

COMPARISON OF THREE NUTRACEUTICALS ADMINISTERED IN TARGETED NUTRITION ON THE REPRODUCTIVE RESPONSE OF PELIBUEY EWES SYNCHRONIZED WITH EXOGENOUS HORMONES IN AN ULTRA-SHORT PROTOCOL

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Abstract: The objective of this work was to evaluate the reproductive response in Pelibuey ewes comparing the oral administration of three nutraceuticals for five days; T1; 10 g of aminosilicate with minerals, T2; 6 g of a gluconeogenic (Lipofeed), T3; 10 g of organic minerals Se and Cr in inert yeast (Biotecap) and T4; 10 ml of drinking water. All ewes were synchronized using a 5-day protocol with reused CIDRS plus prostaglandin F2 α and eCG. Statistical analysis was performed using the GLM procedure of SAS and nonparametric variables using a logistic regression test. The percentage of ewes showing estrus was not different between treatments with percentages between 80 and 90. Hours to estrus was lower ($P < 0.05$) in T1, T2 and T3 with less dispersion with respect to the mean, compared to T4 which had a higher mean. The percentage of gestation was not different between treatments with values of 70 and 80. Prolificacy was higher in T2 and T3 with values of 1.75 and 1.87 ($P < 0.05$) with respect to T1 and T4 with values of 1.4. Blood glucose concentration was not different in T1, T2 and T3 in which less variation was also observed with respect to the mean ($P < 0.05$) with respect to T4. It is concluded that the administration of nutraceuticals in targeted nutrition can improve some reproductive variables in ewes in anestrus, synchronized with an ultra-short protocol with reused CIDR.

Keywords: Aluminosilicate, gluconeogenic, yeast culture, organic minerals, prolificacy.

INTRODUCTION

The intensive production of sheep requires increasing their reproductive efficiency and economic profitability. An alternative is to increase fertility, calving frequency and prolificacy. In this sense, the use of exogenous hormones; progestogens, prostaglandins and gonadotropins play an important role (Letelier et al. 2008). In the same way,

short-term focused nutrition has been used. Camacho et al. (2021) using protein or energy sources prior to service, which takes advantage of the immediate effect of nutrition, different researchers have obtained an increase in the ovulatory rate, pregnancy percentage, and prolificacy (Camacho et al. 2008; Viñoles 2009). In these protocols it is necessary to evaluate new inputs such as nutraceuticals that are defined as the combination of nutrition and pharmaceuticals; that is, it is a food that has medicinal or preventive properties for health (Ortega et al. 2022).

Nutraceuticals, being natural, are in bioavailable forms and can be administered for long periods of time, without the risk of side effects. (Ripoll et al. 2011). Among them, the inclusion of e aluminosilicates with minerals is due to their physicochemical properties, which allow improving nutritional efficiency and adsorb toxins in ruminants. However, little is known about the potential of these and especially in reproductive aspects (Vilariño et al. 2010). On the other hand, glucose regulates reproduction by participating in the release of GnRH and, apparently, insulin-associated peptides participate in the control of energy metabolism in the brain, in addition to having an effect on the size and function of the ovaries. follicle quality (Uribe et al. 2009), The effect of Selenium and organic Chromium has been described as benefactors of reproductive processes in sheep (Ortega et al. 2022), These compounds are derived from the fermentation of *Saccharomyces cerevisiae* yeasts. During the growth of the cell, the ion (mineral in inorganic form) is added, in this process the union of the organic fraction of the yeast with the metallic ion is achieved and the organically bound mineral is obtained, which is called organic mineral (Biotecap), The main function of organic minerals is to increase the level of absorption in the digestive tract, reduce the risk of toxicity and contamination

of soil and water, since the mineral excreted in the animal's feces is reduced. In addition, they participate in various metabolic processes and their antioxidant effect favors reproductive cells and embryos (Ortega et al. 2022).

GENERAL OBJECTIVE

To compare the reproductive response of sheep supplemented with a mineral mixture based on an aluminosilicate (Zeolite), a gluconeogenic agent (Lipofeed), Selenium and organic Chromium in inert yeast, in a nutrition protocol focused on sheep synchronized with a progestogen, prostaglandin F2 α and eCG

MATERIALS AND METHODS

The experiment was carried out during the anoestrous season, in the sheep module of the "El Salado" Zootechnical Post of the BUAP Faculty of Veterinary and Zootechnical Medicine. The geographical location is 97° 41'12.22" W and 18° 53 '34.61" N, with an altitude of 2120 m. The average annual temperature is 18.0 °C and the average annual rainfall is 19 mm (García 2004).

