

Scientific Paper

Effect of the number of parturitions on the productive performance of Pelibuey and crossbred Pelibuey ewes under production conditions

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Abstract

In order to evaluate the effect of the number of parturitions on the weight at birth of the lambs and on the parturition-pregnancy interval of Pelibuey (PBE) and crossbred Pelibuey ewes (CPB), under production conditions, a retrospective study was conducted of the Genetic Center of Pelibuey Sheep belonging to the Livestock Production Enterprise Matanzas, Cuba. The animals grazed in 3 ha of natural pastures and were supplemented with king grass forage, sugarcane, grass hay, commercial concentrate feed, mineral salts, as well as corn distillery residues (Northgold) according to the availability of this feedstuff. There were significant differences ($p \leq 0,05$) in favor of the live weight at birth in the lambs (2,77 vs. 2,69 kg for PBE and CPB, respectively). In turn, significant differences ($p \leq 0,05$) were found in the weight in favor of male lambs, with the highest values in PBE (2,83 vs. 2,72 kg, for PBE and CPB, respectively). The weight at birth of the lambs in PBE and CPB differed ($p \leq 0,05$) with regards to the number of parturitions and it was higher in PBE; the best values were obtained from the second parturition in PBE (3,01 kg) and in the fourth parturition in CPB (2,93 kg). The increase of the number of parturitions in the ewes affected ($p \leq 0,05$) the parturition-pregnancy interval in PBE and CPB. It is concluded that the number of parturitions in Pelibuey and crossbred Pelibuey ewes under commercial production conditions had a marked effect on the weight at birth of the lambs and on the parturition-pregnancy interval, with the best results from the second parturition; in turn, the weight at birth of the lambs was affected by the breed.

Keywords: sheep, weight at birth, breeds**Introduction**

The current values of sheep meat and the perspectives of opening new markets have generated the need to modernize productive systems, granting a higher importance to reproduction and growth rate, indicators in which the degree of intensification of the systems plays a primary role and also has special incidence on the economic results (Ganzábal, 2013).

Tropical forage plants cover an important area of the world and show great potential for sheep production (Poli *et al.*, 2012); the rational use of these plant species can significantly aid the increase of meat production and the enhancement of the productive chain of sheep rearing.

In this sense, reproduction, nutrition and health are essential elements to define the productive efficiency of the herds. The weight at birth is affected by multiple factors, among them: ewe nutrition during pregnancy, genotype of the parents, type of birth, sex, age of the ewe at parturition and duration of the pregnancy period.

Few studies have been conducted in Cuba, under commercial production conditions, about the influence of the number of parturitions of Pelibuey ewes on the weight at birth of the lambs. Thus Fonseca *et al.* (2008), in zones of the eastern region of Cuba, found a marked effect of the number of parturitions on the weight at birth and on the milk production of the ewes. However, this performance could be different in other sheep breeds and zones of the country. Consequently, the objective of this study was to evaluate the effect of the number of parturitions on the weight at birth of the lambs and on the parturition-pregnancy interval of Pelibuey and crossbred Pelibuey ewes, under production conditions.

Materials and Methods

Location. The study was developed at the genetic center of sheep production La Gabriela, in farm No. 7 of the basic entrepreneurial unit Gonzalo belonging to the Livestock Production Enterprise Matanzas –Pedro Betancourt municipality, Matanzas

province, Cuba–, located at 22° 83' 05'' N and 81° 41' 26'' W, at an altitude of 168 m.a.s.l.

Animals and management. The data of the last ten years were used (2005-2015), contained in the technical reproductive control of 400 Pelibuey ewes (PBE) and 400 crossbred Pelibuey ewes (CPB). These animals grazed in 3 ha of natural pastures, and the supplementation was alternated at different moments of the year with chopped forage of king grass (*Cenchrus purpureus*), sugarcane (*Saccharum officinarum*), grass hay, commercial concentrate feed, mineral salts and water at will, as well as corn distillery residue (Northgold), according to the availability of the feedstuff. At night the ewes were kept in shade facilities. Reproduction was organized in a system of directed mounts and estrus detection in the morning. Three to five genotypes of Pelibuey rams were used during the period.

Measurements. The data of the number of parturitions were compiled and the parturition-pregnancy interval was calculated, for each of the ewes (PBE and CPB). Additionally, the weight of the lambs at birth was recorded, and to perform the weighing a 15-kg (± 10 g) hook scale was used.

Statistical analysis. The data were processed through the SPSS® program version 17.0 for Windows®. The effect of the number of parturitions of the lambs was determined through a general lineal model (GLM); in case of detecting differences for the effect of the number of parturitions on the weight at birth of the lambs and the parturition-pregnancy interval, Tukey's test was performed.

The following mathematical model was used:

$$Y_{ijkl} = \mu + F_i + E_j + NP_k + F*E_l + e_{ijkl}$$

Where:

Y_{ijkl} : measurement of the l -eth experimental unit subject to the i -eth.

μ : constant common to all the observations.

F_i : effect corresponding to the i -eth phenotype (PBE and CPB).

E_j : effect of the j -eth age (1, 2, 3...8).

NP_k : effect of the k -eth number of parturitions (1, 2, 3...6).

$F*E_l$: effect of the l -eth interaction between the phenotype and age.

e_{ijkl} : normal and independent random residual error, distributed with mean 0 and variance S^2 .

Results and Discussion

Table 1 shows the range of weight at birth of the lambs of both genotypes, with significant differences ($p \leq 0,05$) in favor of the lambs of Pelibuey ewes with regards to those of crossbred Pelibuey ewes (2,77 vs. 2,69 kg for PBE and CPB, respectively).

Likewise, there were significant differences ($p \leq 0,05$) in the weight of the male lambs of PBE with regards to those of CPB (2,83 vs. 2,72 kg); while in the case of the females the weight did not differ.

These results confirm the reports by several authors about the influence of the fetus's genotype on the weight at birth, beyond the ewe's genotype, and the existence of a positive relation between the parents' size and the weight at birth of sheep between and within the breeds (Dwyer, 2003; Macías *et al.*, 2012; Lynch, 2013).

Such weight values at birth exceed the ones reported by Galina *et al.* (1996) and González-Garduño *et al.* (2010) for Pelibuey sheep in Mexico. The weight at birth in sheep defines to a large extent the survival and later growth, until reaching the final weight; this is a determinant indicator in the development and productivity of the Pelibuey sheep (Herrera *et al.*, 2008). In this sense, Turkson (2003), Nowak and Poindron (2006) and Rodríguez (2007) stated that low weight values at birth predispose to death for many causes, among which starvation, weakness, low reserve energy, hypothermia and immaturity stand out.

Table 2 shows the weight values at birth in the lambs of PBE and CPB with regards to the number of parturitions; this indicator was significantly higher ($p \leq 0,05$) in PBE and the best values were obtained from the second parturition in PBE (3,01

Table 1. Performance of the weight at birth of Pelibuey (PBE) and crossbred Pelibuey (CPB) lambs.

Indicator	Breed		Sig.	
	PBE	CPB	SE \pm	
Weight at birth (kg)	2,77	2,68	0,03	**
Weight at birth females (kg)	2,71	2,67	0,04	NS
Weight at birth males (kg)	2,83	2,72	0,04	**

** $p < 0,01$

NS: not significant

Table 2. Performance of the weight at birth with regards to the number of parturitions of Pelibuey and crossed Pelibuey lambs.

Parturition	Weight at birth (kg)		
	PBE	CPB	Sig.
1 ^{ro}	2,64 ^d	2,37 ^c	**
2 ^{do}	3,01 ^{ac}	2,69 ^b	**
3 ^{ro}	2,93 ^{ab}	2,67 ^b	**
4 ^{to}	2,99 ^a	2,93 ^a	NS
ES \pm	0,018	0,025	

a, b, c: different letters in the columns differ for $p \leq 0,05$ NS: not significant ** $p < 0,01$

kg) and from the fourth parturition in CPB (2,93 kg), compared with those of the first parturition (2,65 and 2,37 kg for PBE and CPB, respectively).

Such results can be explained by the fact that primiparous ewes have a lower live weight (Fonseca *et al.*, 2008; Mohammadabadi and Sattayimokhtari, 2013) and are still growing (Herrera *et al.*, 2008; Cadenas-Cruz *et al.*, 2012). Generally, in that period they do not usually reach adult weight and their requirements are higher (Lynch, 2013).

