Milk production of Criollas and Anglo-Nubian does in Loja, Ecuador

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In order to characterize the daily milk production (1999-2001) and to determine the influence of several environmental effects, records of 99 lactations from 47 Criollas does, and 45 lactations from 28 Anglo-Nubian does were used in the "Estación Experimental de Zapotepamba" from Loja province, Ecuador. The daily milk production was weighed every fifteen days for four months, with a total of eight weighs per animal and the production of accumulated milk at 120 d was determined. The feeding consisted on browsing and free grazing. The she-goats for production were also fed with 200 g/animal/d of a concentrate with 14 % of CP. The weaning of the kids was between 45 to 50 d after the parturition, with mean weights of 13.6 kg. A mixed model was applied to study the effects of the genotype (Criolla and Anglo-Nubian), doe nestled in the genotype, number of parturition (3), parturition season (rainy and dry) and the interactions genotype x number of parturitions and genotype x season of parturition. The average of the daily milk production of the Criollas does was of 0.45 ± 0.22 kg/animal/d, and for the Anglo-Nubian does was of 0.76 ± 0.22 kg/animal/d. The lowest productions in both genotypes were obtained in the first parturition. It can be concluded that the daily milk production of Anglo-Nubian and Criolla does was affected by the effects of genotype and number of parturition and that the milk production in Anglo-Nubian does was superior to the Criollas by 0.30 kg/animal/d.

Key words: *Criollas and Anglo-Nubian does, environmental effects, daily milk production*

The population of adult goats from Ecuador is of 178 367 heads, mainly distributed in the regions of La Sierra, with 151 642 heads, and in La Costa, with 25 957 heads. There are 768 heads reported for the rest of the country. The highest population of goats is located in Loja province, with 110 395 heads (Anon 2003), which represents the 61.89 % of the national population.

The predominant breeds from Ecuador are Anglo-Nubian, Criolla, Boer and Saanen. The four genotypes of goats are located in the region of La Sierra, while in La Costa there are only two of them, the Anglo-Nubian and the Criolla. The Criolla breed is located in the Oriental and Insular region.

Ecuador has few studies on caprine. It is highlighted the evaluation of the growth of Anglo-Nubian, crossbred (F2) and Criollos kids during the birth-weaning phase (Cuenca 2002) and during the raising, coupling and sale phase (Pucha 2002), under the experimental conditions of the Universidad Nacional de Loja.

The objective of this research was to characterize the milk behavior of Criollas and Anglo-Nubian does, according to the influence of different environmental factors.

Materials and Methods

Records of 99 lactations from 47 Criollas does, and 45 lactations from 28 Anglo-Nubian does were used in the "Estación Experimental de Zapotepamba" from Universidad Nacional de Loja, Ecuador. This station is located at 04º01'01'' SL and 79º46'27''WL, between 950 and 1,250 m. o.s.l, with an average temperature of 24 ºC. The feeding consisted on the browsing and the free grazing. The goats fed mainly from tree species endemic from the area (*Acacia macracantha*, *Prosopis pallida* and *Erythrina smithianay*) and herbaceous plants (*Panicum maximum*, *Holcus lanatus*, *Pennisetum purpureum*, *Cynodon nlemfuensis*, *Pennisetum sp.*). The she-goats for production were also fed with 200 g/animal/d of a concentrate with 14 % of CP.

The reproductive management was performed by a naturally controlled service. The service season started in January and February. The observation was used for discovering the estrus. The sires were kept in the paddocks of reproductive females (minimum weight of 25 kg, before the service), in a relation of a male per 25 females.

The milking was manual, during the morning, after translating the goats to the production corral, from the fifth day after parturition. The rearing of the kids was carried out through restricted suckling. The kids remained with their mothers after the milking, from 7:00 a.m. to 4:00 p.m., after returning to the grazing. The restricted suckling was carried out until the weaning of the kids, from 45 to 50 d after the parturition, with an average weight of 13.6 kg.

The daily milk production was weighed every fifteen days for four months, with a total of eight weighs per animal. An adaptation of the method of Fleishman (1945) was used to determine the production of accumulated milk at 120 d, according to this expression:

$$\text{Milk production} = \sum \frac{(p_i + p_{i+1})}{2} * (d_{i+1} - d_i)$$

Where:

• p_i, is milk production in the control number i, which comprises from 1 (parturition) to n (drying)

• d_i, represents the days the goat is in lactation, when the control number i is performed

The production of accumulated milk at 120 d was divided by the 120 d of lactation to obtain the daily milk production of the does. The sample was formed by 144 lactations, between 1999 and 2001. Table 1 shows the amount of observations per year of parturition, number of parturitions and season of parturition.