A total of 40 clinically healthy Pelibuey ewes were used, with an age of 2.6 ± 0.3 years of age, live weight of 40 ± 2 kg, multiparous and a body condition of 3 on a scale of 1 to 5 (Russel et al; 1969), in stable conditions. The feeding was with oat hay and corn stubble offered in two meals per day, freely accessible water and commercial concentrate with 14 % crude protein at a rate of 200 gr d⁻¹.

The ewes were randomly assigned to one of the four treatments, all the ewes received a similar synchronization protocol, which consisted of: application of a CIDR'S, (recycled; three previous uses), these remained placed intravaginally, for a period of time. After five days, what is known as ultra-short synchronization protocol, prostaglandin F2 α was applied to the withdrawal of the CIDR'S(125 mcg Cloprostenol)and 300 IU of

eCG per animal via IM Treatment 1 (n= 10) = 10 g of the mineral mixture, the percentage composition was as follows; Calcium 20, phosphorus 1, silicate 25, carbonate 2, sulfates 2, sodium 4 and chloride 3, Vehicle 43. Treatment 2 (n= 10) = 6 g of Lipofeed (Propanediol 3.3 and Sodium or Calcium Propionates 6.9 percent) by ewe d⁻¹ orally. Treatment 3 (n= 10) = 10 g of a formulated compound: Se 590 mg kg⁻¹ and Cr 990 mg kg⁻¹, in inert yeast, and 10 g of Biotecap[®] was added to the diet, which provided 0.90 mg kg⁻¹ of Se and 1.4 mg kg⁻¹ of Cr. The yeast was powdered *S. cerevisiae* strain 7907 that provided 1×10¹⁰ yeast gd⁻¹ orally. Treatment 4 (n= 10) = 10 ml of drinking water per ewe per day orally (Figure 1). Focused nutrition began three days after the application of the CIDR'S for a period of 5 days, each treatment was provided to the groups at a fixed time (10 am).

Glucose concentration was measured one hour after targeted nutrition, using a One touch glucometer with a blood sample taken from the ear. The measurement of three blood samples was carried out with an interval of 2 days, later the data were analyzed by making a repeated Measurement through time for comparison of means using GLM of the statistical program (SAS 2004).

Heat detection began 24 hours after the removal of the CIDR'S and the application of prostaglandin and eCG, using a male with a harness, it was carried out every two hours for periods of 20 minutes. Once the ewes in heat were detected, they proceeded to natural mounting. The diagnosis of pregnancy was made by ultrasonography, it was carried out at 40, 60 and 80 days after mating, to monitor the pregnancies. The non-parametric variables were analyzed using logistic regression with the GLM procedure with the R 4.1.3 software, for a completely randomized design (R Core Team, 2022). The parametric variables were analyzed by means comparison, with the

GLM procedure of (SAS 2004).

RESULTS

The percentage of ewes that showed heat was not different between treatments with values of 80 (T1 and T4) and 90 percent (T2 and T3). The hours to heat after withdrawing the progestogen was greater and more dispersed in T4 (P<0.05) with 38.1hrs ± 7.2, compared to T1, T2 and T3, these did not show differences and their standard deviation was lower. The pregnancy percentage was not different between treatments with values of 70 percent for T1 and T4, with respect to T2 and T3, which obtained 80 percent of gestations. The prolificacy was higher in T2 and T3 with no difference between them, but higher (P<0.05) than T1 and T4 that showed 1.4, these variables can be observed in table 1.

The glucose concentration was not different between T1, T3 and T3, but it was different from these with respect to T4 (P<.05). T3 showed higher concentration and lower standard deviation in this variable (Table 2).

DISCUSSION

The percentage of estrus observed in the treatments does not show statistical difference between them, however, they differ to multiple results in which the response ranges between 95 and 100% of estrus with the use of new CIDR'S (Camacho et al. 2021). The result obtained in this investigation is possibly due to the fact that it was carried out during the anoestrous season and the CIDR's were reused (three previous uses), however the general average was 85%, considered acceptable.

The hours to estrus were lower and with less dispersion in T2 and T3 without observing a difference between them but of these with respect to T1 and T4 (P<0.05), which indicates that the effect provided by gluconogenic and organic minerals in the animal diet and targeted nutrition contribute

to improving this reproductive variable (Viñoles, 2009). Since T4 has a higher standard error, it indicates greater dispersion for the demonstration of estrus. This analysis is very important, especially when we intend to perform artificial insemination at a fixed time. Similar results were reported by (Camacho et al. 2021), when synchronizing heat in ewes with a similar protocol.

The percentage of gestation of T1 and T4 were lower (70 percent), compared to T2 and T3 that reached 80 percent of gestation, this shows the efficacy of gluconeogenic and organic minerals in modulating endocrine processes that favor embryonic viability as signal (Ortega 2022). In addition, this demonstrates the effectiveness of the use of short progesterone-based protocols together with short-term focused nutrition that, even without modifying the weight of the sheep, favor the ovulatory response in the final stage of follicular development and thus reduces follicular atresia by increasing the ovulation and pregnancy rate (Vinoles 2009; Camacho et al. 2021).

