EFFECT OF ELECTROPHORETIC GOAT'S K-CASEIN POLYMORPHISM ON MILK YIELD AND MAIN COMPONENTS YIELD

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INTRODUCTION

A polymorphism for κ-casein in goat's milk has been described by several authors. This polymorphism presents two electrophoretic variants in urea-acrylamide alcalin gels; the variants were named A and B such that A has greater electrophoretic mobility and B less mobility, (Di Lucia et al., 1990).

Law and Tziboula (1993), using the FPLC technic, found a κ-casein polymorphism and, they also described it as a dialelic polymorphism.

We have detected an electrophoretic polymorphism of κ-casein in milk samples from the Murciana-Granadina Spanish breed of goats (from "Granja Experimental de Albolote de la Exma. Diputación Provincial de Granada"). Two bands have been observed in the region corresponding to this casein fraction. The fast and slow bands have been named A and B, respectively.

The κ-casein variants in dairy cattle have an important relation with the productive parameters. The animals that shows the B variant are those that have a higher total protein yield in milk, higher heat stability, lower coagulation time, more firm curd, and the cheese yield is 5-10% higher than the non B variant carriers (Ordas, 1992). Considering this matter and the fact that in our country more than the 90 per cent of total goat's milk production is used to cheese production, our group is studing whether or not this relationships found in dairy cattle also exists in goats.

Records of milk yield, protein, fat, lactose and casein fractions (α_s-, ß- and κ-casein) were taken during two lactation periods. All phenotipic combinations of these polymorphic variants were found (AA, AB and BB). We looked for a possible realtionship between κ-casein polymorphism and the eight production traits mentioned.

MATERIAL AND METHODS

Three experimental groups of goats were formed, corresponding to their the κ-casein electrophoretic type. Electrophoresis was performed in SDS-PAGE gels with 4-22% gradient (from Hoefer Scientific Instruments (1992-1993) and modifidied by our group). Milk yields were recorded and milk samples were collected monthly from these goats. Contents of the main components were measured with a near-infrared spectrophotometer, which was previously calibrated (Diaz-Carrillo et al., 1991). Total yields per lactation were estimated by the Fleischman method. The model used in statistical analyses was as follow:

$$P=\mu+A_j+E_k+N_l+T_m+G_n+e_{kjlmn}$$

where:

P = yield (kg/lactation)
μ = mean
A_j = kidding year
E_k = kidding season
N_l = number of lactation
T_m = numbers of kids
G_n = genotype of the different casein fractions
e_{kjlmn} = error

All statistical analysis were performed with the SAS programs.

RESULTS AND DISCUSSION

Table 1 shows results of the variance analysis for the following factors: year or kidding, season of kidding, lactation number, numbers of kids and electrophoretic variant of κ-casein. The dependent variables were: total yield per lactation (expressed in Kg.) and the total protein, casein, fat, lactose and casein fractions (α_s (α_{s1}+α_{s2}), β and κ), yields per lactation and the mean contents per lactation of protein, whole casein, fat, lactose, and casein fractions.

The relationship between κ-casein electrophoretic variants to the total milk yield per lactation, the total α_s-casein and protein yield, are significant, the remaining relationships were non significant.

TABLE 1. F values and significance levels corresponding to the variance analysis (GLM) of the data from yields and all the constituents per lactation including the κ-casein electrophoretic variant in the model (N=34). (numbers between brackets mean grades of freedom).

	Kidding year (1)	Season (3)	Lactation number (4)	Kidding type (3)	κ-casein (2)	R^2
Yield	1.8 ns	3.1*	2.1 ns	1.6 ns	3.5*	0.61
Protein	1.9 ns	1.1 ns	3.3*	1.0 ns	2.5 ns	0.63
Casein	1.8 ns	0.8 ns	3.9*	1.3 ns	3.6*	0.65
Fat	0.9 ns	0.2 ns	3.1*	1.2 ns	2.7 ns	0.57
Lactose	0.6 ns	1.2 ns	2.4 ns	1.3 ns	2.8 ns	0.60
α_s-cn	1.1 ns	0.4*	3.5*	1.2 ns	4.4*	0.60
β-cn	2.6 ns	0.7 ns	3.6*	1.8 ns	2.3 ns	0.64
κ-cn	0.8 ns	1.1 ns	2.6*	2.0 ns	0.9 ns	0.60

*: $0.01 < P < 0.05$
ns: non significant

The least squared means for the significant variables of the traits are shown in **Table 2.**

As can be seen, goats carrying the variant BB show higher values for these traits. Particularly important are the higher yields of total and α_s-casein, since these are the main factors affecting cheese yields. However, BB variant has a low frequence in the studied breed.

TABLE 2. The least squared means of the κ-casein electrophoretic variants with the whole yields per lactation. Only least squared means that were found to be significan are shown.

Variant	N	Yield*	Casein*	α_s-cn*
AA	19	319 a	9.12 a	2.9 a
AB	12	301 a	8.11 a	2.7 a
BB	3	593 b	15.32 b	5.4 b

(Means with different letters are significant differents ($\alpha=0.05$), * kg/lactation.)

Table 3 shows the phenotipic correlations among the total yields per lactation of all variables. The correlations among these yields are positive and they have significant correlation coeficients.

TABLE 3. Phenotipic correlation coeficients among the whole yields per lactation data ($N=218$). Correlation coeficients and the significance level related with H_o, $r=0$ are shown.

	Milk Yield	Protein Yield	Casein Yield	Fat Yield	Lactose Yield	α_s-cn Yield	β-cn Yield	κ-cn Yield
Milk Yield	1	0.98*	0.98*	0.91*	0.98*	0.98*	0.94*	0.89*
Protein Yield		1	0.95*	0.87*	0.97*	0.97*	0.98*	0.88*
Casein Yield			1	0.94*	0.94*	0.96*	0.97*	0.88*
Fat Yield				1	0.82*	0.91*	0.94*	0.81*
Lactose Yield					1	0.94*	0.87*	0.88*
αs-cn Yield						1	0.89*	0.88*
β-cn Yield							1	0.79*
κ-cn Yield								1

* $p<0.001$.

Studies are in progress in order to confirm genetic determination of these electrophoretic variants as well as the already proven influence on casein yields. This could be confirmed in goats increasing the sample size, as is done with dairy cows (Medrano and Aguilar-Córdoba, 1990). Information on the κ-casein genotype could be used in breeding programs in order to obtain animals with the BB genotype, which would favour not only an increment in milk yield and total casein yield, but also an increase in yields of all milk components, due to the positive correlation found among all the variables.

If this character is chosen as a selection criterium, single goats could be genotyped in any moment of their life using DNA analysis techniques (e.g. PCR). This would allow notable saving and increase efficiency, because the animals to be used as parentals could be chosen even at the moment of birth whithout having to wait to collect data from their offspring.

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