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Dept.of Animal Production
Fac. Of Agric. Minia Univ., Minia- Egypt.

SOME PHYSIOLOGICAL RESPONSES OF PREMATING EWES TO GLUCOSE INFUSION

(With 3 Tables)

By
M.A.A.EL-BARODY

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بعض الاستجابات الفسيولوجية للحقن بالجلوكوز قبل التلقيح في نعاج الأغنام المحلية

محمد عبد الفتاح احمد البارودي

لدراسة بعض التأثيرات الفسيولوجية للحقن بالجلوكوز ما قبل التلقيح فى نعاج الأغنام المحلية الخليطة (أوسيمي × كيوس)٠ أستخدم عدد ١٩ نعجة خليطه وزعت في مجموعتين متساويتين : المجموعة الأولى وقد تم حقنها بمحلول فسيولوجي (٠,٩ %) وأما المجموعة الأخري قد تم حقنها بمحلول الجلوكوز بتركيز (٢٥ جم جلوكوز) وقد تم الحقن بالوريد يوم بعد يوم و لمدة شهر قبل خلط الكباش مع النعاج٠ وقد أوضحت النتائج أن الحقن بالجلوكوز بشهر قبل تلقيحها أدي الي زيادة معنوية (٠,٠١) في كلا من المأخوذ اليومي من الغذاء وكذا المأخوذ اليومي من الطاقة التمثيلية ٠ أوضحت النتائج أيضا زيادة معنوية (٠,٠٥) في تركيز هرمون النشاط التناسلي (البروجسترون) في السيرم أثناء دورة الشبق وقد صاحب ذلك زيادة معنوية (٠,٠٥) في تركيز الجلوكوز في سيرم الدم ٠مما أدي الي تحسن واضح في معدل الكفاءة التناسلية متمثلة في زيادة الخصوبة و التوائد للنعاج التي تم حقنها مقارنة بالنعاج الغير محقونة بالجلوكوز ٠ نخلص من هذا البحث بأن الحقن بالجلوكوز للنعاج قبل تلقيحها ربما يعتبر وسيلة لتحسين الأداء التناسلي في الأغنام المحلية٠

SUMMARY

Eighteen crossebred ewes (Ossimi x Chios) were used to study some physiological responses of glucose infusion in premating ewes. The half of ewes (n=9) injected with 100 ml of saline (0.9%) and the rest of ewes injected intravenous with glucose (25 g). The injections with every other day for one month premating. Glucose infusion significantly (P<0.01) increased the dry matter and metabolizable energy intakes of ewes. Dry

matter and metabloizable energy intakes were (0.643 ± 0.3 and 0.893 ± 0.3 kg/day) and (10.564 ±2.1 and 14.642 ± 2.1 Mcal/day) in control and glucose treated ewes, respectively. Means of serum progesterone (P_4) concentrations and serum glucose concentration during estrous cycle were (4.27 ± 0.9 vs. 5.86 ± 0.9 ng/ml, P<0.01) and (93.20 ± 5.0 vs. 167.20 ± 5.0 mg/dl, P<0.01) of control and glucose treated ewes, respectively. A positive correlation was found between P_4 and serum glucose during estrous cycle (P=0.833). Number of glucose treated ewes mated at first and second cycles were higher (P<0.05) than of control ones. Fertility and prolificacy were 54.22 % and 111.20 % of control vs. 78.62 % and 129.24 % of glucose treated ewes, respectively, P<0.05). In conclusion, glucose infusion in premating ewes could be used as useful tool for subsequent reproductive success.

Keywords: *Sheep, glucose, reproductive, performance.*

INTRODUCTION

Nutritional factors have major effects on reproduction responses in males and females sheep (Foster, 1994; Martin and Walkden- Brown, 1995). Ciccioli and Wettemann (2000) reported that, postpartum nutrient intake influences days from calving to first estrus and luteal activity, size of the ovulatory follicle and estrous behavior of primiparous beef cows.

