

A Pragmatic Analysis of Total Mixed Ration vs. Component Nutrition in Dairy Cows: A Real Wisdom

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Abstract: Comparing component nutrition of forage and concentrate proved to be more efficient than feeding the same diet as a total mixed ration (TMR) for substrate bioprocessing towards milk production in group-fed, yard-housed lactating dairy cows. Component feeding vs. TMR increased milk fat and protein yields.

Keywords: Total mixed ration, Component nutrition, Dairy cow, Substrate bioprocessing.

INTRODUCTION

Conventionally, feeding total mixed ration (TMR) rather than component feeding of forage and concentrate (CF) has been recommended especially on large scale farming to dilute energy concentration of meal bouts. Presenting TMR is expected to be more useful when rations contain high portions of concentrate and particularly when concentrates contain highly fermentable starches from barley and wheat as well as flaked corn and sorghum grains [1]. Certainly, on paper, TMR vs. CF would reduce rumen peaks of volatile fatty acids, ammonia, and other substrates and would avoid sharp falls in rumen pH. These could in turn theoretically improve microbial efficiency and yield and prevent immune malfunction. However, on farm, preparing TMR is costly and laborious and feeding of TMR requires sound management [2]. Moreover, experience in large ruminant enterprises does not necessarily support these notions. Very recently, TMR was found to be no superior to CF in individually fed and housed dairy cows [3-5]. The objective of this research was to establish prolonged effects of TMR vs. CF in high-producing lactating dairy cows in a competitive environment. Meeting this objective would reveal any substrate bioprocessing efficiency differences in high-producing ruminants fed CF vs. TMR.

METHODOLOGY

Twelve multiparous (650 ± 55 kg body weight; 45 ± 20 days in milk; mean ± SD) and twelve primiparous (579 ± 49 kg body weight; 59 ± 36 days in milk) lactating Holstein cows in free group yards were

monitored continuously in a completely randomized design experiment for three months. A 10-d pre-trial adaptation period was allowed before sampling and data collection. Cows were offered an experimental diet (barley grain and corn silage-alfalfa hay-based) as either TMR or CF of forage and concentrate for the entire experiment. The forage to concentrate ratio on a dry matter basis was 50:50, allowing 5-10% dailyorts. Cows were fed 3 times daily at 0530, 1330, and 2130 h. The daily TMR was divided to three same portions and each portion was fed at each feed delivery. The CF was divided to one portion of forage that was fed at 0530 h, and two same portions of concentrate that were fed at 1330 and 2130 h. Cows were milked 3 times daily at 0500, 1300, and 2100 h. Feeding and chewing behavior data were generated and processed according to a previous study [6]. Statistical data analysis was conducted with Mixed Models composed of fixed (treatment, parity and their interaction) and random (cow within treatment by parity and residuals) effects.

FINDINGS AND DISCUSSION

Feeding TMR vs. CF did not affect ($P>0.15$) dry matter intake (21.7 vs. 22.0 kg/d) and raw milk volume (34.0 vs. 34.5 kg/d). However, feeding CF instead of TMR improved milk content of fat (3.6 vs. 3.3%) and protein (3.3 vs. 3.1%). As a result, milk protein (0.73 vs. 0.67 kg/d) and fat (0.79 vs. 0.72 kg/d) yields were increased by offering CF vs. TMR ($P<0.05$). Daily duration of eating (350 vs. 330 min/d), ruminating (320 vs. 330 min/d), and total chewing (670 vs. 660 min/d) were similar ($P>0.50$) between TMR and CF cows, respectively. The first meal length (FML), starting from feed delivery until the first non-eating bout of ≥ 20 min, was 175 min in the TMR cows vs. 201min in the CF cows ($P<0.01$). Urine (8.1 vs. 8.1) and fecal (6.1 vs. 6.0) pH were unaffected ($P>0.30$).

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The superior production for CF-fed cows suggests that substrate bioprocessing in rumen, post-rumen, splanchnic tissues, and the periphery should have been more efficient, when compared to TMR-fed cows. These findings support the recent data [5] that CF vs. TMR feeding to individually fed and housed dairy cows increased peripheral blood concentrations of energy-producing substrates and reduced non-esterified fatty acids levels, indicating reduced stresses on cows by feeding CF. The increased length of the first meal by feeding CF vs. TMR indicates that altered circadian rhythms of nutrient intake are related to altered production responses [7-9]. The data also suggest that increased feed intake rate shortly post-feeding is not essentially unfavorable to animal health and productivity [7,9].

IMPLICATIONS

In conclusion, the data suggest that in a competitive farm housing and eating environment, offering high-producing cows CF vs. TMR did increase milk fat, protein and energy production as well as the first meal length without affecting feed intake and chewing behaviors. Findings have important economical and health implications for global ruminant enterprises.

ACKNOWLEDGEMENTS

The Iran's Ministry of Science Research and Technology, National Elite Foundation, and University

of Zanjan are thanked for supporting the author's global programs of optimizing science edification in the third millennium.

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Received on 04-05-2015

Accepted on 11-05-2015

Published on 22-05-2015

DOI: <http://dx.doi.org/10.12970/2310-0796.2015.03.01>

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