



Effects of feeding system on growing lamb performance and on macronutrients, alpha tocopherol and fatty acids meat content

S. Spada, M. Fiori, M. Addis, N. Fois, M. Sitzia

AGRIS Sardegna, Dipartimento per la Ricerca nelle Produzioni Animali, 07040 Olmedo, Italy



Introduction

Characteristics of lamb carcasses produce in Mediterranean dairy system are unique: lamb meat originates from dairy ovine breed and lambs are slaughtered very young, after a suckling period of 30 days, during which are fed almost on milk.

In Sardinia, suckling lamb, when slaughtered between 7 and 15 kg of live weight, is protected by the Geographical Indication (IGP)



CONSORZIO TUTELA
**AGNELLO
DI SARDEGNA**
CON.T.A.S.



Nevertheless when Sarda breed is crossed with meat breed, it can also produce heavier carcasses.

Introduction

Inside the human diet meat and meat products are currently considered unhealthy as they are a major source of fat and especially of saturated fatty acids, which are responsible for the increased risk of coronary heart diseases

However

Meat is a good source of:

- Essential amino acids
- Fat-soluble vitamins (alpha tocopherol/Vit. E)
- B-complex vitamins
- Minerals

Lipids in ruminant meat and meat products are rich in:

- essential fatty acids (linoleic acid and linolenic acid)
- polyunsaturated fatty acids ω 3 (PUFA ω 3)
- conjugated linoleic acids (CLAs)



Agris Agenzia regionale per la ricerca in agricoltura



Introduction

Animal diet can play a significant role in improving meat quality in terms of nutraceutical compounds, beneficial to consumer health.

In fact the composition of body fatty acids are linked to the respective fatty acid content in the feed offered, though in ruminants rumen biohydrogenation has a considerable impact in reducing PUFA concentrations.



Agris Agenzia regionale per la ricerca in agricoltura



Objective

The aim of the present study was to compare on Sarda x Ile de France lambs the effect of three different dietary treatments on:

- o growth performance
- o carcass characteristics
- o meat quality (macronutrients, α -tocopherol and fatty acid content)



Agris Agenzia regionale per la ricerca in agricoltura



Materials and methods: animals and feeding treatments



43 Sarda x Ile de France lambs (21 ± 3.3 Kg), after a suckling period of 58 days, were randomly assigned to one of three dietary treatments:

- PL** (pasture lambs, 15 animals), fed at pasture on italian ryegrass sward for 8h/day and supplemented with hay (87 g DM/head day) and commercial concentrate (260 g DM/head day);
- HL** (housed lambs, 14 animals), fed with alfa alfa hay (610 g DM/head day) and commercial concentrate (522 g DM/head day);
- TL** (total mixed ration lambs, 14 animals) fed with a total mixed ration based on hay, maized silage, concentrate, beet pulp and soya bean meal (365, 252, 183, 183, 131 g DM/head day, respectively).

All diets offered were iso-energetic (0.95UFL/Kg of DM) and isoproteic (18g/100g DM of crude protein)

Agris Agenzia regionale per la ricerca in agricoltura



Materials and methods: sampling and analysis

Animals were weighed weekly and they were slaughtered at 125 days of age. The carcass weight was recorded after 24h at 4°C and *M. Longissimus dorsi* was taken for chemical analysis and intramuscular fatty acid (FA) composition.

Chemical analysis performed were as follows:

- ✓ Dry matter, fat, ash, protein (ASPA indications 1996)
- ✓ α -tocopherol and cholesterol by HPLC (Panfili et al. 1994 and Manzi et al. 1996).

Intramuscular fatty acid composition was determined:

- ✓ Fat extraction (Hamilton et al. 1992);
- ✓ Fatty acids transmethylation (Chin et al. 1992);
- ✓ Fatty acids separation by GC (Addis et al., 2009).

To evaluate the effect of treatments all data were analysed by GLM (General Linear Model, $\alpha = 0.05$) using Minitab statistical package, release 15 (Minitab Inc., USA).