Glucose concentration was higher in T1, T2 and T3, showing no difference between them and showing that the use of nutraceuticals in short duration protocols maintains glucose in a higher concentration by favoring the use of food and distribution of nutrients (Aisen et al. 2005; Ortega et al. 2022). The elevation of glucose at that time favors the secretion of GnRH and therefore gonadotropins and interact with hormones such as insulin and leptin. In favor of the ovulatory rate, fertility, avoiding early embryonic death, taking into account that "Focused Nutrition" is an integral component of the "clean, green and ethical" package to increase reproductive efficiency in sheep (Viñoles 2009).

. The prolificacy was higher T2 and T3 there is no difference between them with values of 1.75 and 1.87 respectively, different

from the lower value ($P < 0.05$) in T1 and T4 that obtained 1.4 prolificidad, this shows the efficacy of gluconeogenic and organic minerals Se and Cr in inert yeasts in improving the ovulatory rate and embryonic viability as mentioned (Camacho et al. 2021; Ortega et al. 2022).

CONCLUSIONS

The use of gluconeogenic (Lipofeed) and organic minerals Se and Cr in inert yeast (Biotecap®) administered in short-term focused nutrition improves the reproductive variables of ewes synchronized with progesterin in ultrashort protocol plus, prostaglandins and eCG, with respect to the mineral mixture based on aluminosilicate.

It is recommended to continue analyzing the biologically effective dose of the three nutraceuticals used since they are an excellent tool to improve productivity, as well as being harmless and friendly to the environment.

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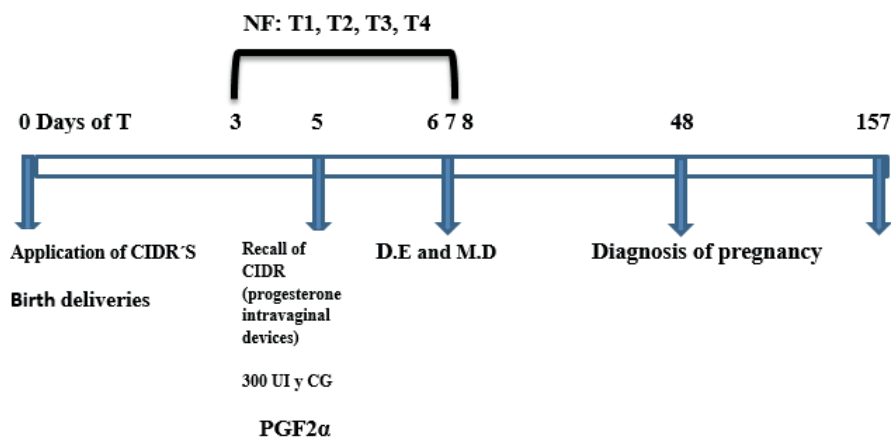


Figure 1. Treatment Protocols

eCG = Equine Chorionic Gonadotropin, PGF2α = (125 mcg Cloprostenol), DE = Oestrus Detection, MD = Direct Mount

T1 = 10gr of the mineral and aminosilicate mixture

T2 = 6 gr of Lipofeed (Propanediol 3.3 percent)

T3 = 10 gr Biotecap® (0.90 mg kg⁻¹ of Se and 1.4 mg kg⁻¹ of Cr 1×10¹⁰ yeast g d⁻¹)

T4 = 10 ml of drinking water

Variable	T1	T2	T3	T4
Jealousy percentage (% _n)	80 (8)	80 (8)	90 (9)	80 (9)
hours in heat	29.7 ± 3.5b	30.8 ± 4.1b	29.8 ± 2.1b	38.1 ± 7.2 a
Pregnancy percentage (% _n)	70 (7)	80 (8)	80 (8)	70 (7)
prolificacy	1.4b	1.75 a	1.87 a	1.4b

a, b: different literal in the row indicates statistical difference (P<0.05).

Table1. Reproductive variables of Pelubey ewes, synchronized with a progestogen andwith targeted nutrition with nutraceuticals for five days

Variable	T1	T2	T3	T3
glucose 1	49.7 ± 3.4 a	46.4 ± 4.1 a	49.4 ± 2.1 a	41.3 ± 4.4b
glucose 2	53.6 ± 5.2 a	53 ± 5.3 a	53.8 ± 2.3 a	43.4 ± 5.1b
glucose 3	53.5 ± 5.4 a	51.4 ± 4.1 a	53.7 ± 1.8 a	42.2 ± 5.6b

a, b: different literal in column indicates statistical difference (P<0.05)

Table 2.Glucose concentration of Pelubey sheep, synchronized with a progestogen and with targeted nutrition with nutraceuticals for five days.