



Effect of some disease stress on cow milk yield and features

F. Piccioli Cappelli, M.G. Maianti & V. Anelli

To cite this article: F. Piccioli Cappelli, M.G. Maianti & V. Anelli (2005) Effect of some disease stress on cow milk yield and features, Italian Journal of Animal Science, 4:sup2, 206-208, DOI: [10.4081/ijas.2005.2s.206](https://doi.org/10.4081/ijas.2005.2s.206)

To link to this article: <https://doi.org/10.4081/ijas.2005.2s.206>



© 2005 Taylor & Francis Group LLC



Published online: 03 Mar 2016.



Submit your article to this journal [↗](#)



Article views: 30



View related articles [↗](#)

Effect of some disease stress on cow milk yield and features

F. Piccioli Cappelli, M.G. Maianti, V. Anelli

Istituto Zootechnica, Facoltà di Agraria, Università Cattolica Sacro Cuore, Italy

Corresponding author: Fiorenzo Piccioli Cappelli. Istituto Zootechnica. Via Emilia Parmense 84, 29100 Piacenza, Italy – Tel: +39 0523 599203 – Fax: +39 0523 599276 – Email: fiorenzo.piccioli@unicatt.it

RIASSUNTO – Effetti indotti da diversi problemi di salute sulla produzione e caratteristiche del latte bovino. 9 bovine con problemi infiammatori sono state divise in due gruppi in funzione del calo di ingestione di alimenti e produzione di latte: 5 non hanno evidenziato alcun calo (IG); 4 un calo marcato (AG). Il latte è stato controllato per 21 giorni prima e 21 dopo l'evidenza dei problemi. In entrambi i gruppi nel periodo di manifestazione dei problemi il tenore in proteina del latte non è variato, l'acidità è diminuita significativamente, mentre le caratteristiche reologiche sono peggiorate e in AG questo si è protratto sino a 7 giorni dopo. A livello delle frazioni proteiche la variazione che parrebbe giustificare questo peggioramento è stata la riduzione della β -caseina, osservata in entrambi i gruppi e solo in AG sino al termine dei controlli. I dati ottenuti confermano che lo stress infiammatorio determina condizioni che modificano le caratteristiche del latte, tra cui anche la frazione proteica, e che le alterazioni sono più marcate in concomitanza di fenomeni di anoressia.

Key words: stress disease, dairy cows, milk features, casein.

INTRODUCTION – In their review, Bertoni *et al.* (2003) have pointed out how in dairy cows milk yield and its characteristics are markedly modified during disease stress (general consequences of any disease). This mainly depends on secretion of cytokines, which determines anorexia, endocrine changes and diversion of some nutrients toward the immune system. The result is a reduced availability of nutrients at blood level, that increases the competition of peripheral tissues for the uptake of blood nutrients. In this situation, noteworthy is the effect of cytokines to redirect the liver protein metabolism toward the synthesis of acute phase protein, with consequent modification of amount of available amino acids (Spurlock, 1997). However, the total effect of cytokines result in a reduction of milk protein yield, and a probable change of milk protein fractions, as well as of titratable acidity and clotting features (Bertoni *et al.*, 2003). The aim of this work was to study the variation of yield, physico-chemical features and protein fractions of milk of dairy cows affected by disease stress.

MATERIAL AND METHODS – 5 dairy cows with health problems (lesions, swollen hock, dermatitis: IG group), and 4 with marked reduction of dry matter intake (DMI) (AG group) were utilised. In all 9 cows the presence of inflammatory stress was confirmed by blood analyses (i.e. increase of aptoglobin and ceruloplasmin) and division into two groups was made on the basis of decrease in DMI and milk yield: nil in IG and marked in AG. Moreover, in AG only, for two cows the DMI reduction was followed by digestive problems (i.e. presence of diarrhoea), but in the 4 cows of AG the DMI recovered with the aid of galenical products. Health problems occurred unexpectedly during lactation, for this reason it was not possible to organize a proper control group, nevertheless the checks carried out at -21 and -7 days were sufficiently far from similar events to be used as control. Moreover, despite the not contemporary occurrence of disease stress, it was possible to compare the data, because the cows were housed in a tied stall barn where T° was maintained between 19-26°C,

