



Association of the ACAA2 gene with production traits in Chios sheep

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Introduction

In the Mediterranean region, the milk from small ruminants is mainly used for the production of high quality cheese from local dairy breeds. Chios sheep is the most important commercial breed in Cyprus, due to its high potential in milk production.

A whole genome QTL study detected a suggestive QTL for milk, fat & protein yield, mapped in the ovine chromosome 23 (Gutierrez-Gil et al., 2009). **ACAA2 gene** is located in this QTL region and encodes the **enzyme Acetyl-CoA acyltransferase 2 (ACAA2)** which has a central role in the energy supply by catalyzing the final stage in mitochondrial fatty acid β -oxidation.

Orford et al. (2012) detected a **novel SNP (g.2982T>C)** in the **3'-UTR** of the **ACAA2 gene** that was associated with **milk yield** in Chios ewes from a single experimental farm. The CC genotype had significantly lower milk production compared to the CT and TT genotypes.

Objective

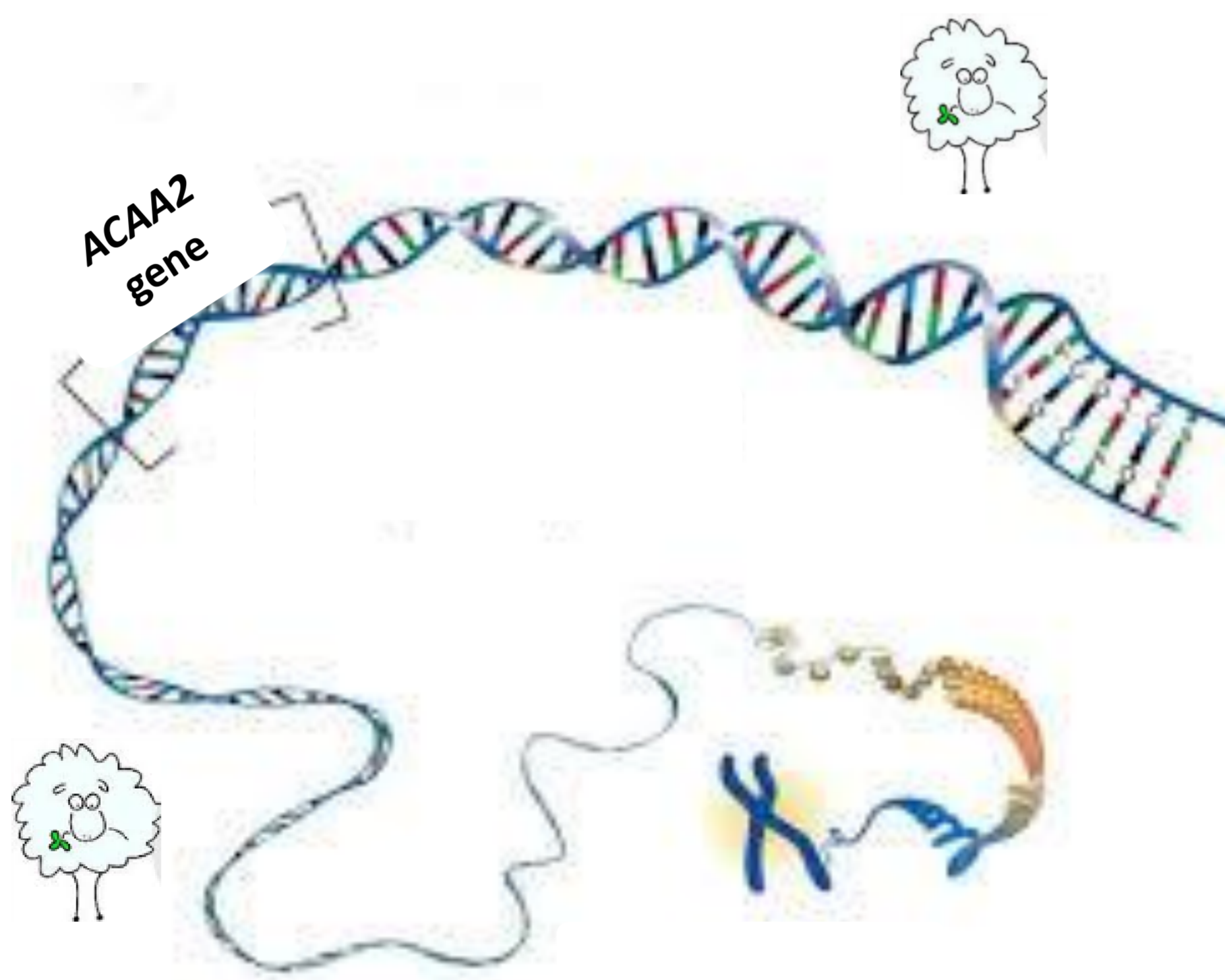
The aim of this study was to investigate the association of the g.2982T>C SNP with milk yield, fat percentage, protein percentage and litter size at birth in an extended population of Chios sheep in Cyprus and in an independent population of Chios sheep from Greece.

