

Felis concolor (Mammalia, Felidae) MILK CHARACTERISTICS

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ABSTRACT: Studies on milk composition of cougar (*Felis concolor*) were carried out. Results show that it has 2.6 ± 1.33 gr/100 ml of caseins (of which 30 % corresponds to α -Cn, 50 % to β -Cn, 5 % to κ -Cn and 14 % to an electrophoretic slow band). Lactosum proteins concentration was 37.14 ± 5.558 mg/ml. These proteins showed eleven bands in PAGE-SDS and six in starch electrophoresis. Two of these should be Igs and serum albumin according to precipitation and electrophoretic migration. For glucids and lipids the values were 29.7 ± 10.9 mg/ml and 111.4 ± 29.0 mg/ml respectively. Caloric value is higher than in most mammalian species, except marine ones. Sialocompounds are found in large concentration.

RESUMEN: Características de la Secreción Láctea de *Felis concolor* (Mammalia, Felidae).

Se ha estudiado la composición de la secreción láctea del puma, con especial referencia a las proteínas. Los resultados muestran que posee $2,6 \pm 1,33$ gr/100 ml de caseínas, de las cuales el 30% corresponde a α -Cn, el 50% a β -Cn, el 5% a κ -Cn y un 14% a bandas electroforéticas de migración lenta. La concentración de PLS era de $37,14 \pm 5,558$ mg/ml. Estas mostraron en las electroforesis en PAGE-SDS once bandas, mientras que en almidón se identificaron seis bandas. Dos de estas bandas correspondían a inmunoglobulinas y seroalbúmina de acuerdo a las características de precipitación y migración electroforética. Para glúcidos y lípidos los valores encontrados fueron de $29,7 \pm 10,9$ mg/ml y $111,4 \pm 29$ mg/ml respectivamente. El valor calórico encontrado fue superior al de la mayor parte de las especies de mamíferos estudiadas exceptuando los marinos. También los sialocompuestos se encontraron en concentraciones más altas que las conocidas en otras especies.

Key words: *Felis*, puma, milk, reproduction

INTRODUCTION

The cougar (puma or mountain lion; *Felis concolor* L.) has the largest geographic distribution of all American felids. It is found from Alberta (Canadá) to the Straits of Magellan (Cabrera et al., 1957). Its breeding in captivity is difficult and the biology of its lactation has not been yet studied.

Lactation is the most characteristic mammalian function, and milk components, the proteins in particular, can provide a great deal of information about different aspects of reproduction, breeding and development (Jenness, 1982).

The aim of the present work is to determine the principal characteristics of cougar milk.

MATERIAL AND METHODS

Milk samples from four female cougars belonging to the following institutions were used: "Dr. Vucetich" Biological Station (Jujuy), "El Cadillac" Pisciculture Station (Secretaría de Agricultura, Tucumán) and two private farms from Burruyacu and Leales Departments (Tucumán).

Samples (between 4 and 20 days of lactation) were taken by hand milking. After adding 1% potassium bichromate (one drop/5 mL)

they were transported on ice to the laboratory where the pH was determined on a Beckman Zeromatic SS-3 pH meter. Then they were frozen at -20°C until the analyses were carried out.

Analytical Methods

Totals glucids and sialic acid were determined according to Winzler (1955), proteins according to Lowry et al. (1955), lipids as Kates (1972) and phosphorus analyses were carried out according to Ames (1966). Blood immunoglobulins were isolated according to Heide and Schwick (1973). Urea-starch gel electrophoresis (USGE) was in accordance with Wake & Baldwin (1961) and polyacrylamide gel electrophoresis with sodium dodecyl sulphate (PAGE-SDS) according to Laemmli (1970). Each major protein concentration was determined by making an elution of the corresponding electrophoretic band and reading it on a Carl Zeiss 1 spectrophotometer. Caseins (Cn) fractionation was carried out on acetate buffer pH 4.5 precipitated caseins. Supernatant lactosera were used to study the proteins contained. Cn isolation was performed according to McKenzie (1967). Lactosera proteins (LSP) fractionation was done according to McKenzie (1967) and the last supernatant at pH 3.5 from this method was used to investigate the presence of β -lactoglobulin in milk. α -lactalbumin (α -La) was isolated by precipitating the remaining proteins with polyethylenglycol (Richter, 1973). All samples were dialyzed against 50

mM tris-citrate buffer at pH 8.3 before electrophoresis.

RESULTS AND DISCUSSION

The concentrations of the principal milk components are shown in **Table 1**. Total milk caloric value was 6.65 MJoules/L. **Tables 2** and **3** show Cn and LSP concentrations. Molecular weights obtained by PAGE-SDS are listed in **Table 4**. Results obtained on the principal components of the cougar milk show that the concentrations of LSP are higher than those of caseins. This is also the case in *Felis catus* (Parkes, 1967). Studies on other feline species will show if this is a characteristic feature of the genus.

