



Effect of Feeding systems on Milk Yield and Composition of Local and Cross Bred Dairy Cows

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ABSTRACT

The study was carried out at Dongola, Northern State - Sudan; from 10/7 to 1/ 9 2010, to investigate the effect of some forage crops and concentrate supplements on milk yield and composition of local and cross-bred cows. Thirty milking cows, of an average body weight 400-450 kg and about 4-10 years old were used. Cows were divided into six groups (five heads per each): Group (1) and (2) [local and cross bred cows, respectively] were fed on Solely Clover; group (3) and(4) [local and crossbred cows, respectively] were offered clover and Sorghum stover; groups (5) and (6) [local and crossbred cows, respectively] were fed Clover and concentrates. The results showed that the cross bred cows in group (6) recorded the highest ($p<0.05$) milk yield (17.5k/day) compared to other groups, followed by G (5) with an average milk yield of 12.9 k/day, while groups (2), (4), (1)and (3) gave an average milk yield of 10.4, 9.2, 8.8 and 7.7k/day, respectively. Concerning the milk components, experimental groups showed a significant variation ($p<0.05$) attributed to type of feed and breed. Group (6) showed the highest fat content (5%) where as group (3), (4) and (5) obtained 4.1, 4.4 and 4.7%, respectively. Milk from group (1) and (2) attended to have the lowest ($p<0.05$) fat content (3.7%). The statistical analysis showed a significant increase ($p<0.05$) in protein % favor for group (3) (5%) compared to other groups (1), (2), (4), (5) and(6) which recorded 4.5, 4.4, 4.6, 4.8and4.1%, respectively. Total solids of group(1) and (2)were12.1, 12.6% which was slightly lower ($p<0.05$) than the values obtained by cows in groups (3), (4), (5) and(6) of 13.7, 13.9, 13.4 and 13.9%, respectively. Also significant variation was recorded for ash%. The highest ash content was recorded by group (1).Water content was found to be higher ($p<0.05$) for group (1), 87.4% and 87.8 % for group (2) than other experimental groups (3), (4), (5)and (6), which obtained %86.,686.3, 86.1, 86.0%, respectively.

Keywords: *forage crops, concentrate supplement, local& crossbred, milk yield and composition*

I. INTRODUCTION

Sudan is the first among the Arab countries and the second in Africa with respect to animal population. According to recent estimates of the livestock, there are about 40 million heads of cattle, 50 million heads of sheep, 43 million heads of goat and 4 million heads of camel [1].Milk production in the Sudan is estimated to be about 7.8 tons per year [2], of which 90% is produced by local breed in traditional sector and 10 % from cross bred by the modern sector [3]. The local breeds in Sudan belong to the group of North Sudan Zebu [4; 5]. Examples are Butana, Kenana and Baggara; multipurpose breeds that are used for milk and meat production as well as draught power [6]. The Butana cow is considered to be the best milk producer of the Sudanese zebu breeds [5]. The milk production of the Sudanese indigenous cattle breeds, Kenana and Butana (*B.indicus*) was found to be lower than that of Holstein Friesian cattle (*B.taurus*), even under the same climatic conditions [7]. The National herd utilizes natural pastures in wet season then return to irrigated land to utilize crop stubble and residues. The cut-and-carry feeding system is associated with small scale irrigated farms (<1-5 ha) where forage crops (Sorghum, Sorghum stover and Alfalfa) are harvested to feed farm animals. Surplus green fodder is sold in nearby towns and villages

to other livestock owners. Weeds and crop residues may also contribute to livestock feed in these farms [8]. The area of study was situated in the Northern Sudan, the sub-Saharan region. Cattle feed clover in the winter while in dry season of summer, fodder crops will be offered to animal beside limited supplementary protein As a legume, clover requires no nitrogen fertilizer making it suitable as a home-grown protein source for low-input or organic farming systems [9].There is an old saying "Half the Breeding is in the Feeding", and this is highly relevant in North and Central Sudan where the programme to develop fodder production and crops on response to programmes to develop milk production through cross breeding Local cows with highly selected introduced milk breeds. So the objectives of this study are to investigate the effect of feeding forage crops and concentrate supplement on milk yield and composition of local and cross bred dairy cows in Dongola province.

II. MATERIAL AND METHODS

Location

The study was carried out at three areas near Dongola Irtidi area, Irtidi Island and Kawa Island, to evaluate the effect of two types of forage crops on milk



yield and composition. Animals in this area depend on clover, sorghum stover and cash crops residues.

Experimental Animal

Thirty lactating cows, (400-450 kg weight), local (Kenana or Butana) and crossbred (local × Friesian) were selected and randomly divided into six comparable groups fed the experimental diets for fifty days.

