



Effect of level of concentrate supplementation on milk yield and composition of grazing dairy cows in Southern Kordofan state, Sudan

Gawaher Z. A.Hassan¹, Intesar Y. Turki² and Muna E, Khogali³

¹Ministry of Animal Wealth-Southern Kordofan State (Kadogli), Sudan; ²Department of Animal Production, Faculty of Animal Production Science and Technology, Sudan University of Science and Technology, Khartoum North (Kuku), Sudan; ³Department of Animal Production, Faculty of Animal Production Science and Technology, Sudan University of Science and Technology, Khartoum North (Kuku), Sudan

Abstract

A study was carried out to evaluate the effect of different levels of concentrate supplementation on milk yield and composition, at East Abasia Tagali-South Kordofan State. Sixteen Nuba Mountain breed (Gadali type) (Bgara x Kenana) dairy cows in mid-lactation, grazing on natural pasture and agricultural by products (sorghum, maize and groundnuts) were selected. The cows were divided in to four groups, each of four animals. The concentrate were supplements at the rate of 0.0 (G1), 0.5 (G2), 1.0 (G3) and 1.5 kg (G4). The milk yield increased linearly ($P < 0.01$) when the level of concentrate supplement increased from 0.0 to 1.5 Kg. The fat content of G1 (5.18%) and G2 (5.25%) were significantly higher compared to G3 (4.90%) and G4 (4.95%). Dairy cows fed 0.5 Kg concentrate attained the highest ($P < 0.05$) ash (0.9 %) followed by G1 (0.8%) and those fed 1.5 Kg (0.79%), which were not significantly different, while G3 recorded the lowest ash (0.7%). Neither protein percentage nor water content and total solid of milk showed significant difference between the four groups of cows.

Keywords: Grazing Dairy Cows, Milk Yield, Milk Composition, Concentrate Supplement

Introduction

Pastures are sources of forage and nutrients for dairy cattle including heifers, dry cows and the milking herd. The use of pasture for dairy cows is less expensive feeding system because grazed forage is the cheapest source of nutrients (Peyraud and Delaby, 2001; Clark and Kanneganti, 1998).

Feeding is one of the most important factors in milk production. Its effect is about 55% while the genetic improvement effect is 25% (Abu-Isa, 2000). The national Sudanese herd depends mainly on natural range, particularly the traditional one which is considered the main producer of milk in the Sudan. The traditional sector possesses 90% of animal population and it produces about 95% of total milk yield and the remaining 5% is produced in cities (Hassabo, 2009). Natural range provides cows with feed requirements which meet the energy requirements for maintenance, but there is a need for concentrate to supply dairy cows with energy and protein requirements necessary for milk production. Furthermore, the natural pasture characterized by low quality grasses (4% CP) (Abd Alla, 1991), leads to lower milk yield (Mahamdin,

1994). Therefore, the use of feeding systems combining pasture plus additional feed supplements such as concentrate is required.

Nuba mountain cows are one of the local breed in Southern Kordofan State represented by Baggara cows where as in East of the State, Baggara cows hybrid with Kenana type which give the grey white colour. Baggara cows represent 80% of cattle in the Sudan, it is of different colour. The grey white Baggara cattle characterized by higher milk and meat production compared to that of red colour (average yield 4-8lb/day). The Southern Kordofan State depends on natural grazing and agricultural by products, particularly the traditional grazing. The dairy cows number is about 331.769 heads and the total milk yield about 71.788 ton (Animal wealth, 1980). The estimated livestock number in 2008 was 140 million heads, comprising 41.4, 43.1, 51.1 and 4.4 million heads of cattle, goats, sheep and camels, respectively (AOAD, 2009).

The objective of this study is to investigate the effect of concentrate inclusion on milk yield and composition of dairy cows raised on natural pastures, in Southern Kordofan State in the Sudan.

Materials and Methods

The feeding trial was conducted at Al-Twmat village for sixty days. Sixteen dairy cattle of Nuba Mountains strain x Baggara cattle x Kenana type, own by Tagali, Kenana and Al-Kwahla. The cows were in the second stage of lactation. Cows were divided into four groups (control group and three treated groups) of four animals each depending on their milk yield (giving more or less an equal average of milk yield/head/day). A completely Randomized Design (CRD) of four treatments and four cows (replicates) per treatment were used.

