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Seasonal effect on the technological and chemical traits of sheep "ricotta Pistoiese" cheese

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ABSTRACT – The "ricotta di pecora pistoiese" is comprised in the list of the traditional agro-food products of Tuscany and the relative PDO (Protected Designation of Origin) has be required. This research, analysing the making process, aimed to evaluate its chemical and nutritive traits as influenced by some factors, with particular attention to the season. During the four seasons of two consecutive years, the making process of ricotta cheese was monitored in four farms for a total of 32 control-days. Yields, chemical composition and fatty acid profile of fat were determined. The amount of milk added to whey influenced the fat and protein content and the yields at 0 and 24 hours. Season affected only the protein content, higher in winter and spring. Fatty acid composition was influenced strongly by the season being the ricotta cheese of summer richer of monounsaturated and polyunsaturated FA than that of autumn and winter, probably due to the feeding regimen based mainly on fresh grass.

Key words: Ricotta cheese, Sheep, Quality, Season effect.

Introduction – Ricotta cheese is a secondary product in the cheese making and, generally, have low market price. Therefore, little attention is attribute to study its productive technology and valorisation. However, in the local reality of the "Appennino pistoiese" country, the sheep ricotta cheese, produced with artisanal technology, is requested and used in typical culinary recipes or as dessert and dairy farms sell it directly, immediately after the making. Thus the "ricotta di pecora pistoiese" is comprised in the list of the traditional agro-food products of Tuscany (D. Lgs. 173/98 and DM Mi.P.A.F. 350/99), since the particular making technology determines its valuable sensorial traits, and the relative PDO has be required. The milk is produced by ewes of Massese breed which can produce along the entire year (Pugliese *et al.*, 2000) and allows to obtain cheese in all the seasons. This work aimed to analyse the productive process and to evaluate chemical and technological traits of this "ricotta cheese" as influenced by some factors with particular attention to the season.

Material and methods – Experiment was conducted in 4 farms located on mountain of Pistoia and belonging to the "Montagne e valli di Pistoia" Consortium, which adopt the cheese-making methodology using raw milk. The ricotta production was analysed during two years in 32 different days (controls) (16 per year; 1 per season/year/farm). At each control, yield at 0 and 24 hours from making was recorded and then samples were taken for subsequent analysis. All samples were analysed for the chemical composition. On the 16 samples of the 2nd year, fatty acid composition was also determined by extracting the fat with a modified Folch method (Folch *et al.*, 1957). The amount of whole milk added to the whey and the temperatures during the various phases of the cheese making at each control were summarized in table 1. Some of these parameters were different among the farms but all parameters

Table 1. Characteristics of the productive process.

		Mean	Dsr	Significance	
				Farm	Season
Added milk	%	14.02	5.93	**	ns
Temperature at milk addition	°C	51.09	4.63	**	ns
Temperature at curdle out	°C	82.12	1.68	ns	ns
Temperature at salt addition	°C	80.79	3.15	ns	ns

***=P<0.01.*

Table 2. Chemical composition (% DM) yield (% of total milk used) of ricotta cheese. Means estimated at average value of "added milk" (14.71%).

	Season				Dsr	Significance		
	Autumn	Winter	Spring	Summer		Season	Farm	Added milk
Dry matter	36.52	37.36	35.86	38.36	4.89	ns	ns	ns
Protein	23.44 b	26.69 a	26.28 a	23.37 b	2.85	*	**	*
Fat	54.85	51.47	49.49	55.92	8.76	ns	ns	*
Ash	2.14	2.77	2.78	2.36	0.64	ns	ns	ns
Yield 0 h	15.08	19.81	16.60	17.39	4.31	ns	ns	**
Yield 24 h	11.28	15.58	13.05	13.45	3.40	ns	ns	**

**=P<0.05; **=P<0.01.*

were relatively constant along the four seasons. Data were analysed by GLM procedure (SAS, 2007) using in the model farm and season as discrete effects and added milk percentage as covariate.

