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The effect of concentrate in meal- or pellet form on milk, protein and butterfat production of Friesian cows receiving Kikuyu grazing and oat silage as the only roughage sources

W.A. Smith* and H.J. Heydenrych
Department of Animal Science, University of Stellenbosch, Stellenbosch, 7600 Republic of South Africa

*To whom correspondence should be addressed

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The effect of the physical form (meal or pellets) of a dairy concentrate, with kikuyu grazing and oat silage as roughage sources, on milk, protein and butterfat production of Friesian cows was investigated. Twelve comparable Friesian cows from the same herd that all calved within 20 days were randomly divided into two groups. Production parameters were measured in three phases: both groups receiving concentrate meal; one group receiving concentrate meal and the other concentrate pellets; and both groups receiving concentrate meal. All production differences were tested according to standard *t*-test procedures. The only production difference was found during the second phase when the group receiving the concentrate pellets produced 10% less butterfat than the group receiving concentrate meal ($P < 0,05$).

Die invloed van die fisiese vorm (meel of korrels) van 'n suiwelkonsentraat, met kikoejoe-weiding en hawerkuilvoer as ruvoerbronne, is ondersoek op die melk-, proteïen- en bottervetproduksie van Frieskoeie. Twaalf vergelykbare Frieskoeie uit dieselfde kudde wat almal binne 'n tydperk van 20 dae gekalf het is ewekansig in twee groepe ingedeel. Produksieparameters is oor drie fases gemeet; met albei groepe op konsentraatmeel; met een groep op konsentraatmeel en die ander groep op konsentraatkorrels; en met albei groepe op konsentraatmeel. Alle produksieverskille is vergelyk volgens standaard *t*-toetsprosedures. Die enigste produksieverskil is tydens die tweede fase gevind. Die groep op die konsentraatkorrels het 10% minder bottervet geproduseer as die groep op die konsentraatmeel ($P < 0,05$).

Keywords: Low butterfat syndrome, dairy concentrate pellets

The feeding of concentrate pellets has become general practice on many dairy farms in South Africa. The processing of cereals in the past has been carried out for two main reasons — firstly, to cause an increase in the digestibility of the feed, and secondly to help to provide a suitable package for the inclusion of other essential or non-essential ingredients in the diet. Pelleting also helps to provide a dust-free, palatable material with minimum spillage and rejection by the animals (Ørskov, 1979). Furthermore, it is well known that dairy cows consume concentrate pellets much quicker than concentrate meal. The main difficulty, however, is to devise a treatment that allows complete digestion, particularly of the starch, without resulting in an excessively fast fermentation with associated milk fat depression (Oldham & Sutton, 1979). Burt (1973) noted that very few studies of the effects of fineness of grinding of cereals or concentrate meal mixtures upon the

Table 1 The mean production of two comparable groups of Friesland cows fed dairy concentrate (15% CP) in meal or pellet form at 0,5 kg per kg milk produced, with 1 kg oat hay, oat silage (*ad lib.*) and kikuyu grazing as roughage (n = 6).

Phase	Group	Days measured	Form of concentrate	Total milk production per cow (kg)	Total butterfat production per cow (kg)	Total protein production per cow (kg)	kg milk produced per concentrate fed (kg)
I	1	21	Meal	487,38 ± 69,94	16,88 ± 1,14	15,77 ± 2,14	2,00 ± 0,11
	2	21	Meal	487,98 ± 123,32	17,05 ± 2,22	15,80 ± 3,81	2,01 ± 0,09
II	1	28	Meal	585,33 ± 109,46	20,77 ± 1,61	19,12 ± 3,57	2,05 ± 0,09
	2	28	Pellets	588,13 ± 159,42	18,66[a] ± 1,38	18,71 ± 4,94	2,04 ± 0,16
III	1	21	Meal	390,27 ± 85,07	13,83 ± 1,78	12,93 ± 2,68	2,03 ± 0,08
	2	21	Meal	385,12 ± 120,07	13,70 ± 2,37	12,83 ± 2,96	2,02 ± 0,09

[a]Significant difference ($P < 0,05$).

productive efficiency of the lactating cow have been done. Very few studies were also done after 1973 and none could be found on the effects of pelleting concentrates and feeding it twice daily, immediately after or with milking, as practised on many dairy farms throughout South Africa. The present study was undertaken to establish whether the pelleted concentrate would have any effect on total energy intake, digestibility or utilization and therefore on milk production and milk composition, and whether the pelleting of a concentrate would have any negative effect on the butterfat production of cows consuming 0,5 kg of concentrate per kg milk produced in only two meals with kikuyu grazing and oat silage as the only roughage sources.

Twelve comparable Friesian cows from the same herd that all calved within 20 days were randomly divided into two groups. Milk, protein and butterfat production were measured in three phases: I. both groups receiving concentrate meal; II. one group receiving concentrate meal and the other concentrate pellets; III. both groups receiving concentrate meal. The trial was carried out during the first 100 days of lactation. Phases I and III each lasted 4 weeks (1 week for adaptation and 3 weeks for production), whereas phase II lasted 5 weeks (1 week for adaptation and 4 weeks for production).