Specific dietary components and metabolic products may influence gonadotropin secretion or ovarian function. Dietary changes cause an immediate and rapid change in a range of metabolic humoral agents. The most important of these from a nutritional point of view are glucose and insulin. Brown *et al.* (1999) found that glucose infusion in ewes was associated with increase serum glucose. In sheep, Downing *et al.* (1995) suggested that increased ovulation rate resulted from a direct ovarian action of increased glucose availability. Indeed where ewes were put on a diet at half of their maintenance energy requirements and offered an additional 1.5 times their maintenance energy requirements as food or in energy equivalent as a direct intravenous infusion of glucose, the increase on ovulation rate achieved was a glucose infusion (Williams *et al.* 1997). Rubio *et al.* (1997) reported that exogenous glucose in ewes resulted in ovarian changes associated with elevated lutcal progesterone production. Funston *et al.* (1995) demonstrated that depletion of glucose availability in ewes suppressed pituitary release of LH and prevented expression of estrous and corpus luteum formation.

Blaszczyk and Udala (2000) found that a positive relationship between glucose and sex hormones, as well as the increase of glucose level in preovulatory period, point to glucose contributing to the ovulation process and confirm the increased demand of the organism for energy at that time. Therefore, this study was aimed to assess some physiological responses in premating ewes subject to glucose infusion.

MATERIALS and METHODS

Eighteen crossbred ewes (Ossimi X Chios), belonging to Minia University farm, 2 years old and averaged 44.11 ± 1.14 kg body weight were used. They were assigned randomly to receive every other day intravenous injections containing 100 ml of saline (0.9 %, control,n =9), and the remaining ewes were treated similarly except injections contained 25 g of glucose (100 ml of 25 % dextrose Monohydrate; Egypt Otsuka Pharm, CO.). Injections were performed at the end of February till the end of March (approximately one month before ram introduction). All ewes kept under wood shed. In winter, they were fed berseem (Trifolium alexandrium) plus 0.5 kg of concentrate mixture/head/day (13.54% digestible protein and 64.21% total digestible nutrient). In summer, they were fed green maize and wheat straw given ad libitium beside concentrate mixture (0.5 kg/h/d). In addition concentrate mixture 300 g/h/d supplemental feed was provided during advanced pregnancy and lactation. Dry matter intake (DMI,kg/day) was calculated, metabolizable energy of feeds was estimated according to NRC (1988) values of sheep. Water was available all the time and ewes had free access to mineral salt licks. All animals were clinically healthy and free of parasites.

Estrous detection was performed twice daily at early morning and at evening using vasectomized/aproned rams which were placed with the ewes for one hour each check. The rams were interchanged between the groups. The ewe which stood for mounting by the ram was considered as being in estrous. Time and date of estrous were recorded. At estrous, about 10 ml of blood samples (jugular venipuncture) were collected daily before feeding and drinking throughout the estrous cycle into unheparinzed tubes and allow to clot at room temperature for 30 min. Serum was then separated by centrifugation (3000 xg, 15 min, 4°C) and stored at – 20°C until analyzed. Serum was analyzed for progesterone (Spieler *et al.* 1972) using RIA technique. Inter and Intra assay coefficients of variation were (9.48% and 8.23 %). Moreover,

serum glucose determination throughout the estrous cycle was carried out calomtrically using commercial kits (Merieux Raims/France). At the end of April, one fertile ram was used for mating. The ram joined all ewes and run with them for two months (mating period). Therefore, the ram had the chance to breed any ewe in any group. During ram introduction, mating dates returns were recorded twice weekly. After parturition, fertility, as percentage of ewe lambed of ewes bred; and prolificacy as percentage of lambs born of ewes lambed were recorded.

Statistical analysis

The data were statistically analyzed using General Linear Model SAS (1990). Chi-square test (SAS, 1990) was carried out to detect the number of ewes mated at each cycle. Correlation between serum blood progesterone and serum glucose concentrations was calculated using SAS (1990).

RESULTS

The results in Table 1 show that the mean serum progesterone hormone concentration throughout estrous cycle were 4.27 ± 0.9 and 5.86 ± 0.9 ng/ml in control and glucose treated ewes, respectively ($P<0.01$). Serum glucose concentration throughout the estrous cycle were 93.20 ± 5.0 and 167.4 ± 5.0 mg/dl in control and glucose treated ewes, respectively ($P<0.01$). A positive correlation was found between serum progesterone and serum glucose ($r=0.833$) throughout the estrous cycle.

Table 1: Effect of glucose infusion in ewes on serum progesterone and glucose concentration throughout the estrous cycle.