Table 1. Amount of observations per year of parturition, number of parturitions and season of parturition

Character	Amount of observations
Years of parturition	
1999	58
2000	63
2001	23
Number of parturition	
1	47
2	51
3	46
Season of Parturition	
Rainy	63
Dry	81

A mixed model was applied through the MIXED procedure from SAS (2007) version 9.1.3, which used a methodology of restricted maximum likelihood (REML) to study the effect of the genotype (Criolla and Anglo-Nubian), doe nestled in the genotype, number of parturition, season of parturition (rainy and dry) and the interactions genotype x number of parturitions and genotype x season of parturition.

The model used was:

$Y_{ijkm} = R_i + C_j(R_i) + P_k + E_m + (RP)_{ik} + (RE)_{im} + E_{ijkm}$

Where:

Y_{iklmn} = Daily milk production

R_i = Fix effect of the i-th genotype (i= Criolla and Anglo-Nubian)

$C_j(R_i)$ = Random effect of the j-th doe nestled in the i-th genotype

P_k = Fix effect of the k-th number of parturition (k= 1-3)

E_m = Fix effect of the l-th parturition season (l= dry: April-November and rainy: December- May).

$(RP)_{ik}$ = Fix effect of the interaction between the i-th genotype and the k-th number of parturition

$(RE)_{im}$ = Fix effect of the interaction between the i-th genotype and the l-th parturition season

E_{ijklmn} = Random error due to each observation NID~ $(0, s^2e)$.

The Tukey-Kramer test was applied for the multiple comparison with the means of the square minimums (Kramer 1956).

Results and Discussion

The analysis of variance of the daily milk production of Criollas and Anglo-nubian does (table 1) demonstrated the important effect of the genotype and the number of parturition (table 2).

The mean of the minimum squares for the daily milk production obtained from Criollas does (0.45 ± 0.22 kg.animal.day-1) is within the range of the results obtained for this breed in Chile, Gálvez *et al*. (1987) (0.50, 0.62 and 0.57 kg/animal/d in the first, second and third lactation, respectively), Cofré (2001) (0.48 kg/animal/d) and Jhan (2012) (0.46 kg/animal/d). It is also similar to results from studies carried out in Mexico by Ávila (1996) and Mellado *et al*. (1996), and to the informed by Rabasa *et al*. (2012) in Argentina.

Other authors obtained lower averages. Ferrando *et al*. (1988) reported 0.24 kg/animal/d in Criollas goats from Chile; Mendizabal (1989) presented 0.40 kg/animal/d in Guatemala; and García *et al*. (1995) informed 0.38 kg/animal/d in Venezuela. However, Sánchez de la Rosa *et al*. (2006) obtained a higher reduction of 0.86 kg/animal/d in Criollas goats in Mexico. These differences could have been developed due to the use of an intensive system with stabulation.

