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The Effect of Body Weight Changes During the Breeding Season on the Ovulation Rate, Blood Progesterone Levels and Embryo Survival of the Crossbreed Mexican Ewe

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Abstract: The effect of body weight changes during the breeding season, on the ovulation rate, blood progesterone levels and embryo survival of the crossbreed Mexican ewe was studied. During may to September 2004, 120 crossbreed ewes were selected from a traditional flock in the high mountains (latitude 19° N, 99°W) of Mexico. Divided at random in four groups of 30. Group A with an average body weight of 40.2±1.7 kg was taken to pasture from 9:00 h until 18:00 h daily and received no supplement. Group B with an average weight of 43.8±2.6 kg was taken to pasture as group B and on arrival to their paddocks received 350 g/ewe of commercial concentrate. Group C (42.1±2.4 kg) was range fed only, no supplement was given. Group D (41.2±2 kg) was range fed and 15 days before the introduction of the rams flushing was given, this consisted in 300 g/ewe of a commercial concentrate. This management for all groups was initiated on the first day of May and it was continued until 15 days before the introduction of the rams (July 25). In July 10, ewes of group A showed an average weight of 41.0±2 kg, ewes of group B had a weight average of 51.2±9.1 kg. Ewes of group C and D weighed 45.3±2.3 kg and 44±1.7 kg. To induce body weight changes in groups A and B, in this day, feeding was reversed, group A were range fed and supplemented with concentrated food and ewes of group B were range fed only as previously mentioned. On august 12 weight of groups A and B was 50.3±2 and 42.6±2.5 kg ($p = .001$) and of groups C and D was 45.4±1.8 and 50.0±2 kg. Groups C and D continued range feeding after the flushing of group D. Body weight in September 8 was 53.7±1.7 kg; 43.5±1.9 kg; 47.8±0.9 and 52.4±2.6 for A, B, C and D groups. Teasing was continued until the end of September. Ovulation rate in ewes displaying oestrus of group A and B was 1.8±.2 and 1.3±.2 and 1.1±.2 and 1.5±.2 for groups C and D, respectively. Difference in between groups AD and BC was significant $p = < 0.001$. Group A produced 35 lambs. Group B 23, Group C 27 lambs and group D 29. Changes in blood progesterone were non significant, except for group B that showed higher levels. It was concluded that in order to attain higher prolificity in range fed ewes, during the following 3 to 4 weeks after mating, ewes should not suffer of nutritional distress.

Key words: Ewe, ovulation rate, body weight, fertility, prolificity

INTRODUCTION

During mating time in seasonal breeders, such as the ewe four main objectives should be pursued: That all seasonal breeders display oestrus. That after mating all should conceive and maintain pregnancy. And after conceiving there should not be embryo loss and prolificity maintained or improved according to the breed.

Since the 60's Coop and Clark[1] considered that nutritional supplementation (flushing) before mating increased ewe fecundity, such effect, they explained was due to two main factors. The first, because there was an increase in body weight as a consequence of nutritional supplementation, in which there is no energetic change because there was no pregnancy. And the second factor is related to body weight changes, due to conception and maintenance of pregnancy until parturition. The experiments of Coop and Clark[1] gave way to a series of consistent differences favouring better production (increased number of born lambs) in those ewes that received supplementary feeding before mating Abecia *et al.*,[2].

In order to determine why production is less in non supplemented ewes, as compared with those that received a nutritional supplement before mating, it is necessary to know ovulation rate together with blood progesterone levels of the ewes under stud Buffening *et al.*,[3]. The latter will support the possibility that non-supplemented ewes

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are suffering an increase in embryo mortality or/and low ovulation rate. This would be due to natural stress, that is, that they are only receiving only the necessary amount of food to maintain "normal pregnancy" and not for contemplating the possibility of maintaining gestation of more than one conceptus. Consequently, when the ewe is suffering of under nutrition during early pregnancy, it is possible that embryo survival decreases. In experiments carried out with Merino ewes, it was observed that ewes showing two ovulations, embryo loss was proportionally less as compared with ewes that had single ovulations under normal range conditions (Foote *et al.*,[4]).

Consequently when ewes are undernourished during the first days/months of gestation it is possible that embryo survival decreases Abecia *et al.*,[2]; Nottle *et al.*,[5]). In third world countries such as Mexico, prolificity is very low (60-75%) in ewes maintained under range conditions and traditional husbandry. Therefore it was considered of interest to study the dynamic effects of body weight changes on embryo survival and blood progesterone concentrations in crossbreed ewes under conditions of traditional range management during the breeding season.

MATERIALS AND METHODS

Animals: For the purpose of this study a flock of 120 crossbreed ewes (Suffolk X Hampshire X Rambouillet) was selected. The area of study was situated in the high lands of central Mexico (19°North, 99°West). They were divided at random in four groups of 30 ewes.

Experiments: The study was commenced during may 2004. Group A was taken to pasture from 9:00 am until 6:00 pm and received no supplement. Water was ad libitum. Group B was handled as group A, but on arrival they were supplemented with 350 g/ewe of a commercial concentrate. Group C received the same management as group A through out the duration of the study and group D was handled as group C but in addition they received a 30 days flushing that commenced 15 days before the introduction of the Rams.

