 days. The PMSG, 400 or 700 IU, was admini-

stered via intramuscular injections, 24 hours prior to progesterone withdrawal (day 13).

Fertile males were introduced into the female flock on day 9 and remained there for 10 days or until 5 days after hormone withdrawal (day 19). Males were fitted with crayon-containing marking harnesses to identify the occurrence and time of breeding. The ovaries of all ewes were examined using the laparoscope during the same estrous cycle as bred to observe the incidence and rate of ovulations. Relevant statistical comparisons were made based on data obtained on occurrence of estrus and ovulation, ovulation rate, lambing rate, and fertilization failure and/or embryo-fetal loss in relation to breed and hormone treatments.

Results

Results of the incidence of estrus and ovulation; ovulation rate, fertility and lambing rates; and fertilization failure, embryo/fetal losses are shown in Table 2. Means and the statistical comparisons among the main effects of PMSG level, type of progestogen and method of application used and breed are summarized in Table 3.

The incidence of estrus was significantly higher in the Criollo than in the Junin (85.7 vs 57.1%; $P < 0.05$). Fertilization failure and/or embryo-fetal loss in ewes receiving FGA in intravaginal sponges was higher than in those receiving progesterone in implants (78.7 vs 56.8%; $P < 0.01$). All other

responses to main effects were statistically nonsignificant ($P > 0.05$). However, an interaction existed between breed and level of PMSG for ovulation rate, with the Criollo being higher than the Junin.

Discussion

The use of hormone therapy to synchronize and induce estrus and ovulation in Junin and Criollo sheep in Central Sierra of Peru is feasible. The results show that under native range grazing and during anestrous season, in total 95.2 percent of sheep ovulated and 71.4 percent showed estrus and were bred. The difference between the proportion of ewes showing estrus and ewes ovulating indicates that 23.8 percent of ewes ovulated unaccompanied by estrus. This difference might also be influenced by the relatively low proportion of males used (4%) in breeding synchronized ewes. This might also have influenced the overall fertility rate at parturition (47.6%) and ewes bred (66.7%). The hormone therapy induced multiple ovulations and consequently increased the lambing rate, which is naturally low in sheep in the Central Sierra of Peru. However, the overall reproductive efficiency based on ewes ovulating, incidence of estrus, fertility rate and prolificacy was low mainly due to fertilization failure and/or embryo-fetal losses. Criollo sheep showed better response to hormone treatment than Junin sheep in all traits observed except fertilization failure and/or embryo-

fetal loss which was increased. Breed differences were also reported by Gordon (1983).

The interaction between breed and level of PMSG may be related to body weight of the ewes. Criollo sheep received 16.7 and 23.4 IU of PMSG/kg of body weight when they received 400 and 700 IU/head, respectively, compared to 8.9 and 13.8 IU/PMSG/kg of body weight, respectively, for Junin sheep. Consequently, the greater response of Criollo might be due to almost twice the dosage of PMSG compared to the Junin when considered on a body weight basis.

Ewes treated with progesterone implants had better reproductive performance than ewes treated with FGA in intravaginal sponges in almost all traits observed except ovulation rate. The fertilization rate and/or embryo-fetal survival was lower in ewes treated with FGA than progesterone but seems to be related to the lower ovulation rate. The advantage of progesterone implants found in this study do not agree with the findings reported by Gordon (1983).

In conclusion, progesterone and PMSG are effective in the induction of estrus and ovulation in the indigenous breeds of sheep in the highland of Peru. The low level of fertility is due primarily to fertilization failure and/or embryo fetal losses. Overall the progesterone implants produced a better response than FGA intravaginal sponges. The 700 IU of PMSG did not show an advantage to 400 IU. The increased response of Criollo compared to Junin in response to PMSG may be related to body weight.

Many factors are apparently influencing reproductive performance of sheep in Central Sierra. Further studies are necessary to indicate the specific factors affecting the reproductive performance under the conditions of high altitude with the existing management conditions.

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Table 1. Number of ewes by hormone treatment and breed.

