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Research Article

Effect of Feeding Levels on the Performance of Erashy Heifers

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Abstract: A feeding trial was carried out to evaluate and study the effect of feed level on the performance of Sudanese Erashy heifers kept under controlled management systems and fed three different dietary regimes. Twenty Erashy heifers aged 3-3.5 years were randomly divided into 4 equal groups of 5 each according to the diet levels. The study was carried out at the department of animal production-Faculty of Agriculture and Natural Resources (New Halfa) –Kassala University –Sudan, during the period from October2010 to October 2011. Data were analyzed by using completely randomized design to compute analysis of variance and means of each variance with standard error (SE). The analyzed data revealed that the dietary level of concentrate had Significant effect ($p \leq o.o5$) on the performance of experimental heifers regarding, feed intake, average growth rate, bi-weekly weight gain, total body weight gain(kg), final body weight(kg), and feed conversion efficiency. The results also indicated that the diet levels had significant effect on the heifer's onset puberty, and showed strong negative correlations between age at puberty and body weight (-0.206), and diet levels effect on successful conception occurrence.

Keywords: Erashy, level of nutrition, onset of puberty, conception rates.

INTRODUCTION

Heifers are future herd of a dairy farm. They must be produced to replace the older and uneconomical females of the farm through voluntary culling (Bhatti, *etal* ., 2007) . Heifer production is most expensive part of the dairy farm operation (Heinrichs, *et al*., 1993). It requires more inputs for a longer period of time with no visible returns than any other farm operation. It is even more important to know whether heifer's performance as adult animals can be enhanced by proper nutrition and management (Kreplin and Yaremcio, 1992). The feed and management program for replacement heifers will have a lifelong effect on their productivity. It will determine how young they may be bred; whether they calve early, late, or not at all; whether they are good milkers or poor milkers; the weaning weights of their calves; and how long they remain in the herd (Kreplin and Yaremcio, 1992). The performance of animals is affected by the system of management, and the plane of nutrition as indicated by (Guibert *et al*., 1944, Saini *et al*., 1986).The effects of poor nutrition differ depending on whether the main deficiency is in energy, protein, vitamins, minerals or trace elements. Under traditional management, usually more than one component is deficient (Roberts, 1971). The nutritional quality of feeds and forage can have a tremendous influence on the reproductive and productive performance of cattle. Although reproductive failure may occur for several reasons, management and the environment are often important contributing factors. Part of the environment and management of any animal is nutrition (Kreplin and Yaremcio, 1992).

Among indigenous cattle in El-Gash area, Erashy cattle can be one of the most promising dairy cattle. Recent scores field studies demonstrate that Erashy cattle don't differ in performance from Butana and Kenana cattle (The main Sudanese dairy cattle) in addition to its adaptation to local environment and good temperament (Osman, 1998). So it may be possible to improve this cow, to participate, in development and improvement socially and economically in Kassala state. Primarily we need to Study some of reproductive productive and characteristics of Erashy cattle heifers in semi intensive system, although a lot of work has been done on various parameters. The present study was, therefore, designed to study the productive and

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reproductive performance of Erashy heifers kept under controlled management systems and fed three different dietary regimes.

MATERIALS AND METHODS

Animals and experimental periods:-

In this trail 20, 3-3.5 years old, white (which are assumed to be pure Erashy) heifers purchased from the local market (Wager city, north Delta Elgash locality, Kassala State, Eastern of Sudan) and transported to the Faculty of Agriculture and Natural Resources, Animal Production Department Farm, in order to obtain baseline data on reproduction and production under research condition, from October2010 to October, 2011**.**

Experimental procedures and treatments:-

The experimental period was 50 weeks including two weeks for adaptation and 48 weeks for data collection. At the start of adaptation period, the animals were wormed and housed in a loose-housing yard divided into four groups (n=5). During this period animals were fed hay and mixture containing equal percentage of the assigned experimental rations (Durra, groundnut hull, conventional oil seed cake, wheat bran, salt, urea, $caco_3$ and lime stone) at adlibitum . Feed were offered in one meal at 8 am, green fodder was also offered to avoid vitamin A deficiency. Clean water and salt lick were available throughout the experimental period. Immediately after the adaptation period the animals were individually weighed and then randomly divided into four groups (A, B, C, and D), each group contained five animals and were identified by numbers (ear tag). Animals were put in four experimental rations (H= high energy, high protein (11.5, 18) respectively M=medium energy, medium protein (10.5, 16) respectively; L=low energy, low protein (8.5, 14) respectively and very low energy, very low protein (6.69, 4.45) respectively) except group (D) were fed roughage only (control). The ingredients (%) and chemical composition of experimental diets are given in (Table 3-1). The experimental animals were weighted (initial weight), then every 14 days and recorded until the end of experiment (48 weeks).The difference in final weight compared to the initial weight divided by the number of days in the feedlot was used to determine the daily weight gain, also the intakes were assessed and expressed in kilogram per day.