To induce body weight changes in groups A and B, feeding was reversed in july 10th, That is; Group A was fed on the range and on their return they received 350 g/ewe of a commercial concentrate and Group B was fed on the range and supplement was withdrawn. All groups were inspected three times a day in order to note any ewe that displayed heat. Half of each group was selected at random to observe ovulation rate through laparoscopy under Xilazine-Ketamine anaesthesia. Laparoscopy was carried out any day from the 8th to the 10th day after displaying oestrus. Blood samples from the jugular vein, were collected on Mondays, Wednesdays and Fridays for the determination of P4 by RIA. The latter was measured using a commercial kit (MYMMSA, México) with a sensitivity of 1.5 ng/ml and intra- and inter- assay coefficients of variation of 7.5% and 14%. Body weight changes were subjected to a Repeated Measures Analysis of Variance and ovulation rate was subjected to a Wilcoxon/Kruskal-Wallis test.

RESULTS

Initial weight on may the 1st was 40.2±1.7 kg for group A and 43.8±2.6 kg for group B. and 42.1±2.4 kg and 41.2 kg for groups C and D. On July 10th, body weight was 41.0±2 kg for group A and 51.2±9.1 kg for group B; for group C 45.3±2.3 kg and 441.7 for group D. On august 10 (15 days before the introduction of the rams) body weight of group A was 50.3±2 kg and that of group B was 42.6±2.5 kg, body weight of groups C and D was 45.4±1.8 kg and 50±2 kg. Body weight for September was 53.7±1.7 kg; 43.5±1.9; 47.8±09 and 52.4±2.6 kg (Table 1)(there were significant differences related to body weight changes in between groups. F value 197.5; p = 0.0001). Ovulation rate on the mated ewes of each group was 1.8±.2 for A and 1.3±.2 for B. And for groups.

C and D it was 1.1±.2 and 1.5±.2. A significant difference was observed between groups, where groups A and D were significantly different from groups B and C. (X^2 = 1865.652, 3df, p_1= 0.0003). Five ewes of group A and 9 from group B remained barren and in groups C and D, 5 and 3 ewes remained silent: Group A produced 35 lams and group B 23 lambs, group C 27 and group d 29 lambs. With a significant difference between groups AD vs BC, p<0.01) Table 2. Progesterone levels were significantly higher on the ewes that received no feed supplement during the introduction of the rams, but there was no significant

Table 1: Body weight changes (kg±SD) in Suffolk X Hampshire ewes during may to september 2004 under range management

Groups	may 1st	July 10th	August 12	Sept. 8
A	40.2±1.7	41.0±2*	50.3±2*	53.7±1.7
B+c	43.8±2.6	51.2±9.1*	42.6±2.5*	43.5±1.9
C	42.1±2.4	45.3±2.3	45.4±1.8	47.8±0.9
D+c	41.2±2	44.0±1.7	50.0±2.0	52.4±2.6

*There were significant differences related to body weight changes between groups. F value 197.5; p = 0.0001. c = supplemented

Table 2: Ovulation rate and lambs produced in Suffolk X Hampshire ewes with induced body weight changes and with/with out feed supplement

Groups	A	B	C	D
Ovulation Rate	1.8±.2*	1.3±.2	1.1±.2	1.5±.2*
Lambs/Group	35*	23	27	29*

*Significant difference between groups AD vs BC

difference in between groups. That were considered non important and are not shown.

DISCUSSION

There have been many reports on the effect of nutrition on the reproductive efficiency of the ewe and it is valid nowadays to mention the preliminary work of Foot *et al.*[9] they observed that in some years when ewes were subjected to a high level of nutrition, since mating and until the 40th day of conception, there was an increase in embryo loss. Observation thereafter corroborated by others (Gunn, Doney and Russel,[6]). In this case is possible to observe that the effect of flushing is favouring an increase in ovulation rate in groups A and D, in which there is an increase of lambs born, correlated with ovulation rate, in agreement with other observations (Abecia *et al.*,[2]). But in groups A and C, there is lower number of lambs born, that might be a reflection of low levels of nutrition affecting ovulation rate Nottle *et al.*,[5]).

In group C there is a lower rate of lambs born that does not correlate with ovulation rate, explaining that maintenance on the range alone does not provide sufficient energy for the full expression of the breeding capacity of the flock Rhind *et al.*,[7]). The latter is sustained because the flushed ewes of group D, produced, produced 29 lambs, in this group ovulation rate was 1.5±.2; therefore it was expected the birth of 40 lambs, introducing the possibility that embryo survival was affected because this group of ewes received a supplement for 30 days and there after they were returned to they normal range feeding; meaning that the food that they obtained form their daily grazing was not enough to sustain twin pregnancies, explaining the low productivity of local sheep farmers.

Progesterone levels were higher in non supplemented groups, this finding is in agreement with others (O'Doherty and Crosby,[8]; Abecia *et al.*,[2]). It is also interesting to note that Abecia *et al.*[2] also reported a low mean LH concentration and high mean plasma progesterone levels in supplemented ewes, while undernourished ewes showed the highest LH level and the lowest plasma progesterone concentrations. The latter is probably due to breed and nutrition differences. As in this study plasma progesterone concentrations were no significantly different in between the groups studied.

Finally, it is necessary to recall the work of Gunn *et al.*[6] where they found that body weight was related to fecundity and prolificity, the better the body condition, ovulation rate increased giving therefore more lambs/ewe.

Taking in to consideration the work of others and the results obtained in this study, it was concluded that flushing during mating in range fed ewes increased ovulation rate, but nutrition should not vary during the following three weeks after mating in order to maintain the expected prolificity.

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