

# Effect of period of milk production and ripening on quality traits of Asiago cheese

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**ABSTRACT:** After 6 and 12 months of ripening, samples of *Asiago d'Allevo* were analyzed for quality traits. Cheeses were produced during 3 periods using milk from cows fed a total mixed ration (TMR, May) or grazing on alpine pasture (AG) in early (July) and late (Sept.) summer. Data were submitted to ANOVA considering ripening, milk production period and farm as main effects, and whole cheese weight as covariate. During ripening, pH of AG-cheese was significantly lower than that of TMR-cheese; crude fat and protein significantly increased. According to period, July-samples showed the significantly lowest value of dry matter (DM), maybe due to a lower crude fat content; however, variability in skimming method could have altered proximate composition. No texture differences were found, although increasing weight of whole cheese significantly reduced max shear force as result of a lower DM content. Lightness (L\*) and yellowness (b\*) significantly decreased during ripening. AG feeding system caused a lower L\* and higher b\* than TMR one, probably as a consequence of a different amount of milk pigments. Cheese varied also within AG season: Sept.-samples showed the lowest L\* value and the highest b\*.

**Key words:** Asiago cheese, Ripening, Quality traits, Alpine grazing.

**INTRODUCTION** – Asiago cheese is a “Protected Denomination of Origin” (PDO) product of the north-eastern regions of Italy marketed in round blocks weighing around 8 kg that could be manufactured with two production methods according to the length of ripening. The so-called ‘*Asiago d'Allevo*’ variety is produced with skimmed raw milk and the length of maturing period varies from 3 to 18 (and even more) months. Ripening of cheese is a very complex and slow biochemical process that influences chemical parameters and organoleptic properties such as texture and colour (Dufossé *et al.*, 2005). Reological traits are also related to milk quality, with regard to feeding system of cows, especially in the comparison between TMR and pasture (Elia *et al.*, 2006). Thus, a characterization of Asiago is still a challenge for producers, including studies of the changes that occur during ripening and intravarietal comparison. The study aimed at evaluating the effect of alpine grazing and ripening length on proximate composition, texture and colour of *Asiago d'Allevo* cheese.

**MATERIAL AND METHODS** – Milk was obtained from three dairy cows herds from alpine farms placed in Asiago plateau (Vicenza, Italy), during three periods characterized by two feeding systems: May, 25 (total mixed ration-TMR); July, 15 and September, 5 (pasture and concentrate supplement-alpine grazing, AG). Cheese (n=36) was manufactured with raw milk: half overnight skimmed in large-surface steel containers and half coming from morning milking, mixed together. After microbial culture inoculation, calf rennet was added at a temperature of 37°C. The gel mass was then finely cut and temperature still raised to 45-48°C. The curd was finally extracted and placed in the moulds for forming. The pre-salting step was conducted for 12 to 48h at 13-15°C and 85% of relative humidity and salting by means of immersion in liquid brine (20±2 °Bé). Cheeses were ripened for 6 and 12 months (10±2°C and 80±5% of relative humidity). Water activity (a<sub>w</sub>) was measured by Aqualab CX-2 tool (Decagon, USA); pH was determined after sample homogenization in distilled water (1/10 w/v) (pHmeter Knick 910 equipped with Metler Toledo Electrode) and results were expressed as the mean value of 3 measurements representative of the cylindrical shape of the cheese. Cheese samples (50 g) were homogenised and analyzed for proximate composition

(AOAC, 2000). After cutting cube-shaped samples (1 cm<sup>2</sup>; 3 cm of length) near the upper surface of the cheese, tenderness was performed using a TA-HDi texture analyzer (Stable Micro Systems, Surrey, UK) with a crosshead speed of 2 mm s<sup>-1</sup>. Texture data were reported as maximum shear force (MSF) and working shear force (applied force from starting point till to MSF). Colour was assessed after exposure to air (1h, 2±2°C) on 5 consecutive sites from the rind to the centre by a spectrophotometer (C508, Minolta Camera Co., Osaka, Japan) set on illuminant D65 (standard daylight) and with a 10° observer. Data were expressed according to CIE L\*a\*b\* colorimetric system. Statistical analysis considered ripening (R; 2 levels) and milk production period (P; 3 levels) and farm (F; 3 levels) as main effects, R×P interaction and whole cheese weight as covariate. ANOVA was supported by the GLM PROC of SAS (1999). When period was significant (P<0.05), LSM were generated and separated using the PDIF option along with SCHEFFE adjust.

**RESULTS AND CONCLUSIONS** – Since R×P interaction never gave significant effect, in Table 1 are reported the effects of ripening and period of milk production. pH significantly decreased as the cheeses aged, maybe due to a residual activity of lactic acid bacteria (LAB). A slightly increase in pH values from surface to centre of cheese was observed both at 6 and 12 months of ripening. Despite the lower lactose content of AG-milk in comparison with TMR-one, pH of AG-cheese was significantly lower than those of TMR thesis, maybe as a consequence of the higher total microbial count of raw milk leading to a more intensive metabolic activity of LAB fraction.

Table 1. Effect of ripening (months), period/feeding system of milk production and cheese weight covariate (b) on pH, proximate composition (% wet weight), texture and colour.