Experimental diets

Clover solely fed *ad libitum* to G₁ (local breed) and G₂ (crossbred). G₃ (local breed) and G₄ (crossbred) fed clover and Sorghum stover (1:1), while G₅ (local) and G₆ (cross bred) were given clover and a concentrate supplement containing groundnut cakes and sorghum grain (2kg per head)

Sampling and chemical analysis: Daily milk yield (Kg) of all groups were recorded in the morning and evening. Thirty Samples for chemical composition were taken weekly, one sample/ cow. Representative milk samples from each group were analyzed in the laboratory using Ecomilk Ultrasonic (Milk-analyzer) to determine the percentages of fat, protein, ash, water, and solid materials.

Statistical analysis: Data for all variables were subjected to analysis of variance (ANOVA) using the Statistical Package for the Social Sciences (SPSS). Treatments means were separated by the Least Significant Difference (LSD) method at 5 % level according to Gomez and Gomez [10].

III. RESULTS AND DISCUSSION

Milk yield:

The effect of dietary treatments on milk yield of dairy cows are shown in table (1). The results showed that, milk yield was significantly affected ($p < 0.05$) by the type of feed. G₆ of crossbred cows that fed clover and concentrate supplement was superior over other groups in milk yield (17.5 kg/day); followed by G₅, the local bred with an average milk yield of 12.9 kg/day. This moral superiority in milk productivity recorded by hybrid cows compared to local bred under the same conditions was proved by many researchers [7]. Result obtained here was in full accordance with the finding reported by [11] and [12], who claimed that feeding animals with oil seed cakes containing higher percentage of protein, which increases milk production, is a good supplement for animal fed on forage. Previous research has demonstrated a positive response in milk production to concentrate supplementation for lactating dairy cows in natural pasture [13], [14] and [15]. Inclusion of concentrate increases the total milk production [16]. Increasing the level of concentrates reduced intake of grass silage but tended to increase the intake of the low starch maize silage forage, and linearly increased the yields of milk, milk constituents

and milk protein concentration ($P < 0.001$) for both forages [17].

Most dairy producers use forages to feed lactating cows as a mean of reducing feed cost and improving net returns. Those dairy producers who use only forage for the lactating cow's diet could reduce the amount of concentrate to increase income over concentrate cost. The present results indicated that it is not possible to feed cow on the clover alone to fulfil the dairy cow requirements, and this is consistent with [16] findings. He stated, that for high production or rapid growth it is not enough to depend only on alfalfa. In other experiments dry matter intake and milk production of lactating dairy cows was improved by replacing red clover with normal or brown midrib corn silage in the diet [18].

Table (1) Effects of feeding clover, sorghum stover and concentrate on milk yield (kg/head/day) of dairy cows during the feeding trial (2010)

Feed	Groups	Means ± SD	Total Means ± SD	F-test
Clover	G ₁	8.84 ± 0.24	9.60 ± 0.34 b	*
	G ₂	10.46 ± 0.40		
Clover + Sorghum stover	G ₃	7.70 ± 0.24	8.46 ± 0.24 c	*
	G ₄	9.20 ± 0.24		
Clover + concentrates	G ₅	12.90 ± 0.39	15.25 ± 0.79 a	*
	G ₆	17.5 ± 0.63		

Means within column followed by different superscripts are significantly different ($p < 0.05$).

G₁ & G₂: Fed on clover; G₃ & G₄: Fed on clover + Sorghum stover; G₅ & G₆: Fed on clover + concentrate.

Milk fat%

The results of chemical analysis of the milk components showed significant differences among experimental groups. Milk fat composition was affected by the amount and composition of dietary component [19]. Genotype had a significant effect on all milk production parameters, high merit cows had the highest yield of milk, fat, protein, and lactose, whereas the low merit cows had the lowest milk fat, protein, and lactose concentrations [20]. G₆ recorded the highest ($P < 0.05$)



percentage of fat in milk (5.3 %) compared to other groups. The yield of milk fat and milk protein was significantly higher for treatments of cotton seed cakes supplement compared with other treatments without concentrate supplement [21]. Proportion of milk fat content of G₃, G₄ and G₅ were 4.4, 7.4 and 4.1%, respectively, were clearly higher ($p < 0.05$) than values obtained from G₁ and G₂ which fed on solely clover of equal proportion 3.7% fat. [22] recorded 3.78 and 3.44 % milk fat of lactating cows fed alfalfa silage or red clover silage, respectively. Egyptian clover is a leguminous crop and a sole source of protein usually deficient in carbohydrates which negatively affected the microbial population as well as microbial protein synthesis which in turn disturbed the acetate production leading to reduced milk fat synthesis. The whole crop maize or sorghum fibre contents were higher than the Egyptian clover causing natural buffering and an increased acetate and propionate ratio which in turn enhanced milk fat content [23].