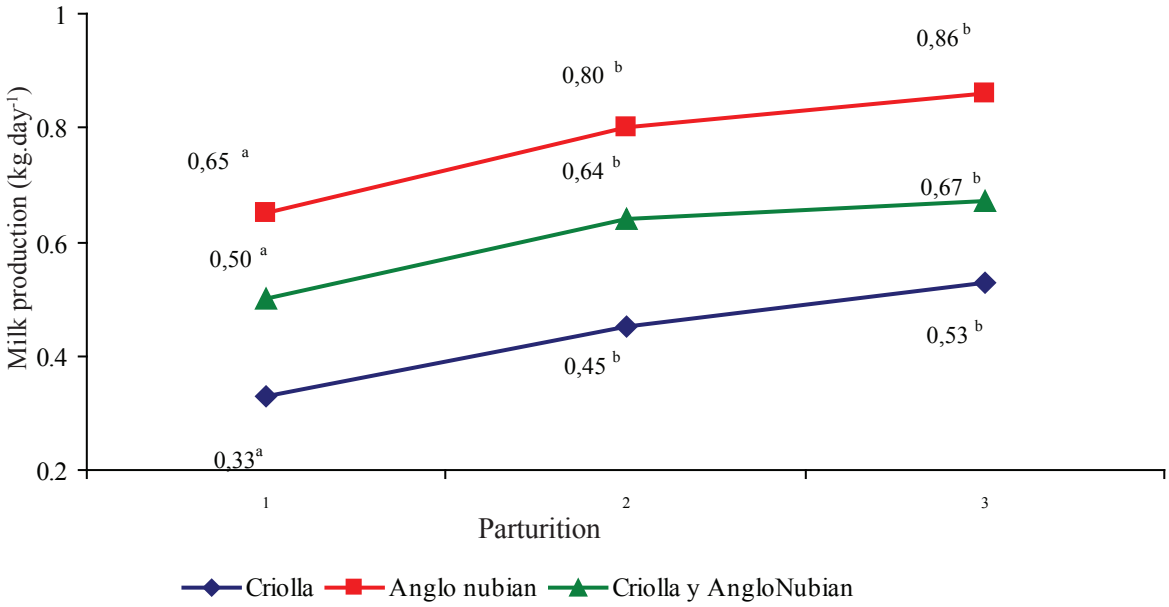
The mean of daily milk production obtained from Anglo-Nubian does (0.76 ± 0.22 kg/animal/d) was in the range reported by Ribas (1999) in Cuba, Dickson *et al*. (2000) in Venezuela, Paz *et al*. (2007) in Argentina and Frau *et al*. (2010) in Mexico for this breed under semi-extensive exploitation conditions. These authors obtained an average production between 0.65 and 1.2 kg/animal/d. However, other experts reported higher mean productions. Palma (1995) obtained 1.24 kg/animal/d, Torres (2004) reported 2.90 kg/animal/d and Sánchez de la Rosa *et al*. (2006) informed 1.07 kg/animal/d. These last results are mainly due to the management and feeding systems used in the flocks. It is an intensive system in semi-stabulation, with a daily supplementation of between 200 and 400 g of a commercial concentrate, with 12 % of CP, 3500 Mcal, and pasture cut during dry season.

The effect of the number of parturition on the daily milk production (figure 1) demonstrated that the lowest production was obtained during the first parturition, with 0.50 ± 0.15 kg/animal/d. There was a similar behavior in the Criolla and Anglo-Nubian breeds, with lower productions during the first parturition.

These results agree with those of other researchers who stated that the goats of the first lactation reached a productive average significantly lower than the following lactations (Browning *et al*. 1995, Ribeiro 1997, Zeng *et al*. 1997, Pacheco *et al*. 1998, Peña *et al*. 1999, Fernández 2000, Antunac *et al*. 2001, and Milerski and Mares 2001). There were mean productions of 0.71, 0.76 and 0.92 kg/animal/d for the first, second and third lactations, respectively, of Anglo-Nubian goats in Argentina,

Table 2. Analysis of variance of the daily milk production of Criollas and Anglo-Nubian does

Source of variation	DF	F	Significance
Genotype	1	104.99	***
Doe nestled in the genotype	2	0.02	
Number of parturition	2	29.67	***
Season of parturition	1	0.16	
Genotype x number of parturition	2	1.67	
Genotype x season of parturition	1	0.05	
Error (denominator)	134		



[a,b,c] Means with different superscripts per lines differ at P ≤ 0.05, according to Tukey-Kramer (1956)

Figure 1. Effect of the number of parturition on the daily milk production per animal

according to Díaz *et al*. (2007). The multiparous does had higher milk production than the primiparous ones (Paz *et al*. 2007). These differences are due to the use of the body reserves to complete the morphological development and pregnancy of primiparous does. The highest milk production was reached during the third lactation, which remained constant until the fifth (Peris *et al*. 1997, Garces *et al*. 2004, cited by García *et al*. 2005).

The effect of the season of parturition on the daily milk production was not significant for this study. This is because it was developed under experimental conditions and due to the supplementation provided to goats in production. These results coincide with those reported by Paz *et al*. (2007). However, Sánchez *et al*. (2006), Sánchez de la Rosa *et al*. (2006) and Dickson *et al*. (2008), under semi-extensive conditions, obtained higher milk production in does that yeaned during the rainy season than those that did it during the dry season, due to the higher availability and quality of forages.