Table (1): Ingredients (%) and chemical composition of experimental diets

forage constituents	A	B	C	D
Ingredients (%)				
Conventional oil seed cake	22	15	13	0
Durra	55	22	0	0
Wheat bran	7	30	33	0
Groundnut hull	0	19	49	0
Molasses	11	9	0	0
Sorghum stalks	0	0	0	100
Urea	2	2	2	0
Hydrated lime	2	2	2	0
Salt	1	1	1	0
Chemical composition				
ME* (Mj/kg DM)	11.5	10,5	8.5	6.69
Crude protein (%)	18	16	14	4.45

***MF** of the complete diet was Calculated according to the equation: ME (Mj/kg Du) = 0.0102CP + 0.031EE + 0.005CF + 0.014 NFE (MAFF, 1975).

Data recorded:

(a) Feed lot performance:

(i) Feed intake

Total feed offered and residual for each feeding trough to any group was weighted and recorded daily till the end of experiment to calculate group feed in take by difference groups. The feed intake of each group was calculated daily as the difference between residual amounts and offered.

(Ii)Weight Gain

In this part animals were weighted every two weeks at morning after fasting the animals for 12 hours to decrease error that result from animal's ruminant content, using digital balance.

(iii) Feed conversion efficiency:-

Feed conversion efficiency was calculated after animals were weighed every two weeks **(**The percentage of feed intake to weight gain**).**

(iv)Initial body weight

(v) Average Growth rate

(Vi)Final body weight

Reproduction performance:

Age at first estrous (Age at puberty (months):

This is the age in days at which the first sign of estrous comes. Number of services per conception.

Statistical Analysis:-

The collected data was compiled, tabulated and analyzed in accordance with the Objectives of the study. The data were subjected to statistical analysis using completely randomized design to compute analysis of variance and means of each variance with standard error (SE) according to (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

Feedlot performance:

From the performance data (Table, 3.1) it became evident that the level of diets had significant effect on performance of the experimental heifers. These observations agreed with that of (Guibert *etal*., 1944; Saini *etal*., 1986). Guibert *et al*., (1944) who showed that maximum efficiency is obtained from a high plane of nutrition with continuous growth and development to produce a unit of product.

There were significant differences (P>0.05) in feed intake across treatments according to the level of diets concentrate (Table 3.1). This finding agrees with that of (McCullough, 1970, Leaver, 1973) who indicated that roughage intakes were depressed by increasing the level of concentrate supplementation, but contradicts with other studies which indicated that roughage intakes were depressed by increasing the level of concentrate supplementation (Tayler and Wilkison, 1972). The varieties in feed intake might be due to increased crude fiber content of the diet, feed physical form.

Table (2): Mean value for Erashy heifers performance fed diets containing different levels of protein and energy over 48weeks

Items	Experimental DIETS					
	H.H	M.M	L.L	Roughage	S.E	L.S
Number of animals	5	5	5	5	-	-
Feed lot period(weeks)	48.00	48.00	48.00	48.00	-	-
Feed intake(kg/head/day)	7.69	7.49	7.51	5.03	0.16	*
Initial body weight (kg)	125.00	121.00	124.00	123.00	0.7	N.S
Average daily growth rate	0.55	0.44	0.28	0.11	0.02	*
Biweekly weight gain (kg/head/2weeks)	8.18	6.68	4.28	1.71	0.3	*
Final body weight (kg)	296.00a	261.00b	192c	168.00 d	11.82	*
Total body weight gain(kg)	171.00a	140.00b	68.00c	45.00d	11.86	*
Feed conversion ratio(kg FI/kg gain)	7.93	9.27	14.40	38.20	0.90	*

H.H = High protein/energy level
M.M = Medium protein/energy level
L.L = Low protein/energy level
S.E = