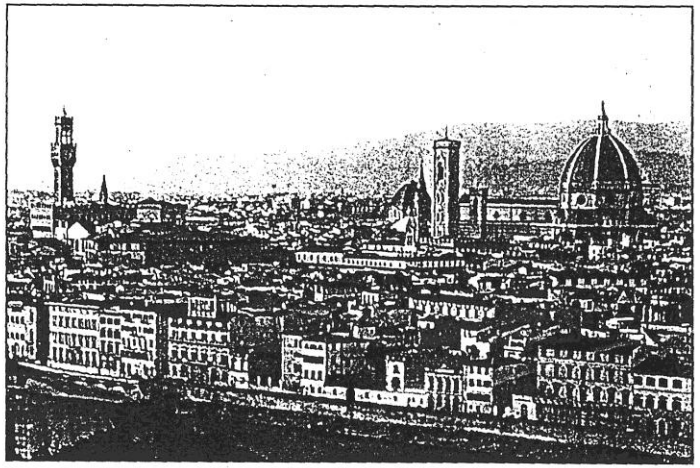
Recent Progress in Animal Production Science. 2



Proceedings of the A.S.P.A. XIV Congress
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Milk yield was not affected by dietary treatment, nor milk fat and protein contents and the SCC (table 2). These results are in agreement with the literature review of Santos *et al.* (1998) that reported an improvement of milk yield due to the partial replacement of soybean meal with high RUP sources, only in 17% of the experiments considered.
On the contrary, significant differences between diets L and H were registered for the lactose content and MUL; the latter, in particular, was higher for diet H, characterised by a higher protein content and a lower concentration of readily fermentable carbohydrates, with a consequent excess of NH_3-N in the rumen. In disagreement with Moscardini *et al.* (1998), who found that the Cornell system over-predicted MUL for cows consuming high level of RUP, in our experimental conditions the CNCPS predicted the milk urea at lower absolute values but with a similar difference between the two treatments: 25.7 and 32.1 mg/dl for diets L and H, respectively.
In conclusion, in the experimental conditions of this trial, the use of diets with a different RUP but with a similar metabolizable protein content did not result in different productive performance.

Table 2 - Milk production and composition of the cows fed the two tested diets

		Diet L	Diet H	SE	P
milk	kg/d	31.6	32.1	0.26	NS
fat	%	3.73	3.78	0.04	NS
fat	g/d	1169	1206	17.6	NS
Protein	%	3.22	3.19	0.02	NS
Protein	g/d	1013	1020	8.5	NS
Lactose	%	4.82	4.86	0.01	*
Urea	mg/dl	30.9	35.7	0.30	***
LS[1]		3.42	3.48	0.10	NS

[1] LS linear score= $\log_2$ (somatic cell count/12500)
* (P<0.05); *** (P<0.001)

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Rumen protected choline administration to transition cows: effects on milk production and plasma leptin

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ABSTRACT: The objective of this study was to determine the influence of rumen-protected choline (RPC) supplementation on milk production and plasma leptin in dairy cows receiving silage based diet. 26 Friesian dairy cows were assigned by parity and average of production in the previous lactation, to one of two groups: control and treated cows receiving 20g of RPC. Treatment was administered from 14 days before calving through 30 days postpartum. DMI, milk yield, milk composition, and choline-containing phospholipids were measured. Blood plasma was analysed for leptin content. During the first month of lactation RPC administration enhanced (+10%; P<0.05) milk production. Main milk composition was unaffected by the treatment, while increased milk choline-containing phospholipids (PLCho) concentration and total secretion were increased by 59 and 50% respectively. Plasma level of leptin was improved (P<0.01) by choline supplementation. These results indicated that higher Cho availability may affect milk production by meeting the dairy cow's methyl donor needs.
Key words: choline, milk, choline-containing phospholipids, leptin.

INTRODUCTION: Early studies using postruminal choline (Cho) supply (Erdman, 1994; Bonomi *et al.*, 1996) suggested that Cho could be a limiting nutrient in lactating dairy cows. Because dietary Cho is extensively degraded in the rumen, Cho supplementation in ruminants requires the development of rumen-protected choline (RPC) form. Milk Cho secretion was used as indicator of post-ruminal Cho supply and may be used as a qualitative indicator of Cho bioavailability (Deuchler *et al.*, 1998). In a previous communication (Pinotti *et al.*, 2000) reduction of 50% of plasma NEFA on parturition in dairy cows receiving RPC was registered. Plasma NEFA is the best predictor of the actual body fat loss (Chillard *et al.*, 2000), but recently other parameters were introduced. The profound effects of leptin on regulating of feed intake, energy expenditure and whole body energy balance makes it a marker for energy metabolism (Houseknecht *et al.*, 1998). Consequently, a possible interaction between lipotropic agents such as Cho and plasma leptin was considered. The aim of this study was to determine the efficacy of RPC administration on milk production, milk composition, and plasma leptin in high yielding dairy cows during the peripartum period.