The daily milk production in goats of Anglo-Nubian and Criolla genotypes was affected by the genotype and number of parturition. The average of daily milk production of Anglo-Nubian does surpassed the average of Criolla does in 0.30 kg/animal/d. There were low productions during the first parturition in both genotypes, which coincides with the information of other authors.

References

Anon 2003. Tercer Censo Nacional Agropecuario. Ministerio de Agricultura Ganadería Acuacultura y Pesca. Ecuador. Available: <http:www.indec.gov.ar/censoAgro2008/cna2008.asp> [Consulted: 02/06/2012]

Antunac, N., Samarzija, D., Havranek, L., Pavič, V. & Mioc, B. 2001. Effects of stage and number of lactation on the chemical composition of goat milk. Czech. J. Anim. Sci. 46:1212

Ávila, N. 1996. Efecto del syncro-Mate-B (norgestomet) implantado en diferentes estadios de la lactancia sobre el porcentaje de cabras en celo y la producción y composición de la leche de cabras mantenidas en agostadero. Dpto. Producción Animal, Universidad Autónoma Agraria "Antonio Narro Saltillo" (Coah), México

Browning, R. Jr., Leite-Browning, L. & Sahlu, T. 1995. Factors affecting standardized milk and fat yields in Alpine goats. Small Rumin. Res. 18:173

Cofré, B. 2001. Producción de cabras lecheras. Instituto de Investigaciones Agropecuarias. Chillan, Chile. Boletín INIA. No 66. 200 pp.

Cuenca, G. 2002. Evaluación del crecimiento de cabritos de tres grupos raciales: Anglo nubian, mestizos (F2) y criollo, en la fase nacimiento destete en la Estación Experimental Zapotepamba. PhD Thesis. "Universidad Nacional de Loja". Ecuador

Díaz, G., Torres, H., Ochoa, C. & Urrutia, M. 2007. Número de parto, tipo de parto y período de lactancia como factores que modifican la producción de leche en cabras Nubia. V Congreso de Especialistas en Pequeños Rumiantes y Camélidos Sudamericanos. Available: <http: www. produccion-animal.com.ar > [Consulted: 02/21/2012]

Dickson, L., Gamarra, I., Salvador, A. & Monasterio, L. 2008. Producción de leche y duración de la lactancia en cabras mestizas de la raza Canaria en Venezuela. Archivos de Zootecnia 57: 63

Dickson, L., Torres, G., Becerril, C. & García, O. 2000. Producción de leche y duración de la lactancia en cabras (*Capra hircus*) Alpinas y Nubias importadas a Venezuela. Vet. Méx. 31:21

Fernández, G. 2000. Parámetros productivos de cabras Pardo Alpinas y sus cruzas, bajo régimen de pastoreo. Producción Latina XXV: 541

Ferrando, G., Peréz, P. & Reveco, M. 1988. Características de la curva de lactancia en cabras Criollas chilenas de primer parto. Vol 10. Facultad de Ciencias Veterinarias y Pecuarias Universidad de Chile. Available: <http://www.revistas. uchile .cl/index.php/ACV/article/view/4492/4379>. [Consulted: 02/06/2012]

Fleischman, W. 1945. Tratado de lechería. Ed. Gustavo Gili S.A. Barcelona, España. 740 pp.

Frau, S., Togo, J., Pece, N., Paz, R. & Font, G. 2010. Estudio comparativo de la producción y composición de leche de cabra de dos razas diferentes en la provincia de Santiago del Estero. Rev. Fac. Agronomía. Vol 109:9

Gálvez, J., Pérez, P., Pittet, J., Guzmán, V., Figueroa, E. & Briones, A. 1987. Producción de leche de cabra criolla según número ordinal del parto. Avances en Ciencias Veterinarias. Vol. 2(2). Facultad de Ciencias Veterinarias y Pecuarias Universidad de Chile. Available: http://www. revistas.uchile.cl/index.php/ACV/article/view/4492/4379 [Consulted: 02/06/2012]

García, O., García, E., Bravo, J. & Bradford, E. 1995. Análisis de un experimento de cruzamiento usando caprinos criollos e importados. VII. Producción de leche y evaluación de grupos raciales. Rev. Fac. Agron. (LUZ) 13: 611. Available: <http: revfacagronluz.org.ve/v13_5/ v135z010.html >. [Consulted: 02/06/2012]

