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Effects of non-structural carbohydrate levels of diet on milk yield of primiparous Sarda ewes

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RIASSUNTO – Effetti dei livelli di carboidrati non strutturali nella dieta sulla produzione di latte di pecore Sarde primipare – *Un mese prima del parto 30 pecore primipare di razza Sarda sono state divise in due gruppi e alimentate con due diete isoproteiche ma a diverso contenuto di carboidrati non strutturali (NSC). Venduti gli agnelli, è stata controllata mensilmente la produzione quanti-qualitativa di latte individuale. Dai risultati ottenuti è emerso che il gruppo alimentato con la dieta a minor contenuto di NSC ha presentato produzioni maggiori (P<0,05) di latte sia reale (996,2* vs *899,8 kg/d) che corretto in funzione del contenuto di grasso e di proteine (FPCM, 979,6* vs *877,7). Non sono emerse differenze tra i parametri relativi alla composizione chimica del latte.*

KEY WORDS: Sarda ewes, milk production, non-structural carbohydrates.

INTRODUCTION – In recent decades Sarda sheep have spread almost throughout Italy due to their high milk yield aptitude. Genetic improvement has contributed greatly to increase production that in 1999 was 137 litres in 110 days of milking in primiparous ewes (Sanna *et al.*, 2000). Knowledge of dairy sheep rationing has also improved apace, with benefits for performance of bred animals. The aim of the present manuscript is to contribute to the study of this subject, evaluating the effect of non-structural carbohydrates (NSC) diet contents on milk yield and quality.

MATERIAL AND METHODS – The study was carried out on a Sarda sheep farm situated in the province of Caserta where the animals were raised in the stall system. The study concerned 30 pregnant sheep, for which single births had been diagnosed by echograph. One month before lambing, they were divided into two groups, homogeneous for predicted date of birth and body weight (43.8±3.7 kg). The diets, isoproteic, consisted (% DM) of maize silage (35), cut oat hay (30) and concentrates (35) differing in the groups: group A received a commercial concentrate while the other a mix of concentrate (14), corn meal (13.4) and soybean meal (7.6) to differentiate the NSC contents while maintaining the same crude protein concentrations. Table 1 shows the chemical and nutritional characteristics of the diets estimated from those determined (ASPA, 1980; Sniffen *et al.*, 1992) on each constituent. The nutritive value was estimated from INRA (1988) indications. Diet A contained less NSC (~ 36 vs 40%) and less nutritive value (0.82 *vs* 0.90 Milk FU/kg DM). After lambing due to complications two animals in A group and three in B were excluded. Under the ration scheme indicated in Table 2, different quantities of DM according to body weight were administered twice daily as TMR. The daily feed residues, consisting only in hay, were always negligible. The lambs were weighed at the birth and at sale to estimate the body weight gain during suckling (Poujardieu, 1969). Milk quality and yield were monitored, until the dry period (end of July 2002) individually and monthly, from early April when, after the lambs were sold, the ewes were milked twice a day. After production measurements, individual samples representing daily production were collected. Following ASPA (1995) procedures, they were used to determine chemical composition and contents of different protein fractions. Finally, with FOSSOMATIC 90 somatic cell count (SCC) was determined.

Table 1. Chemical and nutritional characteristics of compared diets.

		A	B
DM, %		69.02	68.97
Crude protein,	% DM	14.06	14.05
Ash,	"	8.86	7.68
Ether extract,	"	2.77	2.51
NDF,	"	40.74	38.59
ADF,	"	26.06	24.49
ADL,	"	2.87	3.10
NDIP,	"	2.37	2.75
Starch,	"	20.74	26.10
NSC,	"	35.94	39.92
Milk FU/kg DM	"	0.82	0.90

Vitamin integration/kg of concentrates: A 40000 UI; D_3 4000 UI; E 85 mg; B_1 4 mg; B_2 4 mg; B_{12} 0.05 mg; K_3 10 mg; PP 200 mg; Pantotenic acid 6 mg; Colin 800 mg. NSC = 100 – [(NDF-NDIP) + CP + Ash + Ether Extract]