On the other hand high lipid content seems not to be a felid feature since it shows great variability (Ben Shaul, 1962).

Lactosera proteins included a 15,000 daltons band corresponding to a protein that precipitate under the same conditions as bovine or llama α -La and was the faster band in starch gel electrophoresis.

A 63,000 daltons band corresponded to a protein fraction that precipitates like milk serum albumin (S.A.) and that has the same starch gel electrophoretic behavior as blood serum albumin. All remaining lactosera bands were not identified.

Patterns of caseins USGE show the following band numbers: α -Cn, two; β -Cn, one; κ -Cn, two. PAGE-SDS of caseins showed molecular weights detailed in **Table 4**. Note that

Table 1: Principal components of cougar milk.

Glucids	29.70 \pm 10.90	mg/ml
Lipids	111.40 \pm 29.00	mg/ml
Total Proteins	63.60 \pm 5.30	mg/ml
Caseins	26.46 \pm 1.33	mg/ml
Lactosera Proteins	37.14 \pm 5.58	mg/ml
Total Sialic Acid	1.82 \pm 0.30	mg/ml
pH	5.80 \pm 0.50	mg/ml

Table 2: Concentration and phosphorus contents of cougar milk casein

	% total Cn	mg/ml milk	P/mol *
α -Cn	30.47 \pm 4.41	6.76	8
β -Cn	50.33 \pm 5.01	11.27	6
γ -Cn	nd	nd	3
κ -Cn	5.11 \pm 3.69	1.35	3
π -Cn	14.09 \pm 3.05	3.00	nd
Total Cn	100	26.46	7 **

* P atoms by mol of Cn

** P mean content in a total Cn sample

γ -Cn has six different molecular weight peptides. Among all casein types, the greatest concentration corresponds to β -Cn. Its hydrolysis derivative, γ -Cn, having six components, indicates, probably, a different plasmin effect on β -Cn with respect to that found in other species (Eigel, 1984).

The molecular weights of caseins are somewhat larger than those from other species cited in the literature (Jenness, 1982); nevertheless, in porcine caseins higher molecular weight caseins were also found (Aimutis et al., 1982).

We observed an additional slow band that we provisionally named π -Cn. It precipitates together with β -Cn in the methods employed. Up to now the nature of π -Cn is not clear. It may represent a β -Cn subtype or a distinct Cn with similar precipitation characteristics.

The results of assays on caseins phosphorylation are shown in Table 2. No isolation was performed for π -Cn because the sample was too small, but its concentration was determined.

Precipitation assays to look for β -Lg presence showed remaining protein(s) corresponding to 5 % of the total LSP. Double immunodiffusion assays using this protein against anti-bovine β -Lg antiserum failed to show any precipitation line. The absence of β -Lg in cougar milk cannot be inferred from our results. It may be that present immunological

assays are not sensitive enough to detect it, considering the large phylogenetic distance between bovines and felines. Those events leave the β -Lg presence as an open issue.

The large sialic acid concentration found, four time greater than in bovines (Walstra y Jenness, 1987), indicates the nutritional importance for the offspring.

CONCLUSIONS

The present studies on *Felis concolor* milk composition show that it has unusual nutritional properties due to the large energy per volume, higher than most mammalian species except marine ones, and the great amount of sialo-compounds. Other features are the greater amount of lactosoluble proteins with respect to caseins, the eleven casein bands and the fact that two proteins (α -La and serum albumin) make up almost half of the total lactosoluble proteins.

ACKNOWLEDGEMENTS

We wish to express our sincere thanks to Dr. A. Canedi, from "Dr Vucetich" Biological Station (Jujuy), Mr. J. Yapur and Mr. J. Teisairé (Tucumán) for their contributions to this study and to Dra. Patricia Black Decima for reading the manuscript.

The comments of the anonymous reviewers are greatly appreciated by the authors.

Table 3: Lactosoluble proteins of cougar milk.

	% from total	mg/ml lactosoluble
α -La	24.47 \pm 5.29	9.09
S.A.	27.84 \pm 5.13	10.34
Igs	20.73 \pm 15.27	7.70
a band *	5.65 \pm 1.50	2.10
b band *	6.60 \pm 7.30	2.45
c band *	14.70 \pm 2.52	5.46

* Not identified bands.

Table 4: Approximate molecular weights of cougar milk proteins.

Protein	Molecular Weight	Protein	Molecular Weight
Prot. Ia	140,000	κ -Cn	31,000
Prot. Ib	135,000	β -Cn	30,000
Prot. II	130,000	α -Cn	28,500
S.A.(?)	63,000	γ -Cn 1	28,500
Prot. III	60,000	γ -Cn 2	27,000
Prot. IV	51,000	γ -Cn 3	25,000
Prot. V	33,000	γ -Cn 4	22,000
Prot. VI	31,000	γ -Cn 5	18,000
Prot. VII	26,000	γ -Cn 6	15,000
Prot. VIII	21,000		
α -La (?)	14,500		

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