Growth patterns and feed utilization of yearling Butana heifers fed different energy levels

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SUMMARY

present study involved twelve yearling Butana heifers maintained under the routine feeding system of Atbara Research Station (no supplementation) , were used in a growth trial of 364 days [2001/2002] . Heifers were similar in age and weight , assigned randomly to three groups each four animals . The heifers were fed on group basis , two supplemented groups and a control . The basal forage ration portion was fed as an equal amount daily dry matter intake { DMI) of 2.431 kg / group . The supplementary feed supplied 11.43 and 8.32 MJ / kg , offered in daily intake of 4.34 and 4.01 kg DM / group to the heifers on the high energy diet { HED) and the low energy diet (LED) respectively . Heifers in HED showed significantly , overall feeding period the highest final body weight ($P < 0.01$) , total weight gain ($P < 0.01$) as well as the highest daily gain ($P < 0.05$) estimates not energy of gain were 7.7 for HED treatment compared with those on the LED and control groups of 8.6 and 19.1 MJ / kg respectively . Dietary energy supplementation indicated an overall better rate growth performance for heifers on HED .

INTRODUCTION

To maintain the herd size and to improve the genetic potential for high milk production , quality replacement heifers must be continuously available . It is a fact that farmers in the tropical areas must base their animal production on the utilization of natural resources , basically grasses and agro - industrial by products [Preston and Leng , 1987) . It is well

known that heifers in these areas are commonly under - fed and received poor management .

This could explain the low productivity and efficiency of cattle in such regions . Liveweight differences between heifers in tropical and temperate areas are greater in animals over 18 - months old as suggested by [Vacaro and Rivero , 1985) . They added that these problems are slightly related to the genetic potential of the breed with a major role attributed to environmental conditions particularly feeding . The objectives of this study were to assess the growth response of yearling Butana heifers to the energy supplementation at two levels to a forage based feed .

MATERIALS AND METHODS

In a growth trial of 364 days (2001/2002) . 12 yearling Butana heiſer located at Athara Station were divided into 3 comparable groups four heifers cach) with an average liveweight of 90.0 kg and 11.0 months old The groups were randomly assigned to two treatments referred to as a high dietary energy (HED) and low dietary energy (LED) supplementation , while the third group served as a control . Each group of heifers was penned separately in three adjacent earths - bedded pens of 3x6 m The pens ' walls were constructed on an iron - metalic pole with a non - insulated corrugated zinc roof . Water and feeding troughs were available at each pen

The heifers were group - led and have been received a basal feed of fresh Medicago sati Berseem) and Sorghum bicolor (Abu 70) as a principal forage with some seasonal forages (guar and maize) The three groups (HED . LED and Control) were offered their forage at a similar rate of 2.431 kg DM group day . The forage was provided into two separate meals . The morning diet (about 40 %) of the total daily allowance was offered at 8.30 am and the evening one (60 %) was offered at 16.00 p.m.

The two concentrate supplements were formulated provide 11.43 Mkg DM and 8.32 M / kg DM table 1 fed to heifers in HED and LED respectively . It was fed mid - day after the morning forage meal at a rate of 1.085 kg head day . The refusal portion was weighed the day after to estimate the daily intake by heifers .

The experimental animals were allowed an adaptation period of 3 . consecutive days , then the initial liveweight / kg was taken . Liveweight was then monitored regularly fortnightly throughout the feeding trial fusing a weigh bridge maximum capacity load of 1500 kg) to the nearest 5 kg . From these data the average daily gains were computed . The data was subjected to analysis of variance . The regression technique was used to study the relationship between metabolisable energy intake { Y = MJ / W75) and daily gain (X = kg) . Proximate chemical analysis of feeds was done according to A.O.A.C. methods (1990) .

Table 1. Composition and proximate analysis of the experimental diets.
a- Composition:

Ingredients %	High energy diet HED	Low energy diet LED
Crushed sorghum	40	-
Groundnut cake	15	4
Wheat bran	15	2
Groundnut hulls	17.8	56.5
Molasses	10	32
Urea	0.2	3.5
Common salt	1	1
Lime stone	1	1
Total	100	100

b- Proximate analysis (% DM basis)

Forage	DM	CP	CF	EE	Ash	NFE	ME (MJ/kg
Berseem	30	17.2	29.1	1.3	12.3	32.3	8.44
Abu 70	35	5.5	47.2	1.2	9.2	30.5	6.83
Guar	40	11.3	31.4	1.7	9.7	39.6	9.00
Maize	35	3.1	40.2	0.4	8.2	41.3	12.20
Diet/HEL*	98	17.7	16.8	2.3	6.4	55.4	11.43
Diet/LEL*	94.5	17.0	40.4	2.0	9.1	26.0	8.32