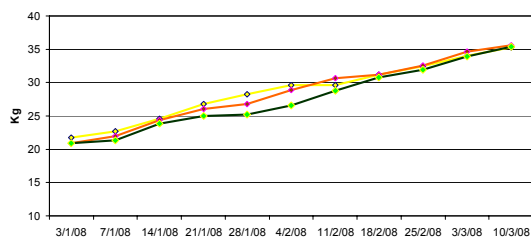


Agris Agenzia regionale per la ricerca in agricoltura



Results: Effects of feeding treatments on lamb weight

PATTERN OF LAMB WEIGHT (Kg) RECORDED WEEKLY DURING THE TRIAL



TL HL PL



Results: Effects of feeding treatments on slaughter performance

	Treatments			SEM	Effect feeding system
	TL	HL	PL		
Weaning weight(kg)	21.7	20.9	20.9	0.50	ns
Slaughter weight (kg)	35.3	35.6	35.4	0.70	ns
Daily weight gain (kg head ⁻¹)	0.203	0.218	0.216	0.01	ns
Cold carcass weight (kg)	16.8	17.4	17.8	0.36	ns
Cold carcass yield(%)	47.4 ^b	49.0 ^a	50.2 ^a	0.32	***
pH at 24 hours	5.76	5.69	5.73	0.02	ns

The feeding treatments did not affect lambs' growth and slaughter performance except for the cold carcass yield that resulted lower in TL than in PL and HL treatment

Results: Chemical composition of lambs meat

	Treatments			SEM	Effect feeding system
	TL	HL	PL		
Dry Matter (%)	24.47 ^b	24.94 ^{ab}	25.36 ^a	0.15	*
Fat (%)	2.22	2.06	2.14	0.15	ns
Ashes (%)	1.17	1.19	1.20	0.01	ns
Protein (%)	21.2 ^b	21.7 ^{ab}	21.9 ^a	0.10	*
Alpha tocopherol (µg/g of meat)	0.5 ^b	0.7 ^b	3.4 ^a	0.33	***
Cholesterol (µg/g of meat)	629	643	679	12.0	ns

Meat of lambs reared on pasture (PL) showed a significantly higher content of dry matter and protein compared to that of lambs from TL groups.

Meat from grazing lambs is characterised by a higher content of alpha tocopherol than that of HL and TL groups.

Dietary treatments had no significant effect ($P>0.05$) on meat fat, ash and cholesterol content.

Results: Fatty acid composition (mg/g of fat) of intra muscular fat

FAME (mg/g fat)	Treatments			SEM	Effect of feeding system
	TL	HL	PL		
C18:2 9c,12c (ω 6)	46.2 ^a	48.1 ^a	38.1 ^b	1.59	**
C18:3 9c,12c,15c (ω 3)	8.4	8.6	9.5	0.41	ns
C18:2 11t 15c	0.95 ^b	1.38 ^b	2.76 ^a	0.22	***
C18:1 11t	7.9 ^b	8.5 ^b	17 ^a	1.0	***
CLA 9c,11t	2.7 ^b	3.1 ^b	4.5 ^a	0.22	***
SFA	323	325	317	4.0	ns
MUFA	292	310	308	7.0	ns
PUFA	85	91	83	3.0	ns
UFA	377	401	391	7.8	ns
PUFA/SFA	0.26	0.28	0.26	0.01	ns
ω 3-PUFA	15.2	16.7	16.8	0.93	ns
ω 6-PUFA	60.0 ^a	62.9 ^a	48.2 ^b	2.39	**
ω 6/ ω 3	4.01 ^a	3.91 ^a	3.01 ^b	0.19	*

Grazing treatment (PL) produced a significantly lower fat content of linoleic acid (C18:2 9c 12c, $P < 0.01$) respect than that of housed lambs (HL) and total mixed ration lambs (TL).

Feeding to pasture leads to a higher content of CLA 9c 11t compared to the other treatments (HL and TL).

The lowest linoleic acid content from PL lambs determined lower content of ω 6-PUFA ($P < 0.01$) and a lower ω 6/ ω 3 ratio ($P < 0.05$) than TL and HL groups.

Conclusions

Meat lamb production obtained from grazing lambs could be a chance for increasing the income of dairy farm achieving a diversification of livestock production.

In growing lambs pasture represents a tool to improve meat quality in terms of healthiness thanks to:

- high α -tocopherol content that improve meat nutritional value, its quality characteristics and overall, extend the products shelf-life reducing lipid oxidation and improving meat colour during retailing;
- low ω 6/ ω 3 ratio due to lowest linoleic acid content in intramuscular fat. This ratio resulted below 4 as recommended by Department of health.