Growth performance of Friesian calves fed mixed Agroindustrial byproducts ration under Sudan conditions

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SUMMARY

21 Friesian heifers and 21 Friesian bull calves were randomly allocated to 3 rations (A, B, and C) formulated in such a way that sorghum gluten feed replaced cotton seed cake and sorghum grain alone or groundnut hulls respectively. Parameters measured were body weight, gain and dry matter consumption during 10 weeks experimental period.

Although the three rations were iso-caloric and iso-nitrogenous, the best performance was observed with ration C followed by B and A. Bull calves were heavier than the heifers, they consumed more food and had better feed conversion efficiency. Under Sudan conditions growth rate of exotic breeds could be improved through manipulation of voluntary feed intake.

INTRODUCTION

in preparing general recommendations for rearing of dairy exotic calves under tropical conditions like Sudan, it was possible to formulate different feeding strategies to see which would the best performance. Parameters such as growth rate and dry matter consumption were investigated.

Post weaning diet plays a critical role in calves development. The type of diet affects nutrient intake and live weight gain at puberty. The

negative weight gain during post weaning period tends to have an adverse influence on heifer reproduction and development (Granger *et al.* 1990). Heifers raised on a high plane of nutrition before and after puberty showed mammary impairment (Sejresen *et al.* 1982) due depressed level of circulating growth hormones that induce mammary development parenchyma development (Sejrsen *et al.* 1983). However, heifers reared moderately (0.76 kg/day) in the first year then more rapidly (1.18 kg/day) during pregnancy showed no mammary tissue development (Roger *et al.* 1983). In bull calves limiting nutrient intake during the prepubertal period decreased both testicular size (Van De Mark and Mayor, 1964) and circumference as well as lowered circulating testosterone (Pruitt *et al.* 1986).

Supplementation with concentrate was found to improve conception rate at first service (Gabber, 1987). Holstein heifers raised on concentrate and hay required 1.7 services for conception while their mates raised on conventional high roughage ration required 1.4 services (Gardener *et al.* 1971). Also high yielding cows were found to achieve better reproductive efficiency if adequately fed high energy and protein supply (Mcceary, 1991).

Relatively large differences in weight gain are observed among breeds and sexes as a reflection of differences in daily intake and feed conversion efficiency (Chewing *et al.* 1990).

Istasse *et al.,* (1990) reported average daily gain for Holstein-Friesian bulls of 1.36 kg vs 1.24 kg for Belgian Blue bulls, where the former (2.3 kg/100 body weight) consumed more food than the latter (1.8 kg/100 body weight). Differences between sexes showed higher live weight gain in males than females (Rollin and Guilbert 1954, Griffith, 1980).

Information pertaining to exotic breeds in Sudan is rare, hence this study was conducted to investigate the growth performance of Friesian calves fed conventional and agroindustrial byproducts under Sudan tropical conditions.

MATERIALS AND METHODS

Climate

The prevailing climatic conditions during the study were: mean

maximum temperature was 38.6 ± 1.1 C and mean minimum 25.7 ± 0.38 °C with mean relative humidity 50 ± 4.6% and mean solar radiation 23.4 ± 0.51 MJ/m^2 .

Animals and Feeds

21 heifers and 21 bull calves were used with body weight ranging from 60-110 kg and age between 2.5 and 4 months. Each group was subdivided into three sub-groups according age. The six sub-group were randomly allocated to three diets in a completely randomized design. Sorghum gluten feed was used to replace groundnut hulls, cotton seed cake and sorghum grain to formulate three rations as shown in Table 1. During the experimental period each subgroup of animals was kept separately in an open-side shed which was constructed with iron bars and partially roofed with sloped corrugated and galvanized zinc cover coated with an insulated material. The animal barn was oriented in a north-south direction, the floor was slightly sloping and made of concrete. Clean water was offered in metal troughs provided with special taps turned on when was pressed by the animal.

The experimental study covered two periods, an adaptation period of 16 days and a measurement period of 70 days. The tested ration (byproducts) was added gradually to the basal ration (25, 50, 75 and 100%) at 4 days interval.Green fodder *(Sorghum vulgare)* was offered ad-libitum.The animals were weighed at weekly interval forl 0 weeks. Daily food intake was measured by weighing the amounts of food offered and residues from the previous day. Feed conversion ratio was calculated by dividing gain in body weight by the amount of dry matter consumed. Chemical analysis of feed was determined according to AOAC (1970).

The data were analyzed using analysis of variance. (two-way) and differences between means were tested by least significant difference (LSD), Simple linear regression and correlation analysis were used to evaluate the effect of dry matter intake on body weight according to Steel and Tonic (1980).