Dietary Metabolisable energy was calculated according to equation quoted by Suleiman and Mabrouk (1999) . ME = 0.012CP + 0.031 EE + 0.005CF + 0.014 NFE

RESULTS

The growth performance of Butana yearling heifers is shown in table 2 and figure 1. The results revealed that the heaviest final body weight attained was 233.82 kg obtained by the HED heifers ($P < 0.01$) compared to the LED and the control group weights of 158.34 and 141.30 kg respectively . Consequently greatest body weight gained along the experimental period was also attained by the HED group of 143.21 { $P < 0.01$) compared to 69.88 and 51.88 kg for the heifers in LED and the control groups respectively , Subsequently the daily weight gain was significantly higher ($P < 0.05$) for heifers in HED of 0.393 kg / day compared with the gain in LED and the control groups of 0.192 and 0.143 kg / day respectively . Feed and energy intake of heifers are shown in table 3. It can be seen that the total dry matter intake was comparatively similar in both HED and LED groups , which was higher than the intake of control group that was fed forage only without any access to concentrate supplement . It can also be noticed from table 3 that all groups had a similar forage intake of 2.431 kg DM day , although the metabolisable energy intake was highest 69.0 MJ in the HED than 52.8 MJ / day in the LED due to difference in diet composition because of difference in amount of grain content , table 1 , while the control forage fed group consumed only 19.4 MJ / day .

Table 2. Performance of yearling Butana heifers {11-24 months} during 364 days feeding trial

Item	Treatments				
	Control	LED	HED	SE±	F. Sig.
Number of animals	4	4	4	-	-
Initial body weight /kg	89.42	88.46	90.61	4.21	NS
Final body weight /kg	141.30^{b}	158.34^{b}	233.82^{a}	9.56	**
Mean body weight /kg	115.36	123.46	162.22	-	-
Mean metabolic body weight /kg $^{0.75}$	35.20	37.02	45.45	-	-
Total gain /kg	51.88^{b}	68.88^{b}	143.23^{a}	5.24	**
Daily gain/ kg/head	0.143^{b}	0.192^{b}	0.393^{a}	0.01	*

* *(P<0.05)*
** *(P<0.01)*
NS *Not significant (P>0.05).*

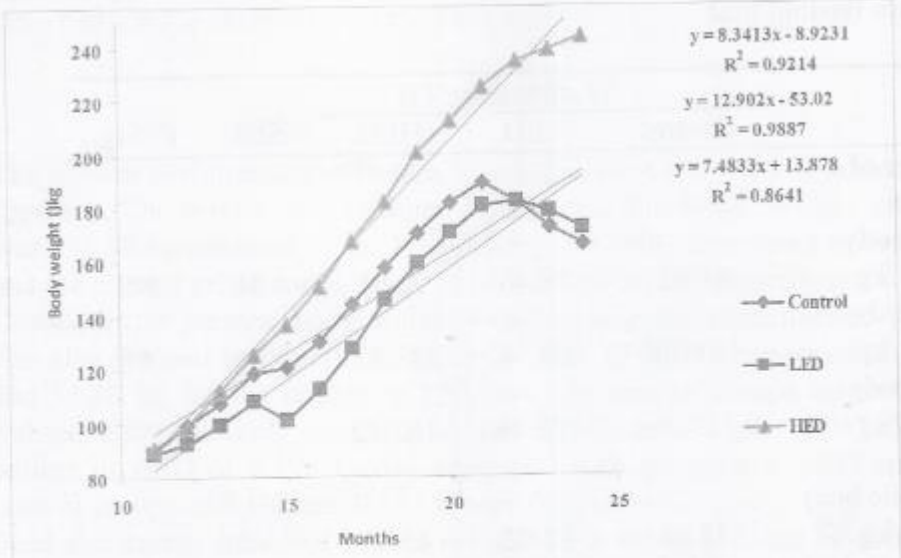

Figure 1: The growth pattern of Butana heifers (11-24 month) fed different energy levels

However , the metabolizable energy { ME } intake (Table 3 & table 4) was above maintenance level of feeding : 1.12 . 1.21 and 1.42 for the first half of the feeding period { 0-29 weeks of age) , then the level of feeding fell to levels below maintenance , varying between 0.91 , 0.90 and 0.99 during the second period , when the heifers were 25-52 weeks of age (figure 2) . This fall . in general varied between a mean of 19 % in the control group rising to 20 % in the LED group and up to 30 % in the HED group ; such trend that can be described as a downwards reciprocal trend .