From the recorded milk yield the amount of corrected milk at 6.5% of fat and 5.8% of protein (FPCM) was calculated using the equation reported by Serra *et al.* (1998). The results were processed, after logarithmic conversion of SCC, by GLM procedure of SAS (2000), following the model:

$$y_{ijk}=\mu+D_i+P_j+DxP_{ij}+\varepsilon_{ijk}$$

where: y_{ijk}=each observation; μ=general mean; D_i=diet effect (i = 1, 2); P_j=effect of jmo months of milking (j = 1,..5); DxP_{ij}=interaction diet x months in milk; ε_{ijk}=error.

Table 2. DM administered to the animals by days from lambing.

Period		DM, % BW
Before lambing		2.2
Days from lambing:	since 5^{th}	3.7
	8^{th} – 14^{th} and 95^{th} –118^{th}	4.5
	15^{th} - 94^{th} and 119^{th} – 148^{th}	5.0

RESULTS AND CONCLUSIONS – Table 3 shows the production and the average results of analytical determinations on individual milk samples. Group A, fed the diet with lowest NSC contents, showed significantly higher production (observed and FPCM) than the other (P<0.05). No significant differences were found between % concentrations of fat, crude protein, casein, non-protein nitrogen (NPN) and soluble proteins (SP) of milk produced by the two groups. NPN, SP and casein represent on average 3, 18 and 79% of crude protein, respectively. While the latter two values are in line with those indicated in Sarda ewes by Pulina (1990), the NPN concentration is less than that indicated by the above author (3 *vs* 5%). The average concentration of somatic cells was very similar in the two groups and always less than 1 million per ml. As expected, production decreased during milking from 1188 g/d of FPCM at the first month of milking to about 600 at dry-off. The % contents of fat, CP, casein, SP and SC showed the opposite trend milk. Yield during suckling (estimated from body weight gain of lambs) and the first month of milking were the highest (1444 *vs* 1224 g/d) in the group that received the diet with the highest NSC content. However, from the 2nd month of milking group A showed higher yield. Our results are in line with those of Cannas *et al.* (1998). Indeed, it seems that in the first lactation period, probably due to the negative energy balance of sheep, the NSC were used for milk production while, once the deficit had been plugged, they stored body fat deposits.

Table 3. Milk yield and quality.

	Yield g/d	Fat %	CP %	FPCM g/d	Casein %	NPN %	SP %	SC $\log_{10}$
				Diet effect (D), DF = 1				
A	996.2^{a}	6.69	4.99	979.6^{a}	3.98	0.15	0.88	5.32
B	899.8^{b}	6.71	5.02	877.7^{b}	3.93	0.16	0.92	5.29
				Sampling effect (S), DF = 4				
1	1334.4^{A}	5.59^{E}	4.67^{E}	1187.9^{A}	3.76^{B}	0.17^{A}	0.73^{Bb}	4.46^{B}
2	1191.6^{B}	6.14^{D}	4.76^{D}	1123.7^{A}	3.90^{B}	0.13^{C}	0.73^{Bb}	4.61^{B}
3	940.8^{C}	6.36^{C}	4.96^{C}	910.0^{B}	3.88^{B}	0.16^{Aab}	0.88^{Ba}	5.78^{A}
4	750.9^{D}	6.93^{B}	5.15^{B}	740.4^{Ca}	3.92^{B}	0.14^{BCb}	1.08^{A}	5.91^{A}
5	532.0^{E}	8.48^{A}	5.48^{A}	614.4^{Cb}	4.31^{A}	0.13^{C}	1.08^{A}	5.76^{A}
				Significant				
D	*	NS	NS	*	NS	NS	NS	NS
S	**	**	**	**	**	**	**	**
I	NS	*	*	NS	**	NS	NS	NS
				Variance of error (DF = 115)				
	61274	0.47	0.22	51063	0.001	0.158	0.04	0.37

*I=interaction DxS. A, B and **=P<0.01; a, b and *=P<0.05; NS=non significant.*

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