All ingredients (for the meal and the pellets) were milled through a 4-mm screen. Meal ingredients were then mixed and bagged while pellet ingredients were pelleted to 5-mm pellets with a Lamex 800 pelleting machine using dry steam. Pellet temperature in the pelleting die reached approximately 100°C. The two concentrates were iso-caloric and iso-nitrogenous with the only difference being that the pellets contained 1% sodium bentonite as a pelleting agent which could have had a buffering effect and was excluded from the meal. The calculated chemical analysis of the concentrates ('as is' basis) was protein 150 g/kg; ME 11 MJ/kg; Ca 12 g/kg; P 6 g/kg. Concentrates were fed at 0,5 kg/kg milk produced daily and were offered twice daily in a feeding unit immediately after milking. The remainder of the daily feed intake per cow consisted ('dry matter' basis) of ± 5 kg kikuyu grazing, 4 kg oat silage and 1 kg oat hay. All cows grazed together and feeding spaces for concentrate feeding were taken up at random by the cows after milking. Milk production were measured daily and the butterfat and protein content of the milk were analysed weekly. Butterfat analyses were done according to the method of Atherton & Newlander (1977) and the protein analysis according to the AOAC (1980) procedure. All production differences were compared according to standard t-test procedures (Paterson, 1939).

Total milk-, butterfat and protein production as well as kg milk produced per kg of concentrate consumed, are presented

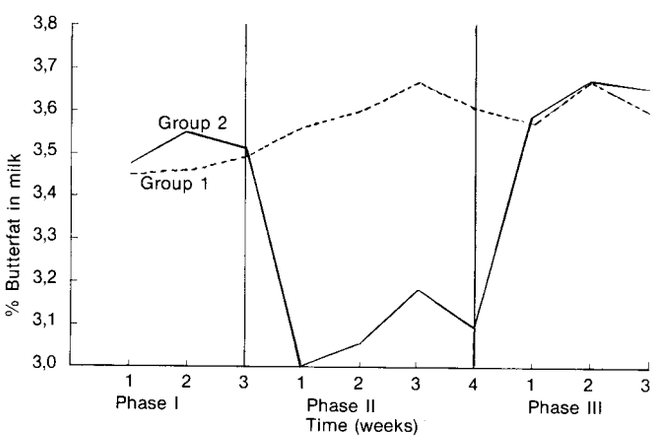

Figure 1 The mean weekly butterfat percentage of the milk of two comparable groups of Friesland cows fed dairy concentrate (15% CP) in meal- or pellet form at 0,5 kg per kg milk produced, with 1 kg oat hay, oat silage *ad lib.* and kikuyu grazing as roughage. During Phases I and III both groups were fed concentrate in meal form. During Phase II, group 1 received concentrate in meal form, while group 2 received concentrate in pellet form

in Table 1. The only production difference was found during phase II, when the group receiving the concentrate pellets produced 10% less butterfat than the group receiving concentrate meal ($P < 0,05$) which was clearly evident from the percentage butterfat in the milk of the two groups of cows (Figure 1).

The lowering of milk fat is largely explained by a decreasing ratio of acetate to propionate (van Soest, 1963). Not only does the feeding of less roughage and more concentrate enhance propionate production but also the feeding of feedstuffs with a smaller particle size (Storry, 1969; Thomas & Rook, 1977; Jorgenson, Santini & Cowley, 1981). The chewing and rumination time of a complete diet should be sufficient to ensure adequate saliva production for rumen buffering and thus normal acetate: propionate ratio and butterfat production (Sudweeks, Law, Ely, McCullough & Sisk, 1979; Taniguchi, Yamatani & Otani, 1983).

The smaller volume, smaller particle size (because of the pelleting process) and possible better availability (heat and pressure during pelleting) to rumen fermentation of the concentrate pellets would lead to a faster intake, less rumination and faster hydrolysis in the rumen resulting in a lower rumen pH, smaller acetate: propionate ratio and less butterfat production especially if total roughage intake and rumination time is critical which seems to be the case with kikuyu grazing and oat silage as the only roughage sources. The feeding of

the concentrate in more meals per day or the feeding of more roughage or roughage with a higher rumination time could have alleviated the problem. The possible higher total energy intake because of the faster intake, less rumination and possible faster hydrolysis and thus faster through flow of the concentrate pellets or its possible higher digestibility and better utilization did not have any positive effect on milk production or milk composition.

The fresh milk price for 4% fat-corrected milk being 44,38c per kg (Dairy Board, 1985-personal communication) during October 1985, means a loss of R145 per cow producing 6300 kg fat-corrected milk over 300 days, when fed concentrate in pellet form as compared with concentrate in meal form.

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