humidity between 50-70%, light fixed at 14h and quality of feeds was constant. Cows received the following diet: 20-24 kg of corn silage, 3 kg of chopped alfalfa hay, 2-4 kg of chopped grass hay, 1 kg of concentrate every 3 kg of milk yield. The forages were distributed in 2 meals at 12 h interval (7.30 a.m. and p.m.), while the concentrates were distributed in 8 meals at 3 hour intervals. Daily feed intake and every anomaly (kind, day of occurrence and recovery) were recorded. Dairy cows were milked at 6 a.m. and 4 p.m., the milk was weighed at each milking, and samples of morning milk were collected every 3-4 days for the determination of total protein, lactose, pH, titratable acidity, milk clotting features (clotting time: r; curd firming rate: k20; curd firmness: a30), casein and whey protein fractions, with methods described in ASPA (1996). Data of IG and AG were processed separately using a 2-way ANOVA (GLM of SAS) using cow and time before and after health problem as main factors.

RESULTS AND DISCUSSION – DMI and milk yield pattern confirmed the criteria used to divide the cows; in fact, while in IG a slight reduction was observed, in AG the reduction was significant and did not return to the level pre - health problems (Table 1). Milk lactose was unchanged in IG while decreased significantly in AG, where a concomitant marked increase of somatic cell count was observed (5.62 vs. 3.73 ln(n/μl) P<0.01, on day0 and -3), indicating that the inflammation problems that caused anorexia in cows of AG group, altered the integrity of mammary gland epithelium, without apparent mastitis. Protein content showed a slight decrease in IG while in AG it remained almost unchanged (Table 1).

Table 1. Levels of dry matter intake (kg/d), milk yield (kg/d), protein content (%), milk titratable acidity (°SH/50 ml) and a30 (mm), in dairy cows affected by different health problems.

Days from stress - disease evidence		21	-7	-3	0	+3	+7	+21	MSE
parameters	group								
Dry matter intake	IG	21.5	21.6	21.7	21.1	21.1	21.3	21.5	0.2716
	AG	24.4 c	24.5 c	23.0bc	14.3 a	21.0 b	21.9bc	22.5bc	5.1746
Milk yield	IG	30.0	30.0	29.7	28.5	27.7	27.9	28.9	0.6795
	AG	38.2d	38.4d	37.0cd	21.5a	28.3b	31.3b	33.0bc	10.823
Total protein	IG	3.21	3.20	3.23	3.00	3.14	3.25	3.33	0.0211
	AG	3.05	3.09	3.11	3.05	3.12	3.14	3.22	0.0148
°SH	IG	3.56b	3.76b	3.44ab	3.20a	3.67ab	3.63b	3.53b	0.0362
	AG	3.21bc	3.30c	3.16ab	2.98a	3.22bc	3.23bc	3.37c	0.0241
a30	IG	18.6ab	18.2ab	15.6ab	10.6a	15.3ab	20.3b	18.0a	27.781
	AG	17.5	19.9	19.0	14.8	14.1	15.0	18.1	29.626

a, b, c, d: letters indicate means of the same row different for P<0.05.

Milk titratable acidity (Table 1) decreased significantly on day0 in both groups and in AG a significant reduction was observed also at -3 d, before evident signs of illness; however, in both groups, the recovery was completed at +3 d. In both groups there was a worsening of milk clotting features, as indicated by marked decrease of a30 but significantly only in IG (Table 1); nevertheless, in IG there was slight decrease also at -3 and +3, while in AG the recovery to initial levels took 21 days. The lack of statistical significance of a30 in AG group on day 0 was due to a30 marked increase in one cow, apparently without explanation, as other milk parameters, and in particularly protein content and titratable acidity, were consistent with those of other cows. Main protein fractions are shown in table 2. In IG whey protein contents showed a significant decrease on day 0 and -3, while in AG it remained almost unchanged. In AG α-lactoalbumin decreased on day0 – confirming behaviour of lactose and somatic cell count - and lasting till 7 days after, while in IG the decrease was evident only

on day +3. Among caseins, the main variation observed in both groups was the reduction of β -casein, also before health problems in AG, and lasted till the end of the checks, but with significant difference only in AG on day 0 and +7. The reduction of β -casein did not seem only due to its degradation (i.e. presence of plasmin), as the increase of γ -casein was very slight.