Under equal conditions, but a little more favored by age, are the ewes in the second parturition; nevertheless, in this stage the uterus shows a higher size and is more vascularized, which allows the flow of a higher blood volume. This justifies an increase in the weight at birth of the lambs; performance which is better verified when the ewes have reached their adult live weight. In this regard, Fonseca *et al.* (2008) and Lynch (2013) state that the higher the weight of the mother is at parturition, the higher the weight of the lamb will be at birth, and in most cases third-parturition ewes reach more than 31 kg, value considered as the adult weight for the Pelibuey breed (Herrera *et al.*, 2008).

The number of parturitions in Pelibuey ewes constitutes a trait of higher interest because it has repercussions on the efficiency of the productive life of ewes (Pérez *et al.*, 2007) and has its effect on the live weight at birth of the lambs. Several studies have shown an increase in the weight at birth of the lambs, as the number of parturitions of the ewe increases (Nowak and Poindron, 2006). In this sense, Rico and Palmas (cited by Fraga, 2015) reported the significant effects of the number of parturitions on the least-square mean of the weight at birth (2,3 kg) in crossbred Pelibuey ewes.

Table 3 shows the values of the parturition-pregnancy interval of PBE and CPB, indicator that

showed significant differences ($p \leq 0,05$) with regards to the number of parturitions (221 to 202 days and 259 to 206 days from the second to the sixth parturition for PBE and CPB, respectively), and a decrease in days as the number of parturitions in the ewes increased. This result coincides with the reports by several authors regarding the fact that the number of parturitions in ewes has a significant effect on the duration of the period from the parturition to pregnancy and as this variable increases the productivity of the ewe decreases (Castillo *et al.*, 2002; Herrera *et al.*, 2010; Perón, 2010; Hinojosa-Cuellar *et al.*, 2015). Such performance could be ascribed to the fact that the ewes, as they mature and reach their full development, can be more efficient from the reproductive point of view (Magaña-Monforte *et al.*, 2013; Mohammadabadi and Sattayimokhtari, 2013; Ríos-Utrera *et al.*, 2013).

No significant difference was found when comparing the values of the parturition-pregnancy interval in equal number of parturitions for the PBE and CPB, which could be related to their being subject to the same management and feeding system throughout the period; this confirms variability in this indicator among the different management and feeding systems under production conditions, independently from the breed of the ewes. The interval days in this study are higher than those reported by Fonseca (2003) when evaluating the effect of the number of parturitions (205 to 121 days) and of the season on the parturition-pregnancy period (171 to 132 days), in Pelibuey ewes that grazed in areas of natural pasture and received supplement with urea molasses at 3 % and star grass forage. However, they are lower than those reported by Hinojosa-Cuellar *et al.* ((2015) in a study about the productivity of F₁ Pelibuey x Blackbelly ewes and their crossings with Dorper and Katahdin, in a humid tropic production

Table 3. Performance of the parturition-pregnancy interval with regards to the number of parturitions in Pelibuey and crossbred Pelibuey ewes.

Parturition	Parturition-pregnancy interval (days)	
	PBE	CPB
2 ^{do}	221 ^{ab}	259 ^c
3 ^{ro}	219 ^{ab}	197 ^a
4 ^{to}	230 ^b	218 ^b
5 ^{to}	214 ^{ab}	224 ^b
6 ^{to}	202 ^a	206 ^{ab}
SE \pm	6,7	6,8

a, b, c: different letters in columns differ for $p \leq 0,05$.

system (291 to 245 days), with feeding being determinant in its results; and also than the ones found by Magaña-Monforte *et al.* (2013), in Pelibuey ewes under humid tropic conditions (267 to 242 days). From these studies it can be inferred that age, season and number of parturitions are factors that affect the parturition-pregnancy interval, for which they should be considered to establish a strategic management of feeding, in order to decrease such interval and improve the efficiency and productivity of the animals under production conditions.

It is concluded that the number of parturitions of Pelibuey and crossbred Pelibuey ewes under commercial production conditions had a marked effect on the performance of the weight at birth of the lambs and on the parturition-pregnancy interval, with better results from the second parturition; likewise, the weight at birth of the lambs was affected by the breed of the ewes in favor of Pelibuey compared with crossbred Pelibuey.

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