		Ripening		Period/Feeding system			b	DSR
		6	12	May, 25	July, 15	Sept., 5		
				TMR	Alp. grazing	Alp. grazing		
pH		5.79 <sup>a</sup>	5.71 <sup>b</sup>	5.83 <sup>a</sup>	5.70 <sup>b</sup>	5.73 <sup>b</sup>	..0.03	0.07
Water activity		0.93 <sup>A</sup>	0.90 <sup>B</sup>	0.91 <sup>B</sup>	0.91 <sup>B</sup>	0.93 <sup>A</sup>	..0.01	0.01
Proximate composition								
Dry matter	%	68.0 <sup>B</sup>	71.2 <sup>A</sup>	69.9 <sup>a</sup>	68.8 <sup>b</sup>	70.0 <sup>a</sup>	-0.77**	0.7
Crude protein	%	29.6 <sup>B</sup>	31.3 <sup>A</sup>	30.0 <sup>B</sup>	30.5 <sup>B</sup>	30.9 <sup>A</sup>	-0.13	0.4
Crude fat	%	29.3 <sup>B</sup>	31.1 <sup>A</sup>	31.3 <sup>a</sup>	29.8 <sup>b</sup>	29.6 <sup>b</sup>	-0.72*	1.0
Tenderness§								
MSF	N	17.1	18.9	18.0	17.9	18.1	-2.35*	4.4
WSF	N-mm	14.7	16.1	13.7	16.4	16.2	-0.95	7.2
Colour								
Lightness	L	65.3 <sup>A</sup>	60.7 <sup>B</sup>	65.0 <sup>A</sup>	63.4 <sup>A</sup>	60.7 <sup>B</sup>	0.54	2.3
Redness	a	-1.1 <sup>A</sup>	-1.5 <sup>B</sup>	-2.0 <sup>B</sup>	-1.0 <sup>A</sup>	-0.9 <sup>A</sup>	0.12	0.3
Yellowness	b	12.6 <sup>A</sup>	9.8 <sup>B</sup>	8.3 <sup>c</sup>	12.1 <sup>b</sup>	13.3 <sup>a</sup>	0.32	1.3
Croma	C	12.7 <sup>A</sup>	10.0 <sup>B</sup>	8.6 <sup>c</sup>	12.1 <sup>b</sup>	13.3 <sup>a</sup>	0.30	1.3
Hue	H	95.6 <sup>B</sup>	100.0 <sup>A</sup>	103.6 <sup>A</sup>	95.5 <sup>B</sup>	94.2 <sup>B</sup>	-0.95	1.9
R580-600	%	36.6 <sup>A</sup>	30.4 <sup>B</sup>	35.4 <sup>A</sup>	34.2 <sup>A</sup>	31.1 <sup>B</sup>	..0.72	2.7

§MSF=max shear force; WSF=working shear force. <sup>a, b, c</sup> and \*: P<0.05; <sup>A, B</sup> and \*\*: P<0.01. b = regression coefficient of whole cheese weight (kg) covariate. R<sub>580-600</sub> = % of reflectance between 580 and 600 nm.

Ripening length time significantly affected proximate composition; the increase of dry matter (DM) both as protein and fat during ripening could be simply due to the moisture loss. A significant negative correlation was observed between whole cheese weight (kg) and DM percentage (b=-0.77; P<0.01); in the bigger round block maybe the phenomenon of water evaporation was reduced because of the less favourable surface:volume ratio. Milk production period (TMR vs. AG) significantly affected DM: July-cheese exhibited the lowest value; the decrease of DM content

was related to a lower crude fat content, also observed in September. The highest protein percentage of Sept.-cheese led to a similar DM content in comparison to TMR-cheese. The switch from TMR diet to AG significantly affected milk quality. Despite the decrease in milk production, AG-milk showed a slightly lower crude fat and a similar crude protein content than TMR-milk. However, cheese was produced using skimmed milk obtained with a rather artisan method, so variability in this productive phase might have altered the results in term of proximate composition. No differences in texture properties were observed among experimental thesis. As showed by *b* value ( $b = -2.35$ ;  $P < 0.01$ ), the MSF was negatively influenced by whole cheese weight probably because the greater round block were characterized by a lower DM content, reducing their toughness. According to literature (Dufossé *et al.*, 2005; Pinho *et al.*, 2005), ripening treatment significantly influenced colour, resulting in a decrease of  $L^*$  and  $b^*$  as cheese aged. Cows feeding systems also affected cheese colour. AG-cheese was characterized by lower  $L^*$  value and higher  $b^*$  value than TMR-cheese. Grazing alpine pasture enhanced milk pigments content such as  $\alpha$ -tocopherol and  $\beta$ -carotene (Elia *et al.*, 2006), resulting in a more yellow matter. However, changes in cheese colour could be also related to the biochemical activity of the different microflora of AG-milk compared to TMR-milk. Colour differences were observed also within season of AG, since cheese made with Sept.-milk showed the lowest value of  $L^*$  and the highest of  $b^*$ . Quite a part the different kind and amount of concentrate supplement, these differences maybe attributed to the changes in botanical composition of pasture (i.e. more incidence of *Fabaceae* in Sept.). In conclusion, changes in pH, proximate composition and colour were observed in *Asiago d'Allevo* cheese from 6<sup>th</sup> till to 12<sup>th</sup> months of ripening. The more prominent phenomenon was related to a decrease in  $L^*$  and *croma* (i.e.  $b^*$ ), whereas tenderness did not change. Period/feeding system of milk production also significantly affected chemical and colour parameters in a similar way between ripening treatments.

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