García, R., Mudarra, I., Salcedo, M., Vert, I. & Banda, I. 2005. Desarrollo de la ganadería ecológica en el sector ovino y caprino de la provincia de Granada. Technical report. CIFAED. Granada

Jhan, E. 2012. Producción de leche con distintos genotipos de cabras. Available: < http://www.inia.cl/medios/biblioteca/ boletines/NR28598.pdf > [Consulted: 02/21/2012]

Kramer, C.Y. 1956. Extension of Multiple Range Tests to Group Means with Unequal Numbers of Replications. Biometrics 12:307

Mellado, M., Bernal, A., Mendoza, R. & Carrillo, E. 1996. Hormonal induction of lactation in prepuberal and multiparous crossbred goats kept under extensive conditions. Small Rum Res. Vol. 19: 143

Mendizabal, G. 1989. Dos sistemas alimentarios en la explotación de la cabra lechera sin raza definida en el departamento de Guatemala. Facultad de Medicina Veterinaria y Zootecnia. Universidad de San Carlos. Guatemala

Milerski, M. & Mares, V. 2001. Analysis of systematic factors affecting milk production in dairy goat. Acta Univ. Agric. et Silvic. Mendel. Brun (Brno).1: 43

Pacheco, F., Monteiro, A., Lopes, Z. & Barros, M. 1998. Controle laitier caprin dans la région du Minho (Portugal). In: Milking and milk production of dairy sheep and goats. Proc. Int. Symposium on the Milking of Small Ruminants. Athens, Greece. EAAP. 95: 460

Palma, J. 1995. Factores que influyen en la producción de lechera de un hato caprino en el semiárido mexicano. PhD Thesis. Universidad de Colima. Facultad de Medicina Veterinaria y Zootenia. Colima, Col, México. 99 pp.

Paz, R., Togo, J. & López, C. 2007. Evaluación de parámetros de producción de leche en caprinos (Santiago del Estero, Argentina). Universidad del Zulia. Rev. Científica. 17: 161. Maracaibo, Venezuela

Peña, B., Veg, V., Sánchez, R., Marots, P., Garcia, M. & Doménech, G. 1999. Producción láctea y ajuste de la curva de lactación en caprinos de raza Florida. Rev. Archiv de Zootecnia. 48: 415

Pucha, K. 2002. Evaluación del crecimiento de cabritos de tres grupos raciales: Anglo nubian, mestizos (F2) y criollo en la fase destete venta en la Estación Experimental Zapotepamba. PhD Thesis. Universidad Nacional de Loja, Ecuador

Rabasa, A., Roldán, D., Fernández, J., Saldaño, S. & Poli, M. 2012. Eficiencia de producción de leche en cabras criollas serranas y Saanen-criollas (F1). CONICET. Fac. Agron. y Zoot. Available: <http: www.aapa.org.ar/congresos/2003/ GmPdf/Gm8.PDF>. [Consulted: 02/06/2012]

Ribas, M. 1999. El caprino: perspectivas de la especie para la producción de leche en el trópico. Rev. ACPA. 4:31

Ribeiro, A. 1997. Estudo dos efeitos genéticos e de ambiente sobre características de importancia económica em caprinos de raca Saanen. Master Thesis. Facultad de Ciencias Agrárias e Veterinárias. Universidade Estadual Paulista. Brasil. 116 pp.

Sánchez, M., Fernández, E., Martín, D. & Muñoz, E. 2006. Influencia de la época y número de parto en los parámetros de producción y calidad de leche en la raza Florida. SEOC 2006. Zamora-5. p. 191

Sánchez de la Rosa, I., Martínez, R., Torres, G., Becerril, C., Mastache, A., Suáres, J. & Rubio, M. 2006. Milk production and lactation curves in three goat breeds in the dry tropic of Mexico. Rev. Vet. Méx. 37(4). Available: <http://www.medigraphic.com/pdfs/vetme x/ vm-2006/vm064i.pdf >. [Consulted: 02/21/2012]

SAS. 2007. SAS User's guide: Statistics. Version 9.1.3. De. SAS Institute. INC, Cary, N.C., USA

Torres, C. 2004. Principales razas caprinas en México. Revista Cabras. marzo-abril. p. 6-8

Zeng, S., Escobar, E. & Popham, T. 1997. Daily variations in somatic cell count, composition, and production of Alpine goat milk. Small Rumin. Res. 26: 253

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