Results and conclusions – Chemical composition and yields of ricotta cheese are reported in table 2. As expected, the addition of milk to whey had important effect on composition and yield while farm affected only the protein content. Season effect influenced only the protein content which had the lowest values in summer and autumn while, due to the high variability, the differences in fat content and in yields never attained statistic significance. The same contents related to wet basis (not tabulated) were not influenced by the considered factors. In comparison with analogous sheep cheeses reported in other work (Contarini *et al.*, 2002), the Pistoiese ricotta cheese appears richer of fat, probably because of the making technology but also for the original milk which seems very rich in fat and protein content (Giustini *et al.*, 2008). Fatty acids composition (Table 3) was influenced by the season while minimum effect had the farm. From the general picture of the acidic profile we can observed that the ricotta cheese of summer was richer of monounsaturated and polyunsaturated FA than that of autumn and winter. The other two seasons had an intermediate behaviour even if the spring product had close similar composition to that of summer. Probably, this result is due to the feeding regimen based mainly on fresh grass of pasture during the spring-summer period.

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Table 3. Fatty acid composition (% of total FA) of ricotta cheese.

	Season				Dsr	Significance	
	Autumn	Winter	Spring	Summer		Farm	Season
$C_{8:0}$	0.69	0.68	0.58	0.44	0.26	ns	ns
$C_{10:0}$	7.23	6.98	5.96	4.59	1.54	ns	ns
$C_{10:1}$	0.14	0.16	0.12	0.11	0.03	ns	ns
$C_{12:0}$	5.16a	5.33a	4.37ab	3.33b	0.97	ns	*
C_{14} iso	0.15	0.20	0.19	0.15	0.04	ns	ns
$C_{14:0}$	12.78ab	13.70a	11.98bc	10.96c	0.93	ns	**
$C_{14:1n5}$	0.14	0.21	0.15	0.17	0.04	ns	ns
C_{15} iso	0.31	0.37	0.33	0.38	0.10	ns	ns
C_{15} anteiso	0.49a	0.66b	0.69b	0.64b	0.05	*	**
$C_{15:0}$	0.97a	1.39b	1.34b	1.30b	0.14	ns	**
$C_{16:0}$ iso	0.31	0.39	0.36	0.31	0.05	ns	ns
$C_{16:0}$	28.66	30.98	28.46	28.05	1.70	ns	ns
$C_{16:1n7}$	0.74a	1.02bc	0.95b	1.16c	0.12	ns	**
C_{17} iso	0.48	0.54	0.53	0.60	0.06	ns	ns
C_{17} anteiso	0.38a	0.50b	0.57b	0.49b	0.05	ns	**
$C_{17:0}$	0.71a	1.02b	1.00b	0.83ab	0.14	ns	*
$C_{17:1}$	0.14a	0.20b	0.17ab	0.25c	0.03	ns	**
$C_{18:0}$	13.41	10.32	11.85	12.46	2.14	ns	ns
$C_{18:1n9n7}$	21.70	20.54	24.63	25.79	2.81	ns	ns
$C_{18:1}$	0.40	0.22	0.37	0.62	0.21	ns	ns
$C_{18:2}$	0.10a	0.06a	0.11a	0.20b	0.05	ns	*
$C_{18:2}$ conjugated	0.36a	0.24a	0.40a	1.08b	0.19	ns	**
$C_{18:2n6}$ *cis*	2.65	2.52	2.62	3.11	0.34	ns	ns
$C_{18:2n4}$	0.16a	0.09a	0.19a	0.44b	0.11	ns	**
$C_{18:3n3}$	0.77	0.69	0.95	1.11	0.24	ns	ns
$C_{20:0}$	0.26	0.25	0.26	0.31	0.07	ns	ns
$C_{20:1n11}$	0.15	0.13	0.23	0.32	0.116	ns	ns
$C_{20:4n6}$	0.10	0.10	0.14	0.15	0.048	ns	ns
$C_{22:0}$	0.06	0.11	0.10	0.12	0.03	ns	ns
Total UFA	27.75ab	26.31a	31.20bc	34.84c	2.99	ns	**
Total MUFA	23.61ab	22.61a	26.78bc	28.75c	2.87	ns	*
Total PUFA	4.14a	3.70a	4.42a	6.10b	0.55	ns	**

*=P<0.05; **=P<0.01; Other FAs determined (<0.1%): $C_{11:0}$; $C_{12:1}$; C_{13} iso; $C_{13:0}$.

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