MATERIALS AND METHODS: 26 Friesian dairy cows were assigned by parity and average of production in the previous lactation, to one of two groups: control and treated cows receiving 20g of RPC (45g of overcholine 45% coated, ASCOR Chimici). Silage based TMR were balanced to provide (on DM basis) 1.3 Mcal of NE_L/kg, 12.8% of CP, and 1.8 Mcal of NE_L/kg, 15.5% of CP, to dry and lactating cows respectively. Treatment was administered from 14 days before the expected calving through 30 days postpartum. DMI were measured during the experiment for each group. Cows were milked twice daily, and milk production was recorded. Milk samples were obtained on day 10, 20, and 30 of lactation and analysed for somatic cell count, fat and protein contents. Milk choline-containing phospholipids (PLCho-including phophatidyl choline, sphingomyelin and lysophosphatidyl choline) concentration were determinate using Takayama *et al.* (1977) method. Blood was sampled on 1 week before the expected calving date, and on day 0, 10, and 20 postpartum. Plasma was analysed for leptin content (Rosi *et al.*, 1999). Data were analysed by ANOVA (SAS, 1989).

RESULTS AND DISCUSSION: The mean prepartum and postpartum DMI were 11.26 vs. 11.43 kg/d, and 19.41 vs. 19.90 kg/d, for control and treated group respectively. During first month of lactation RPC administration enhanced ($P<0.05$) milk production (table 1). As shown on table 1 milk composition was unaffected by the treatment, although fat yield and 3.5% FCM were increased ($P<0.05$) in the RPC group. Data from this experiment indicate that Cho may be a limiting nutrient for milk production in cows in early lactation (Erdman, 1994), and that Cho effects could be enhanced by silage and CP contents in the diet. When milk choline-moiety was considered, milk from treated group has shown an higher content of PLCho ($P<0.05$) compared with milk of control cows (table 1).

Table 1 – Effects of RPC on milk production and composition.

	Control	RPC	SEM
Milk, kg/d	28.16	31.66*	1.25
3.5 %FCM[§], kg/d	26.46	30.85*	1.22
Milk fat, %	3.24	3.36	0.15
Milk fat, g/d	880.92	1056.32*	47.4
Milk protein, %	3.11	3.05	0.04
Milk protein, g/d	868.67	966.42	41.7
Milk PLCho[#], mg/kg	99.66	158.59*	13.46
Milk PLCho[#], g/d	2.53	3.81*	0.28

*$P<0.05$ [§]FCM: fat correct milk; [#] PLCho choline-containing phospholipids

Milk PLCho concentration and total secretion showed an increase of 59 and 50% respectively. Even if the PLCho are quantitatively the minor component of the lipid fraction in milk, they are the main component of the milk fat globule membrane (Bitman and Wood, 1990). Our data indicate that milk Cho is responsive to postruminal choline supply and bioavailability. In turn, higher availability of Cho in milk could represent an important goal in human nutrition, since it has been

established that "Cho is an essential nutrient for human" (Zeisel, 2000). Mean plasma leptin was higher ($P<0.01$) in treated cows (3.19µg/l vs. 2.34µg/l) than in control ones. As shown in figure 1, when time trend was considered plasma leptin did not differ after calving. Delavaud *et al.* (2000) have indicated in ruminant that plasma leptin is related to variation in body fatness and, to a lesser extent, in nutritional status. From our data it is not possible to conclude the same, even if control cows lost BW more rapidly than in treated cows after parturition and this difference was not significant.

To conclude RPC supplementation in addition to provide rumen protection, allows Cho release and absorption. Higher Cho availability may affect milk production by meeting the dairy cow's methyl donor needs. However, additional researches are needed to investigate the relationship between lipotropic substance, such as Cho, and plasma leptin in lactating dairy cows.

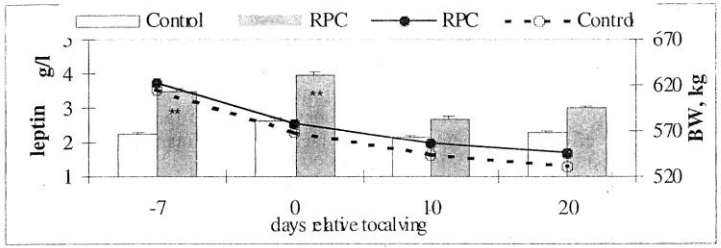

Figure 1 – Plasma leptin concentration (bars) and body weight (lines) during the experiment. (** $P<0.01$).

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