Hormone Treatments	Breed		Total
	Junin	Criollo	
Implants Containing Progesterone[1]			
PMSG 400 IU	4	5	9
700 IU	5	6	11
Sponges Containing FGA[2]			
PMSG 400 IU	6	5	11
700 IU	6	5	11
Total	21	21	42

[1]Subcutaneous silicone rubber implants, 375 mg (10%) progesterone.

[2]Intravaginal sponges, 40 mg Cronolone (FGA).

Table 2. Estrus and ovulation and related reproductive performance in hormonally treated adult ewes during the anestrous season. (Central Sierra - Peru, 1983 - 1984)

Reproductive Traits	Junin		Criollo		Total	
	400IU*	700IU	400IU	700IU	400IU	700IU
			Progesterone Implants			
Incid. of estrus (%)	75.0	60.0	100.0	100.0	88.9	81.8
Incidence of ovulations (%)	100.0	100.0	100.0	100.0	100.0	100.0
Fertility rate (%)	40.0	40.0	60.0	66.7	55.6	54.6
Ovulation rate (n)	1.3	1.6	1.8	2.5	1.6	2.1
Lambing rate (n)	1.5	1.5	1.0	2.0	1.2	1.8
Fertilization failure/ embryo loss (%)	40.0	62.5	66.7	53.3	57.1	56.5
			FGA Intravaginal Sponges			
Incid. of estrus (%)	50.0	50.0	60.0	80.0	54.6	63.6
Incidence of ovulations (%)	83.3	83.3	100.0	100.0	90.9	90.9
Fertility rate (%)	33.3	50.0	20.0	60.0	27.3	54.6
Ovulation rate (n)	1.8	2.6	3.0	4.8	2.4	3.7
Lambing rate (n)	1.3	1.3	1.0	1.3	1.3	1.3
Fertilization failure/ embryo loss (%)	55.6	69.2	93.3	83.3	79.2	78.4
			Implants and Sponges Combined			
Incid. of estrus (%)	60.0	54.6	80.0	90.9	70.0	72.7
Incidence of ovulations (%)	90.0	90.9	100.0	100.0	95.0	95.5
Fertility rate (%)	40.0	45.5	40.0	63.6	40.0	54.6
Ovulation rate (n)	1.6	2.1	2.4	3.6	2.0	2.9
Lambing rate (n)	1.4	1.4	1.0	1.7	1.2	1.6
Fertilization failure/ embryo loss (%)	50.0	66.7	83.3	71.8	71.1	70.0

* 400 and 700 IU of PMSG

Table 3. Chi square values and statistical probability levels among variables.

Variables	Means		X^2	Probability
Incidence of ovulations (%):				
Breed[1]	90.5	100.0	2.106	NS
Type of progestogen[2]	100.0	90.9	1.903	NS
PMSG levels[3]	95.0	95.5	0.033	NS
Incidence of estrus (%):				
Breed	57.1	85.7	4.192	*
Type of progestogen	85.0	59.1	3.443	NS
PMSG levels	70.0	72.7	0.031	NS
Fertility rate (%):				
Breed	42.9	52.4	0.382	NS
Type of progestogen	55.0	40.9	0.834	NS
PMSG levels	40.0	54.6	0.890	NS
Ovulation rate (n):				
Breed	1.8	3.0	2.380	NS
Type of progestogen	1.9	3.1	0.380	NS
PMSG levels	2.0	2.9	0.380	NS
Lambing rate (n):				
Breed	1.4	1.5	0.383	NS
Type of progestogen	1.6	1.3	0.095	NS
PMSG levels	1.2	1.6	0.058	NS
Fertilization failure/ embryo-fetal loss (%):				
Breed	60.0	76.2	2.824	NS
Type of progestogen	56.8	78.7	5.319	**
PMSG level	71.1	70.0	0.003	NS

[1]Junin vs. Criollo breed, respectively.

[2]Progesterone implant vs. FGA sponge, respectively.

[3]400 IU vs. 700 IU of PMSG, respectively.

* $P < 0.05$ ** $P < 0.02$ NS Non significant.