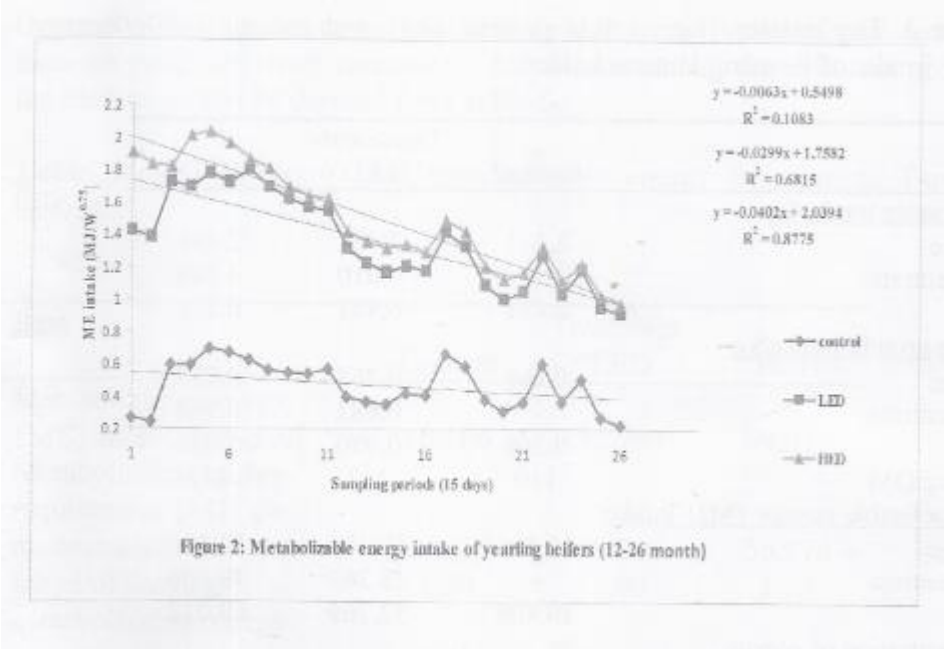

Figure 2: Metabolizable energy intake of yearling heifers (12-26 month)

Table 3. Dry matter {kg}, crude protein {kg} and metabolisable energy {MJ} intake of yearling Butana heifers.

Item	Treatments		
	Control	LED	HED
Dry matter intake/kg			
Forage	2.431	2.431	2.431
Concentrate	-	4.010	4.340
Total	2.431	6.441	6.771
Crude protein intake/kg			
Forage	0.268	0.268	0.268
Concentrate	-	0.682	0.768
Total	0.268	0.950	1.036
g cp/kg DM	110	147	153
Metabolisable energy {MJ} intake			
Forage	19.406	19.406	19.406
Concentrate	-	33.363	49.606
Total	19.406	52.769	69.012
Concentration of energy {M/D}	8.0	8.2	10.2
Metabolizability energy {qm}	0.43	0.45	0.52

qm – M/D – 18.4

Table 4. Relationship {Y= a +bx} between metabolisable energy intake {Y= MJ/$W^{0.75}$} and daily gain {X= kg} in growing yearling Butana heifers groups {n= 26}

Treatment	Variables means		Constants			
-	X	Y	A	B	SE	Sig.
Control	0.041	0.462	0.459	0.073	0.118	***
LED	0.242	1.354	1.302	0.215	0.246	**
HED	0.420	1.497	1.247	0.595	0.308	NS

*** *{P<0.001}*
** *{P<0.01}*
NS Not significant {P>0.05}.

Generally , daily gain , energetic efficiency and energy value of gain tend to increase positively with increase in ME intake among the different group fed heifers ; as can be derived from table 5 .

Table 5. Utilization of feed metabolizable energy by yearling Butana heifers.

Item	Treatment		
-	Control	LED	HED
Metabolizable energy {ME} intake {MJ/day}	19.406	52.769	69.012
Metabolizable energy requirement {MJ} for maintenance	16.157	48.200	56.676
Level of feeding	1.20	1.09	1.22
Metabolizable energy remaining for growth {MJ}	3.249	4.569	12.336
Efficiency of gain	0.34	0.36	0.45
Efficiency of maintenance	0.654	0.661	0.703
Metabolizable energy of gain {MJ}	1.105	1.645	7.03
Daily gain {kg}	0.143	0.192	0.393
Energy value of gain {MJ NE/kg}	7.7	8.6	14.1
Efficiency of energy [2] use for combined maintenance and production {Kmp}	0.601	0.635	0.648

(1) Calculated from data and equation in table 4 and table 2.
(2) Quoted from McDonald, Edwards, Greenhalgh and Morgan (1995) Animal Nutrition, pp 267-273.