The dairy cows, after grazing in natural range, were allocated to four dietary treatments of sesame seed cake concentrate: 0.0, 0.5, 1.0 and 1.5Kg /head/day (Table 1). The cows were fed individually and had *ad libitum* access to water throughout the duration of the trial (sixty days).

Table 1: Proximate analysis (DM-Basis) of the sesame seed cake concentrate ration fed to dairy cows during the feeding trail (2009)

Nutrient composition%	DM	CP	CF	Ash
	94.6	48.18	8.1	14.7

Daily milk yields (Kg) of the four groups of cows were recorded in the morning and evening, using buckets and scale balance. Twelve milk samples were collected from the four groups to determine the contents of fat, protein, water and solid substance using milk analyzer.

Statistical Analysis

Data for the feeding trial was analyzed as Completely Randomized Design (CRD) by standard analysis of variance (ANOVA). Treatments means were

separated by Multiple Range Test (DMRT) at 5% level according to Gomez and Gomez (1984).

Results

The effect of concentrate supplement on milk production is shown in Table 2. There was a significant ($P<0.05$) linear increase in milk yield as the concentrate feeding level increased from 0.0 to 1.5 Kg. Cows fed on 1.5 Kg sesame seed cake concentrate/head/day. Besides natural grazing produced the highest significant ($P<0.05$) milk yield (3.35 Kg/day) compared to other groups. The control group raised on natural pasture recorded the lower milk yield (0.98 Kg/day) ($P<0.05$) during the experimental period (nine weeks) followed by G2 with 1.71 Kg milk/day and G3 which recorded 2.36 Kg milk/day ($P<0.05$).

Table 3 presents the effect of concentrate supplement on percentages of milk composition. There was a significant difference ($P<0.05$) between the four groups of cows in milk fat percentage. G2 and G1 recorded the highest fat percentage (5.25 and 5.18 respectively) compared to G4 and G3 (4.95 and 4.90%, respectively). The statistical analysis of milk composition showed no significant difference ($P>0.05$) in protein % among the four groups of milking cows. Water content did not differ by the treatment. Concentrate supplements resulted in a significant difference ($P<0.05$) in ash % between the four groups of cows. G2 scored the highest ash (0.9%) followed by G1 (0.80) and G4 (0.79), whereas in G3 the lowest ash (0.7%) was recorded. No significant difference in solid substance ($P>0.05$) among the cows were recorded. The mean daily cost on 0.5 and 1.0 Kg concentrate supplement to G2 and G3 respectively was 1.80 SDG (Sudanese pound) resulting in average increase of 2.11 Kg in milk yield, and the profit of milk sale was 2.98 SDG. The increase in

Table 2: Effect of amount of concentrate supplementation (Kg) on mean daily milk production (kg) \pm SD of dairy cows on pasture

Weeks	G1	G2	G3	G4
1 st	1.10 \pm 0.15 ^d	1.98 \pm 0.31 ^c	3.0 \pm 0.36 ^b	3.83 \pm 0.47 ^a
2 nd	1.10 \pm 0.18 ^d	1.85 \pm 0.26 ^c	2.9 \pm 0.37 ^b	3.66 \pm 0.45 ^a
3 rd	1.05 \pm 0.19 ^d	1.77 \pm 0.25 ^c	2.83 \pm 0.47 ^b	3.50 \pm 0.45 ^a
4 th	1.00 \pm 0.24 ^d	1.76 \pm 0.21 ^c	2.69 \pm 0.33 ^b	3.51 \pm 0.44 ^a
5 th	0.94 \pm 0.16 ^d	1.60 \pm 0.21 ^c	2.50 \pm 0.24 ^b	3.34 \pm 0.31 ^a
6 th	0.98 \pm 0.16 ^d	1.67 \pm 0.19 ^c	2.58 \pm 0.27 ^b	3.25 \pm 0.54 ^a
7 th	0.98 \pm 0.11 ^d	1.67 \pm 0.20 ^c	2.51 \pm 0.19 ^b	3.25 \pm 0.49 ^a
8 th	0.87 \pm 0.13 ^d	1.58 \pm 0.20 ^c	2.37 \pm 0.30 ^b	2.96 \pm 0.28 ^a
9 th	0.81 \pm 0.16 ^d	1.54 \pm 0.15 ^c	2.40 \pm 0.27 ^b	2.85 \pm 0.27 ^a
Mean of total production	0.98 \pm 1.21 ^d	1.71 \pm 1.10 ^c	2.36 \pm 0.11 ^b	3.35 \pm 1.01 ^a

G1: group one fed 0.0 Kg conc/G2: group two fed 0.5 Kg conc. / G3: group three fed 1.0 Kg conc/G4: group four fed 1.5 Kg conc. ^{a-d}Means within each row followed by the same letters are not significantly different at (5%) level according to DMRT.

Table 3: Effect of amount of concentrate supplementation (Kg) on milk composition % \pm SD of dairy cows on pasture

Variables	G ₁	G3	G2	G4	F-test
Total solid	14.18 \pm 0.06 ^a	14.1 \pm 0.08 ^a	14.1 \pm 0.31 ^a	14.10 \pm 0.70 ^a	NS
Ash	0.80 \pm 0.00 ^b	0.70 \pm 0.5 ^c	0.90 \pm 0.01 ^a	0.79 \pm 0.00 ^b	*
Protein	3.73 \pm 1.50 ^a	3.50 \pm 0.03 ^a	3.81 \pm 0.07 ^a	3.93 \pm 0.08 ^a	NS
Fat	5.18 \pm 0.02 ^a	4.90 \pm 0.24 ^b	5.25 \pm 0.29 ^a	4.95 \pm 0.40 ^b	*
Water	85.82 \pm 0.29 ^a	85.9 \pm 0.08 ^a	85.9 \pm 0.31 ^a	85.9 \pm 0.05 ^a	NS

G1: group one fed 0.0 Kg conc/G2: group two fed 0.5 Kg conc/G3: group three fed 1.0 Kg conc/G4: group four fed 1.5 Kg conc; NS: Not significant; *: Significant (5%); ^{a-c} Means within each row followed by the same letters are not significantly different at (5%) level according to DMRT.

concentrate supplement added resulted in more increase in milk yield and hence, more profit. Accordingly, cows fed 1.5 Kg concentrate yielded 3.35 Kg milk, giving 3.5 SDG profit.

Discussion

Increasing the quantity of sesame seed cake concentrate from 0.0 to 1.5 Kg to the grazing cows increased the produced milk yield from 1.0 to 3.0 Kg approximately. This confirms the finding of Doyle (1983) and Salama (2006). Darwish (2009) reported that inclusion of concentrate increase the total milk production. Also, this result was in full accordance with the finding reported by Marphes (1994) and Castillo (1999), who claimed that feeding animals with oil seed cakes containing higher percentage of protein, which increases milk production. A significant ($P < 0.05$) reduction in milk fat concentration resulted from increasing concentrate supplementation. Most of the studies showed that milk fat percentage decreased when the amount of concentrate was increased (Reis and Combs, 2000; Valentine et al., 2000; walker et al., 2001; Bargo et al., 2002). Also, Castillo (1999) reported that grazing dairy cows had higher fat content compared to those raised on limited grazing. In the present trial, cows fed 0.5 Kg concentrate scored the highest ash (0.9%) followed by those raised in pasture (0.8%) and cows fed on 1.5 Kg (0.8%). Whereas cows fed 1.0 Kg obtained the lowest ash (0.7%) indicating a nonlinear effect of concentrate supplement on ash percentage. Concentrate supplement had no effect on milk protein concentration. Dillon et al. (1997) stated that protein content of milk was unaffected by concentrate supplementation from 0 to 3.6 kg DM/day of grazing dairy Cows. Walker et al. (2001) found no changes in milk protein percentage within a range of supplementation from 0 to 10.4 kg DM/day. Water percentage was not significantly ($P > 0.05$) affected by the concentrate treatment. Similar results were reported by Hilali (1986). The non significant effect of concentrate supplementation on percentage of solid

substances was in line with the finding reported by Hilali (1986).

