The transfer of conjugated linoleic acid and vaccenic acid from milk to meat in goats

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RIASSUNTO – Trasferimento dell'acido linoleico coniugato (CLA) e dell'acido vaccenico (VA) dal latte alla carne nei caprini. *Quindici capretti di razza Sarda sono stati alimentati esclusivamente con latte materno e macellati a circa 50 giorni di età. Il profilo acidico del grasso del latte ha evidenziato un contenuto maggiore di acidi grassi a corta e media catena e in C18:0 e VA rispetto al Longissimus dorsi (LD). Il contenuto in CLA non è stato differente tra latte e carne. L'analisi della regressione fra latte e LD ha evidenziato relazioni positive per la maggior parte degli acidi grassi. La relazione fra VA+CLA c9,t11 nel LD e nel latte è risultata elevata (R^2=0,80). I risultati di questo lavoro hanno evidenziato che il profilo acidico della carne di capretto è dipendente dal profilo acidico del latte con un efficace trasferimento di VA e CLA e con un vantaggioso minore contenuto di acidi grassi a corta catena.*

Key words: kid, goat, milk, meat, fatty acid.

INTRODUCTION – Biomedical studies with animal models have demonstrated that conjugated linoleic acids (CLA) have many positive health benefits. The major sources of CLA in human diets are meat and milk products from ruminants. The content of CLA in ruminant fat depends on the rumen's production of CLA and *trans*-11 C18:1 (vaccenic acid, VA) as bio-hydrogenation intermediates and on VA by D9-desaturase. Kid's meat is a valuable and expensive product. The kids are fed exclusively with the milk of the mothers and they are slaughtered at approximately 30-45 days of age, when they reach a weight of 7-10 kg. Thus the milk component is not degraded by the rumen before it is absorbed from the intestine, and as a result the meat fatty acid (FA) content could be markedly influenced by the fatty acid composition of the milk. The aim of this work is to evaluate the transfer of fatty acids, included CLA and VA, from the milk of the goats to the meat of the kids.

MATERIALS AND METHODS – Fifteen suckling Sarda breed kids were fed exclusively on maternal milk until slaughter. The goats were fed a commercial concentrate (1.2 kg/d) supplemented with 125 g/d of oilseed and hay *ad libitum*. Four milk samples were taken from each goat during the suckling phase. Milk samples (about 100 ml) were collected in the morning before the kids started to suckle. The kids were slaughtered at approximately 50 days of age. Kids were weighted before slaughtering. The cold carcass weight (CCW) was measured after 24 hours of storage at 4°C. Twenty-four hours after slaughter the *longissimus dorsi* (LD) muscle was removed and stored at –80°C until the fatty acid could be analysed. Fat from milk was extracted using the method reported by Secchiari *et al.* (2003). Intramuscular fat from LD was extracted using the Folch method. Fatty acid methyl ester (FAME) from the triglyceride fraction was obtained using the standard FIL-IDF methylation procedure (1999). The chromatographic conditions were described by Nudda *et al.* (2005). The content of each FAME was expressed as a percentage of total FAME. Data were analyzed with one-way ANOVA to assess differences in the FAME profiles of milk and LD muscles and to detect differences in the FAME composition of LD between males and females. The relationship between the FAME content of milk and LD was estimated through regression analysis.

RESULTS AND CONCLUSION – The kids body weight (mean±SD) at slaughtering was 10.2±1.5 for males and 9.2±2.4 kg for females. The CCW was 6.6±1.0 kg for males and 5.8±1.6 for females. The FA profile of the milk and the LD are reported in Table 1. The milk FA profile, included VA and CLA, agrees with the results reported by Chilliard *et al.* (2003). In LD, the largest proportion of FA was made up of palmitic (C16:0), stearic (C18:0), oleic (C18:1) and linoleic (C18:2) acids, with C18:1 the most abundant. The C16:0 content in the muscle of suckling kids was lower, and C18:1 and C18:2 higher, than reported by Potchoiba *et al.* (1990). There was no consistent variation between males and females in almost all fatty acids analyzed (data not presented) with the exception of CLA content (1.05 *vs.* 0.63%; $P<0.05$). In the LD of suckling kids the content of VA was lower and CLA higher than those usually observed in the meat of various ruminant and non-ruminant species (Raes *et al.*, 2004). Todaro *et al.* (2004) analysed the CLA content of pelvic fat in suckling kids, and his results were lower than our values. This may be due either to the different tissue analyzed or to the different milk composition of the mothers. As expected, the FA profile of LD when compared to milk showed a markedly lower content of short-medium FA (C6–C14) and, consequently, an overall higher proportion of long FA, with the exception of C18:0 and VA. Goat milk fat is characterized by its high C4 – C14 FA content. This is used for energy metabolism by the kids. The lower C18:0 and VA contents in LD may be due to desaturase and isomerase activity in the muscle tissues. Regression analysis found a positive relationship between FA in milk and in meat for most of the FA. The relationship between the percentage of VA+CLAc9,t11 in LD (Y) and in milk (X) was: $Y = 0.75 + 0.31X$ ($R^2 = 0.80$). This result confirms that long chain FA' s in meat with a beneficial nutritional value, such as VA and CLA, also depend on the FA composition of the milk.

In conclusion the results of this experiment found a lower content of short-medium chain FA in meat and an efficient transfer of VA and CLA from milk to meat. This enhanced the organoleptic and nutritional characteristic of kid's meat.

Table 1. Fatty acid profiles (% of total FAME) in milk of goats and in *Longissimus dorsi* (LD) of suckling kids.

	Milk	SE	LD	SE	P
C6-C14:0	24.67	0.53	4.72	0.99	**
C16:0	21.60	0.38	20.05	0.70	NS
C16:1	0.50	0.04	1.32	0.07	**
C17:0	0.59	0.02	0.59	0.03	NS
C17:1	0.20	0.02	0.38	0.03	**
C18:0	15.98	0.48	13.05	0.90	**
C18:1 t11	3.20	0.43	1.20	0.80	*
C18:1 c9	22.80	0.56	28.80	1.04	**
C18:2 c9,c12	3.71	0.21	12.14	0.39	**
C18:3	1.08	0.08	1.14	0.16	NS
CLA c9,t11	1.11	0.13	0.78	0.24	NS
CLA total	1.65	0.15	1.35	0.28	NS
C20:5 (EPA)	0.07	0.03	1.12	0.05	**
C22:6 (DHA)	0.08	0.04	1.09	0.07	**

*P<0.05; **P<0.01; NS = not significant

ACKNOWLEDGEMENTS – Work funded by MIPAF. The authors are grateful to Dr. G. Antonio Carboni of the Istituto Zooprofilattico Sperimentale della Sardegna and to Antonio Fenu and Gesumino Spanu for their invaluable assistance.

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