RESULTS

When comparing the DMI of the three rations for heifer calves during the 10 weeks of the measurement period, ration C showed the highest intake **(P <** 0.05) followed by B and A except for week **4** (Table 2). For bull calves a similar trend was observed. However, no significant differences could be detected between rations A and B during weeks 1, 2, 3, **4,** and 9 (Table 3).

Table 1. Ingredient and chemical composition of the experimental rations on dry matter basis.

Table 5. Reression of dry matter intake (Y) on body weight change (kg $^{.75}$) (X) in female Friesian heifer calves.

Rations	Regression equation	R^2	
A	Y = 39.82 — 6.26X	0.43	-0.68
B	Y = 16.6 + 5.69X	0.19	0.43
C	Y = -2.72 + 10.64X	0.82	0.92

Table 6. Regression of dry matter intake (Y) on body weight change (kg$^{.75}$) (X) in female Friesian bull calves.

Rations	Regression equation	R^2	
A	Y = 32.07 + 0.57X	0.01	0.16
B	Y = 10.22 + 8.63X	0.48	0.71
C	Y = 14.89 + 5.66X	0.61	0.78

R^2 = Coefficient of determination; r = Coefficient of correlation. R > 0.12 is significant at P > 0.01.

For both heifers and bull calves a steady increase in body weight

gain was observed throughout the experimental period with ration C exhibiting highest gain followed by B and A .

The effect of sex on feed utilization was significant (P < 0.05) for dry matter consumption. Bull calves consumed significantly (P< 0.05) more food than heifers, they were heavier and showed better feed conversion efficiency (Table 4). Regression analysis of DMI on body weight of the three rations for heifers (Table 5) indicated a decline of 6.26 kg $^{.75}$ (P > 0.01) for every 1 kg increase in DMI of ration A. with ration B an increase in body weight (kg $^{0.75}$) of 5.69 was obtained for 1 kg increase in DMI (P > 0.01). For ration C an increase of 10.64 kg ^{075} was obtained for every 1 kg increase in DMI. Male calves showed non-significant correlation with

ration A. With rations B and C the correlations were significant ($P > 0.01$), the increase in body weights (kg^{075}) were 8.63 and 5.66 respectively for each increase in DMI.

DISCUSSION

Both sexes showed the best performance with ration C followed by B and A. This could be related to the highest proportion (30%) of cotton seed cake and sorghum grain (25%) in comparison with rations B and A (see Table 1). Cotton seed cake would have provided a source of by-pass protein, while sorghum grain provided a source of fermentable carbohydrate. This was found to be in agreement with other studies in cows (Campling *et al.* 1962) and bulls (Leng, 1984). Bypass proteins entering the small intestine are known to correct for the essential amino acids insufficiencies and provide ATP when oxidized, they were also observed to increase food intake, feed conversion efficiency and live weight gain (Nolan *et al.* 1986). Generally growing calves have high protein requirement and usually a source of bypass protein is required to achieVe maximum performance (Amos, 1986; Kloptenstein *et al.* 1991 and Coomer, 1993). With ration B, a source of fermentable carbohydrate (10% sorghum grain) might have assisted bacterial population in utilizing the available protein in the diet. However, ration A was devoid from both a source of fermentable carbohydrate or bypass protein which might have been reflected on the poor performance of this ration. Regression analysis had further confirmed this relationship between body weight changes in response to dry matter consumption of the three rations.

The average gain in body weights showed bull calves on ration B were similar to those obtained by Kesler (1962) for Friesian calves (0.58-0.81 kg/day) on pasture and barn feeding at different seasons. Also heifers fed diet B showed similar gain as that reported by Hollon and Mochrie (1961) for calves maintained on pasture.

With ration C, gain in body weight was comparable with that obtained by Haenlein *et at* (1962) for heifers fed non expanded grain (yellow corn + raw soybean) and those receiving diets varying in energy contents (0.6-1.0 kg/day) (Amos, 1986). The growth rate obtained for the heifers in this study with diet C (0.76 kg/day) is the optimum to sustain better mammary tissue development and subsequent increase in milk production (Swanson, 1960; Sejrsen *et at ,* 1982 and Roger *et al.,* 1983).

It could be concluded that, under the prevailing tropical conditions of Sudan the performance of exotic dairy breeds could be improved by designing more effective supplementation strategies to see the best influence during the critical prepubertal period. For heifer calves **a** daily gain of 0.76 kg was shown to be the best for mammary tissues development. For bull calves, 0.83 kg gain per day was ideal for the expression of full sexual behaviour at puberty.

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