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Change in feeding strategies affects intake, rumination behavior, ruminal pH pattern, productions and immunity in dairy cows

Part 1: Effect of the presence/absence of long hay and the administration of ad libitum or restricted TMR

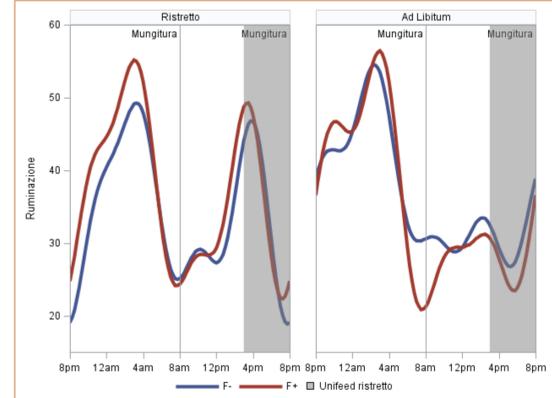
Objective: The objective of this study was to investigate in high producing cows diets, the effects of presence or absence of long hay and the administration of ad libitum or restricted TMR on feed intake, digestibility, ruminal pH and productive performance.

M&M: Treatment one(24hH+): feed available at the feed bunk for 24h, with long grass hay; treatment two(24hH-): feed available at the feed bunk with no long grass hay; treatment three(19hH+): restricted TMR(19h/d), with long grass hay; treatment four(19hH-): restricted TMR, with no long grass hay. Eight multiparous Holstein cows were assigned to a 4 x 4 Latin square design, with 3 weeks adaptation and 1 week of collection. Dry matter intake, milk production and quality, and rumination time, measured by collar, were measured daily. Rumen pH was measured continuously by ruminal bolus. Rumen liquor was collected two times point and analysed for ammonia and VFA. Fecal samples were collected at multiple time points and then weekly averaged. Diets and feces were analyzed for aNDFom, ADF, ADL, uNDF₂₄₀ and pdNDF, in order to calculate total tract fiber digestibility. During the experimental week of each period, diets were sampled daily and analyzed for chemical composition. All data were statistically analyzed with a factorial arrangement of treatments using the MIXED procedure of SAS(v9.1).

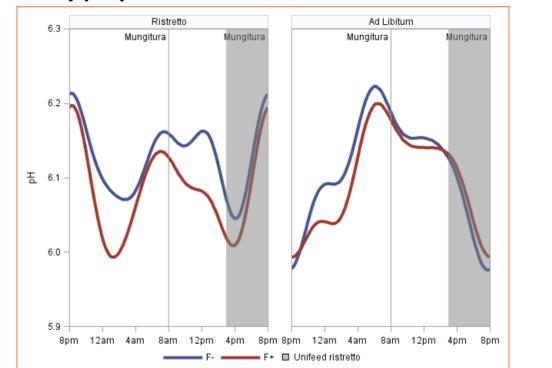
Results: The results obtained showed the diet available for 24 hours improve significantly dry matter intake(27.36vs23.27 in 24h and 19h P<0.05) and tend to improve NDF intake(8.79vs7.73 in 24h and 19h respectively P<0.1). Milk production tends to be higher in cows receiving long hay(37.87vs36.56kg/d in F+ and F-, respectively P<0.1). When calculating the ECM that consider the milk fat and protein content, the difference became significant(40.26vs38.23 in F+ and F- respectively P=0.01). However it was detected for the first time as far as we know, that a restriction of TMR availability for 5 hours could led to an increase significantly in feed efficiency(1.91vs1.40 in 19h and 24h respectively P<0.05) The pH average results obtained testify to a situation concerning the physiological pH of the rumen for the type of animals in experiments. There were no difference in rumination time, average ammonia and ruminal VFA.

Conclusions: The conclusions obtained in this experimentation showed that in our condition the administration of TMR constantly available, associated with the presence of long hay, offers the best conditions of ruminal function and pH stability.

Daily pattern of rumination.



Daily pH pattern.



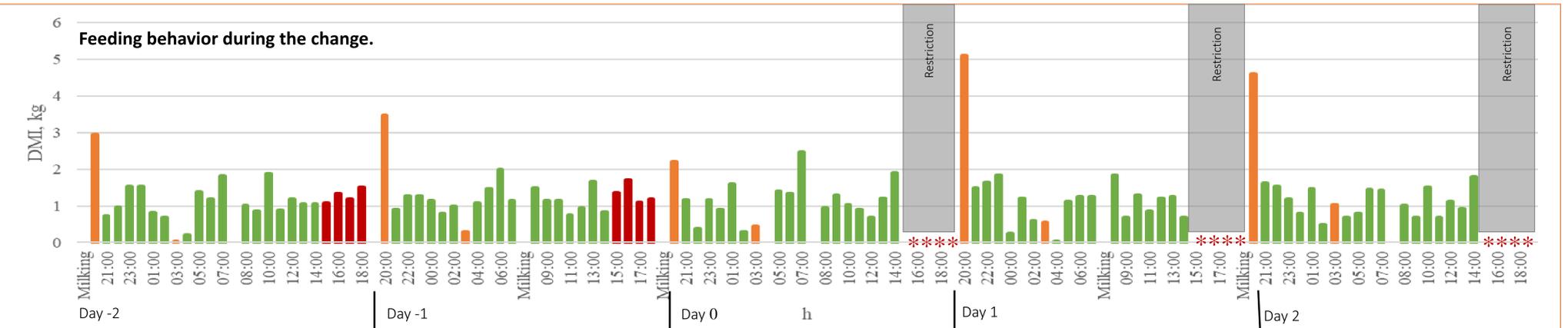
Part 2: Effects of abrupt change in feed availability in DMI, rumination behavior, and ruminal pH pattern in dairy cows

Objective: investigate feeding behavior of dairy cows fed restricted or ad-libitum total mixed rations (TMR) with abrupt changes between.