Conclusion

Concentrate supplementation in the feeding system of dairy cows in natural pasture, which alone may not satisfy the nutritional requirements of dairy cows because of low quality grasses, had positive effects on milk production and composition. The amount of concentrate supplementation should consider economics of feeding (prices of added concentrate versus increase in milk yield and the final profit).

Acknowledgements

The authors would like to thank the staff of the Sudan University of Science and Technology, particularly those in Animal Production Research Laboratory for their technical assistance.

References

- AbdAlla, S.A. 1991. Using of agricultural & industrial byproducts in animal feeding. Conference of Southern DarFur and Nyala Development.
- Abu Isa, H.E. and Abd-Al rahman, M.A. 2000. Effect of nutrition on milk production-Sudan-Khartoum.
- Animal Wealth Statistics 1980. Livestock statistics-Ministry of Agriculture and Animal Wealth-Khartoum-Sudan.
- A.O.A.D. 2009. Livestock number. Arab Agricultural Statistics Yearbook, Vol NO.29, Khartoum, Sudan.
- Bargo, F., Muller, L.D, Delahoy, J.E. and Cassidy, T.W. 2002. Milk response to concentrate supplementation of high producing dairy cows grazing at two pasture allowances. *Journal of Dairy Science*. 85:1777-1792.
- Castillo, A.R. 2007. Improving nitrogen utilization in dairy cows. MSc thesis, University of Reading UK.
- Clark, D.A. and Kanneganti, V.R. 1998. Grazing management systems for dairy cattle, In: Cherney, J .H, Cherney, D.J.R (editor). Grass for Dairy Cattle, Oxon, UK: CAB International; P: 331.

- Darwish, S. 2009. Factors affecting milk production- Agricultural report. www.reefnet.gov
- Dillon, P., Crosse, S. and O'Brien, B. 1997. Effect of concentrate supplementation of grazing dairy cows in early lactation on milk production and milk processing quality. *Irish Journal of Agriculture and Food Research*, 36:145–159.
- Doyle, C.J. 1983. Evaluation feeding strategies for dairy cows. A modelling approach. *Animal Production*.
- Gomez, K.A. and Gomez, A.A. 1984. Statistical procedures for agricultural research. 2nd (ed.), John Willy and sons Inc., New York. P: 680.
- Hassabo, A.A. 2009. Milk adulteration by adding water and starch at Khartoum State. *Pakistan Journal of Nutrition*, 4:439-440.
- Hilali, E.A. 1986. Preparation Feed stuff. Al-Oloom Press, Cairo.
- Mhamadain, A.D. 1994. National report of milk production of small milk producer in the Sudan. National wealth of milk production–Small milk producers in Arab countries-Al Rabat-Morocco.
- Marphes, A.M. 1964. Milk production. *Ecosystem of the world Billiton*, 17 (86): 101-112.
- Peyraud, J.L. and Delaby, L. 2001. Ideal concentrate feeds for grazing dairy cows responses to supplementation in interaction with grazing management and grass quality. In: Garnsworthy, .PC, Wiseman, J. (editors). *Recent Advances in Animal Nutrition*. UK: Nottingham University Press, P: 203.
- Reis, R.B, and Combs, D.K. 2000. Effects of increasing levels of grain supplementation on rumen environment and lactation performance of dairy cows grazing grass-legume pasture. *Journal of Dairy Science*. 83:2888–2898.
- Slama, M. 2006. Feeding dairy cows on concentrate. <http://www.almhewar.org>.
- Valentine, S.C, Clayton, E.H, Hudson, G.J. and Rowe, J.B. 2000. Effect of virginiamycin and sodium bicarbonate on milk production, milk composition and metabolism of dairy cows fed high levels of concentrates. *Australian Journal of Experimental Agriculture*. 40:773–781.
- Walker, G.P., Stockdale, C.R, Wales, W.J, Doyle, P.T. and Dellow, D.W. 2001. Effect of level of grain supplementation on milk production responses of dairy cows in mid-late lactation when grazing irrigated pastures high in paspalum (*Paspalum dilatatum* Poir.). *Australian Journal of Experimental Agriculture*. 41:1–11.