High degree of variability within αs1-casein in llama (Lama glama) identified by isoelectric focusin

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Abstract

Studies concerning milk yield and composition of llamas, as one of the main species of the New World Camelids, are until now scarce. First analyses concerning electrophoretic separation of milk proteins were made, but to our knowledge no milk protein variability was described for this species until now. In a first step we analysed protein variability of alpha s1-casein (αs1 -CN), coded by *CSN1S1*, as one of the main milk proteins in llama milk. Therefore, milk samples of 45 llamas (*Lama glama*), hold in different flocks in Germany, The Netherlands, Switzerland, and Chile, were analysed by isoelectric focusing in ultrathin layer polyacrylamide gels using carrier ampholytes. Llama milk samples showed a high variability within αs1-CN with the simultaneous identification of four αs1-CN alleles, preliminary named with 1 to 4, on the basis of increasing isoelectric point, whereas allele 2 showed highest frequency (0.79). Homozygous phenotypes are characterized by four bands with different intensity and could be demonstrated for the alleles 1 to 3. The results show a higher degree of variability within *Lama glama* in comparison to *Camelus dromedarius*, where, until now, two alleles are described. Analyses of further llama milk samples and DNA-based studies concerning *CSN1S1* are in progress to get a more complete picture about αs1-CN/*CSN1S1* variability within llama and to use them in evolutionary and population studies.

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Introduction

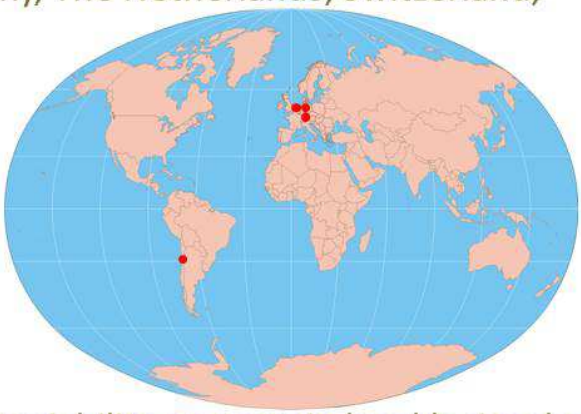
- Llamas (*Lama glama*) are one of the main species of the South American Camelids
- Studies concerning milk composition and milk protein variability in llama are very limited and challenging
- Milk protein polymorphisms show associations to milk performance traits in ruminants and are used in evolutionary and population studies
- Alpha$_{s1}$-casein (α_{s1}-CN), coded by *CSN1S1*, is one of the main milk proteins in llama milk (Rosenberg, 2006)

Aims of the study

- Separation of llama milk proteins by IEF and analysis of the potential genetic variability within α_{s1}-CN

Material and Methods

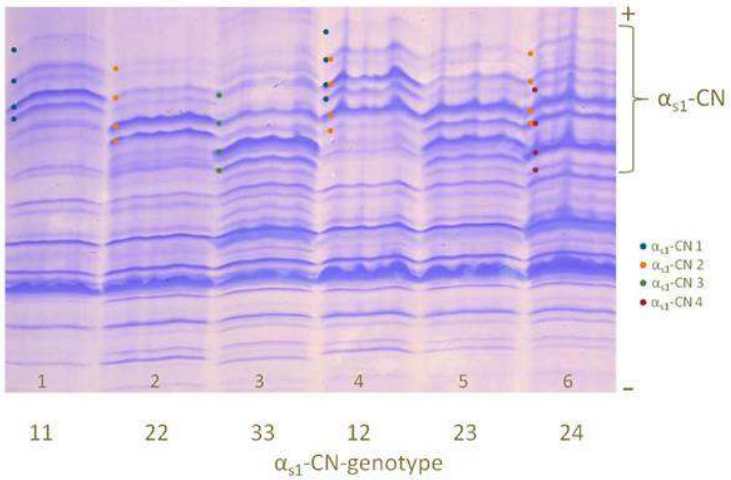
- Collection of milk samples of 45 llamas (*Lama glama*) from different flocks in Germany, The Netherlands, Switzerland, and Chile by hand milking



- Analysis of llama α_{s1}-CN variability on protein level by isoelectric focusing (IEF) in ultrathin layer polyacrylamide gels using carrier ampholytes (Erhardt, 1989)

Results and Discussion

- Llama milk proteins show great phenotypical variation in IEF-gels



- α_{s1}-CN fraction was identified by direct sequencing of IEF bands
- Four α_{s1}-CN alleles could simultaneously be demonstrated on the basis of increasing isoelectric point
- Preliminary named with 1 to 4
- Homozygous phenotypes are characterized by four bands with different intensities

Tab. 1: Allele and genotype frequencies of llama α_{s1}-CN determined by IEF

Milk protein	n	Allele frequencies				Genotype frequencies					
		1	2	3	4	11	12	22	23	33	24
α_{s1}-CN	45	0.03	0.79	0.17	0.01	0.02	0.02	0.67	0.20	0.07	0.02

- We could demonstrate most of the possible genotypes within the postulated 4 allele system except the genotypes 34 and 44
- Homozygous genotypes could be demonstrated for the alleles 1 to 3
- Within the α_{s1}-CN fraction allele 2 showed highest frequency

Conclusions and future prospects

- *Lama glama* shows a higher degree of α_{s1}-CN variability in comparison to *Camelus dromedarius*, where, until now, only two alleles are described (Shuiep et al., 2013)
- Analyses of further llama milk samples and DNA-based studies concerning *CSN1S1* are necessary to get a more complete picture about α_{s1}-CN/*CSN1S1* variability within llama and to use them in future evolutionary and population studies
- Therefore, also the inclusion of the other main milk proteins of llama milk is reasonable

Acknowledgement

We thank all llama breeders for their support and Günter Lochnit for his help in identification of the α_{s1}-CN fraction.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Thank you for
your attention.