M&M: Eight multiparous Holstein cows were assigned to a double crossover design, with treatment 1 (T1) corresponding to ad-libitum feeding and treatment 2 (T2) to restricted feeding with TMR available for 19 h/d. After 4 wk of adaptation, data were collected for 2 d before (d -2 and -1), on d 0, and for 2 d after (d 1 and 2) the switch of feeding strategy. Rumination time, ruminal pH, and dry matter intake (DMI) were recorded continuously. Statistical analysis: Performed with a factorial arrangement of treatments using the MIXED procedure of JMPpro (v13.1.0, 2016, SAS).

Results: The change from T1 to T2 decreased DMI dramatically on d 0 (-8 kg; P < 0.01). The DMI of the first meal after feed delivery was higher on d 1 after switching from T1 to T2 (5.11 vs 2.19 kg; P < 0.05). On d 2, animals showed the same feeding pattern. In T2 during feed restriction time (1500 to 2000 h), rumination time and pH increased (+19 min in d 0 vs 1; P < 0.05, and +0.24 pH in d 0 vs 1; P < 0.01). When animals were moved from T1 to T2, the daily rumination pattern changed from 1 peak observed early in the morning (0200 to 0400 h) to a bimodal pattern with a second peak of rumination during the hours of restriction (1500 to 2000 h). Similar changes occurred in the ruminal pH, which shifted its maximum from 0500 to 0600 h to 1800 h during the restriction. When animals were moved from T2 to T1, pH, rumination, and DMI quickly changed to the usual pattern.

Conclusions: Our results confirm that an abrupt change in availability of TMR affects feeding and rumination behavior and ruminal pH pattern; however, cows adapt within 1 d after the change.



Part 3: Effects of a nutritional stress challenge in Parmigiano Reggiano lactating dairy cows

Objective: The aim of this study was to:

1. characterize changes in rumen environment, immunity and production in high producing PR Holstein cows subjected to a nutritional and handling stress challenge and,
2. evaluate the effect of feeding OmniGen-AF® (OG, Phibro Animal Health, Teaneck NJ) on immune cell responses to an induced acidosis.

M&M: Nutritional stress was induced by altering the forage to concentrate (F:C) ratio of the base diet from 46:54 F:C (28% starch) to 25:75 F:C (35% starch), and handling stress initiated by moving cows from free stalls to tie stalls. Cows (n=24) were blocked by DIM, milk yield and parity and randomly assigned at trial start to control (CON, no OG, n=12) or treatment (TRT, OG fed at 55 g/h/d, n=12) group. The study consisted of 3 dietary periods: adaptation (AP: base diet, free stalls, 28d), challenge (CP: acidosis diet, tie stalls, 28d) and recovery (RP: base diet, free stalls, 28d). During the whole trial, rumination time (RT), reticulo-rumen pH, milk yield, milk compositions, blood components and stress markers were recorded. Data were analysed with MIXED procedure (JMP 14). Period, treatment and interactions were considered as fixed effects, and cow as random.

Results: Feeding OG produced the best outcomes in terms of daily pH during CP and RP (6.07, 6.10; respectively, P=.05) compared to CON and showed a tendency of less daily minutes of pH < 5.8 (249 vs 341 m/d; P=.08, CP). TRT showed a numerically higher milk fat % throughout CP than CON (3.07 vs 2.87). OG fed cows tended to have higher leukocytes and neutrophils counts during CP than CON. BHOB level was higher for CON in CP (+0.23mmol/L, P<.01) than TRT. FRAP resulted lower in OG during P (P<.05) after 3 and 14d (-28.98 and -24.73 µmol/L, P<.05 and P<.10).

Conclusions: Results from this study demonstrated that a combination of stressors could impact the rumen environment and that OG can play a possible positive role to attenuate systemic inflammation in cows experiencing rumen acidosis.

pH parameters and milk quality.

Period	Adaptation		Challenge		Recovery		SEM	P
	TRT	CTR	TRT	CTR	TRT	CTR		
daily reticular pH	6.02 ^b	6.04 ^{ab}	6.07 ^a	6.04 ^{ab}	6.10 ^a	6.05 ^{ab}	0.07	0.05
minutes of pH < 5.8	284.8	284.5	249.2	341.0	192.5	337.0	106.0	0.08
milk fat content (%)	3.24	3.61	3.07	2.88	3.35	3.50	0.20	0.37

White cell parameters.