Methodology

- 1374 Chios ewes (25 flocks)
- Genomic DNA isolation (Macherey-Nagel kit)
- Genotyping → Sequencing (Cyprus)
 - Taqman RT-PCR (Greece)

Statistics for association analysis

- Mixed model association analyses (ASReml3)



5 Cypriot flocks: 742 ewes 20 Greek flocks: 632 ewes

Allelic frequencies

T: 0,54 0,60 (g.2982T)

0,46 (g.2982C) 0,40 (g.2982C)

Genotypic frequencies

0,27 (g.2982TT) 0,37 (g.2982TT)

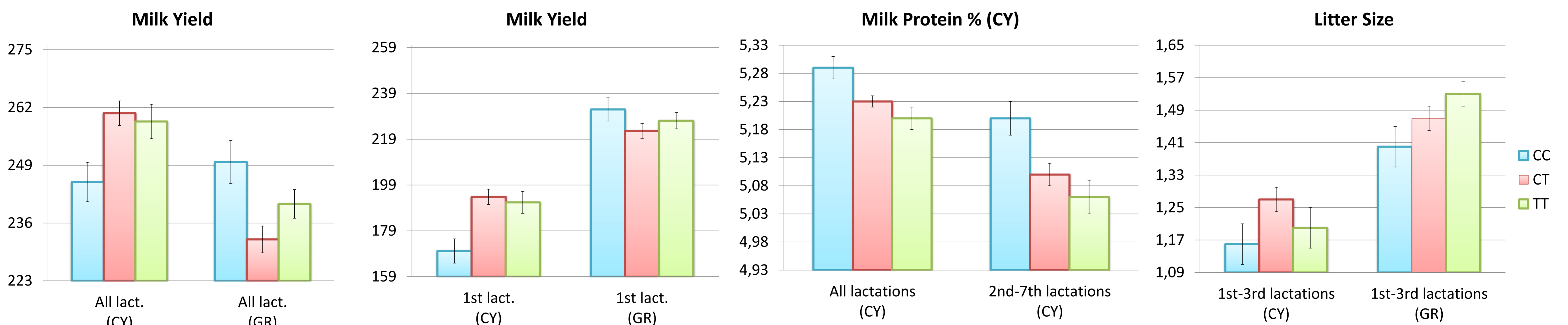
0,54 (g.2982CT) 0,45 (g.2982CT)

0,19 (g.2982CC) 0,18 (g.2982CC)

Deviation from Hardy-Weinberg equilibrium (p=0,0188)

in Hardy-Weinberg equilibrium

Results



	Milk Yield (kg) CY				Milk Yield (kg) GR			
	All lactations	1 st lactation	mean	SE	All lactations	1 st lactation	mean	SE
additive effect	6.81	2.95	10.61	3.56	-4.72	2.9	-2.47	3.1
dominance effect	8.67	3.53	13.02	4.26	-12.71	3.6	-6.86	3.86
%Vp due to SNP	0.62%		2.25%		0.62%		2.26%	
%Va due to SNP	2.53%				2.34%			

	Milk protein % CY			
	All lactations	2 nd - 7 th lactations	mean	SE
additive effect	-0,05	0.02	-0.07	0.02
dominance effect	-0,02	0.02	-0.03	0.02
%Vp due to SNP	1,68%		3.59%	
%Va due to SNP				

	Litter Size CY		Litter Size GR			
	1 st -3 rd lactations	mean	SE	1 st -3 rd lactations	mean	SE
additive effect	0.012	0.04		0.06	0.03	
dominance effect	0,09	0.04		0.00	0.04	
%Vp due to SNP	0.06%		0.43%			
%Va due to SNP	0.34%		4.70%			

Conclusion

The ACAA2 gene is significantly associated with milk yield and protein percentage
There is an effect of the g.2982 SNP on litter size at birth across 1st to 3rd lactation

References

- M. Orford, G. Hadjipavlou, O. Tzamaloukas, D. Chatziplis, A. Koumas, A. Mavrogenis, C. Papachristoforou, and D. Miltiadou, 2012. A single nucleotide polymorphism in the acetyl-coenzyme A acyltransferase 2 (ACAA2) gene is associated with milk yield in Chios sheep. J. Dairy Sci. 95 :3419–3427.
- B. Gutierrez-Gil