Item	Control	25g glucose/ewe	±SE
Progesterone (ng/ml)	4.27[a]	5.86[b]	0.90
Glucose (mg/dl)	93.20[a]	167.40[b]	5.0

[a],[b] means within the same row having different superscripts significantly different ($P<0.01$)

Dry matter and metabloizable energy intakes were (0.643 ± 0.3 and 0.893 ± 0.3 kg/day) and (10.564 ± 2.1 and 14.642 ± 2.1 Mcal/day) in control and glucose treated ewes, respectively ($P<0.01$), (Table 2).

Table 2: Effect of glucose infusion in ewes on dry matter intake and metabolizable energy intake

Item	Control	25 g glucose/ewe	±SE
Dry matter intake (kg/day)	0.643[a]	0.893[b]	0.3
Metabolizable energy intake of ewe (Mcal/day)	10.564[a]	14.672[b]	1.2

[a, b] means within the same row having different superscripts significantly different (P<0.01)

Fertility and prolificacy percentage of ewes were (54.22 and 78.82 %) and (111.20 and 129.24 %) in control and glucose treated ewes, respectively (P<0.05), (Table 3). Moreover, the results presented in Table (3) revealed that the most ewes in glucose treated group were mated in the first and second and less in the third cycle compared with control (P<0.05).

Table 3: Effect of glucose infusion in ewes on reproductive performance

Item	Control	25 g glucose/ewe	Sig.
Reproductive performance of ewe:			
No. of ewes mated during 1st cycle[d]	--	2	*
No. of ewes mated during 2nd cycle[d]	2	6	*
No. of ewes mated during 3rd cycle[d]	7	1	*
Fertility of ewes %	54.22 ±0.9[a]	78.62 ± 0.9[b]	
Prolificacy of ewes %	111.20 ± 1.3[a]	129.24 ± 1.3[b]	

[a, b] means within the same row having different superscripts significantly different (P<0.01)

[d] No SE associated with Chi square analysis (*P<0.05)

DISCUSSION

The improvement in ewe performance in term of increasing dry matter and metabolizable energy intakes due to the glucose infusion are in agreement with previous reported by (Grovum, 1987).

Kutsky (1981) pointed to that progesterone hormone has a great importance in reproduction and its importance stems from the fact that it is a precursor to all steroid hormones and it act synergistically to maintain sexual behavior of ewes (Martin, 1984 and Hafez, 1987). In the present study, it is clear that glucose infusion was associated with an increase in progesterone hormone during the estrous cycle of ewes. Those results are in agreement with previous reported by Rubio *et al.* (1997) that exogenous glucose in ewes resulted in ovarian changes

associated with elevated luteal progesterone production. On the other hand, Fuston *et al.* (1995) demonstrated that depletion of glucose availability in ewes suppressed pituitary release of LH and prevented expression of estrous and corpus luteum formation. Several possible explanation could be behind such increase of progesterone hormone in the present study: The increase in the dry matter intake of glucose treated ewes (Table 1) may have caused 1) increase in responsiveness of corpora lutea to LH (Gombe and Hansel 1973). 2) stimulate enzymes that are involved in the progesterone synthetic pathway and increase in insulin that may cause an increase in the number of receptors in luteal tissue, thus increasing the ability to synthesize progesterone (Schrich *et al.* 1990). A positive correlation between serum progesterone (as sex hormone which act synergistically with estradiol hormone in regulating reproductive performance) and glucose concentrations are in agreement with previous reported by Blaszczyk *et al.* (2000), and it may indicated that glucose contributing to ovulation process and confirm that increased demand of the organism for energy at that time.

Several possible explanations could be the reasons for the improvement of fertility, prolificacy and reproductive ability in response to glucose infusion in ewes. 1- Glucose infusion in ewes caused increase in serum glucose concentration during estrous cycle (Table 2) which consider as regulator of GnRH (Short *et al.*, 1990), that responsible in regulating ovarian steroidgenesis (steroid hormone secretion) for a good sexual vigor (Hafez,1987). 2- In sheep, Downing *et al.* (1995) and Williams *et al.* (1997) suggested that increased ovulation rate resulted from a direct ovarian action resulted from action of increased glucose availability.3- Glucose infusion caused increase dry matter and metabolizable energy intakes of ewes (Table 1) which was responsible for promoting secretion normal levels of the reproductive hormones (Callaghan and Boland 1999) and influence estrous behavior and luteal activity (Ciccioli and Wetteman, 2000).

In conclusion, glucose infusion in premating ewes are particularly important as energy source for subsequent reproductive success.

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