DISCUSSION

The effects of dietary energy supplementation on final weight in cattle have been studied by many authors , among them ; Elkhidir et al . , (1988) . Abu Hatab (1994) and Mohamed (1999) . They indicated an association of heavier body weight with higher dietary energy concentration : In compliance in the present study results ; the final body weight of the

heifers in high energy diet { HED } supplemented group was heavier { P < 0.05) .than the other groups .

Similarly , Brown et al . , (2005) , study the effect of dietary energy supplementation on improving the growth rate in Holstein heifers . He indicated a higher rate of gain on higher dietary level , which is in line with the present study findings .

On the other hand the lowest weight gain obtained by the control non supplemented group might be attributed to the limited supply of energy intake by forage only feeding that varied considerably in quality and quantity particularly during the later period of the experiment ; However , Elkhidir (1977) in his study attributed such low performance to the low nutritive value of highly fibrous grass fed .

Moreover on the same line Abu 1994) studies had shown the adverse effect of energy limitation on growing heifer calves fed sole sorghum stovers { ME = 6.7 } resulted in negative gain , which was moderated by concentrate resupplementation . It had been earlier indicated that the efficiency of utilization of feed for production purpose depends on the type of feed consumed and its digestion products absorbed that will be less efficiently utilized for production from the roughage than from concentrate as indicated by Blaxter and Wainman . (1964) .

This might explain the low performance of the forage - fed group compared to high energy supplemented group { HED } . The increase is feed consumption with dietary energy concentration ; [table 3] in inconsistent with results obtained by Owen and Geay (1992) who reported a decline in feed intake with increase of energy while total energy intake remained reasonably constant which they attributed to the influence of other factors such as physical form , crude fibre and protein content of the diet .

The positive trend in energetic efficiency rise with metabolizable energy intake , in the current study similarly corroborates with Colenbrander et al . , (1971] findings observing a linear trend towards an improved energetic efficiency use in yearling Holstein heifers , expressed as estimated net energy intake required for both maintenance and growth . It can be concluded that regular high dietary energy supplementation for yearling

heifers is desirable . It would induce a sustainable and optimal growth rate thus attains an earlier mature body size . A metabolizable energy concentration { M / D) , not less than ten , can be advised .

ACKNOWLEDGEMENT

Deepest gratitude and profound that is to the members of staff of Atbara Research Station with special regard to Dr. Kamal A. Wahab , Ex - director of the Station , his family and to Dr. Yassir Ahmed Hassan for generous co operation , unlimited assistance and encouragement during the course of the study .

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أنموذج النمو واستخدامات الطاقة الغذائية خلال السنة الأولي من العمر في عجلات البطانة تحت مستويات مختلفة من الطاقة

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ملخص البحث

اجريت هذه الدراسة تحت ظروف التغذية الطبيعية بمحطة تربية الحيوان - عطبرة التقدير معتل پر اليومي في عجلات البطانة الفترة من اها 364 بوما (2002 / 2007 م) . وقد اخترت التي عشرة علة متماثلة في الوزن و العمر قسمت لثلاث مجموعات عشوائية : المجموعة الأولى أعطيت عليقة عالية الطاقة 43/1 1 ميجاجول و الثانية متخصصة الطاقة 32/8 ميداجول / كيلو جرام مادة جافة ، و الثالثة مجموعة الشاهد اعطيت المجموعات الثلاث كميات مشاويات من العلف الأخضر بمعدل 2431 كيلوجرام مادة جافة للمجموعة في اليوم الطبقة المركزة فكانت بمقدار 434 ، 401 كيلو جرام للمجموعتير عالية ومخلصة الطاقة علي الترتيب . صحت الدراسة أن كلا من الوزن { P < 0.01 } النهائي وإجمالى الوزن المكتب كانا عالي المعنوية في المجموعة ذات الطاقة العالية أيضا أوضحت الدراسة أن معدل النمو اليومي العجلات كان عالي المعنوية في المجموعة ذات . نرت الطاقة 77 للمجموعة عالية الطاقة مقارنة بالمجموعة منخفضة P < الطاقة العالية { 0.05 الطاقة ة الشاد 8.6 و 14.1 (ميجاجول / كجم) على التوالي . وخلصت الدراسة إلى أن العليقة المركزة ذات الطاقة العالية أعطت أعلى أداء انتاجي (نمو) لعجلات البطانة