Milk protein

The current study showed significant ($P < 0.05$) differences in milk protein%. G₃ had the highest milk protein (5.0%), than G₁, G₂, G₄, G₅ and G₆ with 4.5, 4.4, 4.8, 4.6 and 4.2%, respectively. These values were slightly higher than those obtained by [22], who studied the effect of feeding forage as alfalfa silage (AS) or red clover silage (RCS), with or without supplemental fish meal (FM) on DM intake, body weight gain, production of milk and milk components. They signed 2.96 % and 3.02% milk protein for cows fed on clover silage and clover silage supplemented Fish meal, respectively. Here, from data of total means of groups; a highly milk protein content was recorded by cows fed on clover and Sorghum stover. [22] stated that cows fed alfalfa silage or hay produced milk with lower protein content than cows fed corn silage-based diets that were supplemented with soybean meal [24].

Table (2): Effect of dietary treatments on milk composition of the dairy cows during 2010

Treatment Parameter	G1	G2	G3	G4	G5	G6	F-test
Fat%	3.7±0.12 c	3.7±0.150c	4.4±0.130b	4.7±1.10b	4.1±1.3b	5.3±1.20 a	*
Protein%	4.5 ±0.80 b	4.4±.11b	5.0 ±1.30a	4.6±0.80b	4.8±1.3b	4.2±0.50b	*
T.S%	12.6±1.10b	12.1±1.80b	13.4±0.90a	13.9±1.1a	13.7±2.80a	13.9±1.10a	*
ASH%	0.64±0.03a	0.62±0.10b	0.54±0.02d	0.61±0.04c	0.53±0.02d	0.55±0.15d	*
Moisture%	87.4±1.10a	87.6±1.80a	86.6±0.68b	86.1±1.2b	86.3±2.80b	86.0±1.20b	*

Means within each column followed by different superscripts are significantly different ($p < 0.05$).

G₁ & G₂: Fed on clover G₃ & G₄: Fed on clover + Sorghum stover. G₅ & G₆: Fed on clover + concentrate

Total Means of Groups

Feed	Fat%	protein%	TS%	Ash%	Moisture%
Clover	3.72 c	4.45 bc	12.37 c	0.63 a	87.63 a
Clover+ Sorghum stover	4.56 ab	4.83 a	13.66 ab	0.58 b	86.38 b
Clover+ concentrate	4.71 a	4.53 b	13.83 a	0.55 c	86.17 bc



Means within each column followed with difference superscripts are significantly different ($p < 0.05$).

Other research recorded no changes in milk protein percentage within a range of concentrate supplementation from 0 to 3.6 kg DM/d [25] as it seen in this result.

Solid material

The proportion of solid material showed a significant difference ($p < 0.05$) between groups. G1 and G2; recorded the lowest TS% of 12.6 and 12.1, respectively than G 3, G 4, G 5 and G 6 of 13.4, 13.9, 13.7, and 13.9, respectively. Added Sorghum stover or concentrate to clover in dairy diets improved milk TS. The increased milk yields from later groups, led to increased ($P < 0.05$) milk solids yield from cows fed clover with Sorghum stover or concentrate compared to clover alone. This result was in line with the finding reported by [16].

Water content

The study showed a significant difference ($p < 0.05$) in water content among groups. G1 and G2 recorded the highest water content 87.8, 87.9% than G3, G4, G5 and G6 of 86.6, 86.3, 86.1, and 86.0, respectively. No significant difference was observed among the last groups.

Ash content

The results showed a significant difference ($p < 0.05$) among groups. G 1 recorded the highest proportion of 0.64 followed by G 2 0.62 which was significantly higher than other groups. G 4 signed a higher value than G3 and G 5 and G 6 of 0.54, 0.53, and 0.55, respectively. No literature was found to compare our data or to justify the highest ash in milk of cows fed clover, that may be due to highly Mg and K elements content in clover.

IV. CONCLUSIONS & RECOMMENDATIONS

In conclusion, feeding clover had a slight suppressing effect on milk production. Clover with concentrate supplementation or sorghum stover significantly improved milk yield and milk components. Concentrate supplementation in the feeding system of dairy cows depends on crops forage, which alone may not satisfy the nutritional requirements of dairy cows because of low quality, it had a 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). Also, offered two types of forages to dairy cows had good responses on milk yield and fat content than offering one type of forage. So it is

recommended to use supplemental protein to maintain good milk yield when using clover forages for lactating cows. On the other hand clover has been and is an excellent feed for many classes of livestock including dry dairy cows, dairy heifers, or beef cows.

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