Table 2. Levels of whey protein (% of total protein), α -lactoalbumin (% of whey protein), k-casein, β -casein, α_{s1} -casein, α_{s2} -casein and γ -casein (all as% of total casein) in milk of dairy cows affected by different health problems.

Days from stress disease evidence parameters			-21	-7	-3	0	+3	+7	21	MSE
group										
Whey protein	IG		17.8ab	17.5ab	16.2a	16.2a	17.8ab	18.1b	16.2a	2.0853
	AG		17.7	17.2	17.1	17.9	17.5	17.1	17.3	2.9316
α -lacto- albumin	IG		7.07b	6.48ab	6.31ab	6.41ab	6.08a	6.39ab	6.27ab	0.5846
	AG		6.68	6.63	6.88	6.28	5.88	6.03	6.30	0.7642
k-casein	IG		8.50ab	7.97ab	7.23a	8.53ab	9.26b	9.17b	8.53ab	1.0240
	AG		8.32	7.69	7.58	9.03	8.90	7.52	7.32	3.7225
β -casein	IG		33.1	34.5	35.7	30.6	29.9	30.3	31.5	27.795
	AG		35.6b	34.3b	32.1ab	28.4a	30.1ab	29.3a	30.9ab	19.881
α_{s1} -casein	IG		45.2	45.0	45.1	47.1	48.0	47.5	44.9	21.392
	AG		42.1	44.0	44.1	44.0	44.5	44.7	42.6	11.218
α_{s2} -casein	IG		10.5	9.4	8.62	10.1	8.97	8.15	8.85	3.5028
	AG		11.5	12.1	12.9	11.7	9.89	10.3	12.0	5.6511
γ -casein	IG		1.40	1.12	1.22	1.55	1.84	1.98	2.10	0.7275
	AG		1.30	0.99	1.13	1.82	1.47	1.72	1.67	0.3931

a, b: letters indicate means of the same row different for $P < 0.05$.

As the levels of β -casein decrease, an increase of k-casein (both groups), α_{s1} and α_{s2} -casein (only in IG) were observed, but these variations were always very slight and short-lived.

Our results confirm, as with Bertoni *et al.* (2003), that disease stress strongly alters milk yield and its composition, and that in some situations this could start before the health problems manifest. Moreover, as observed by Remeuf and Hutard (1991), also in a disease stress situation, the worsening of milk clotting features seems mainly due to the decrease of β -casein. However, when stress disease causes marked DMI reduction, milk yield and feature changes are more marked and the recovery could be incomplete.

REFERENCES – **A.S.P.A.**, Commissione di studio su Metodologie di valutazione della produzione quantitativa del latte, 1996. Metodi di analisi del latte delle principali specie di interesse zootecnico. Univ. degli Studi di Perugia. **Bertoni, G.**, Calamari, L., Maianti, M.G., 2003. Factors of welfare status in dairy cows and the relationship with milk features. pp63-94 in 38^o Simp. Intern. Zootecnia: Milk & research. **Remeuf, F.**, Hurtaud, C., 1991. Liaisons entre les caracteristiques physico-chimiques des laits et leur aptitude fromagere. In: "Qualité des laits a la production et aptitude fromagère". INRA Rennes 23-24 gennaio. **Spurlock, M.E.**, 1997. Regulation of metabolism and growth during immune challenge: an overview of cytokine function. *J. Anim. Sci.* 75:1773–1783.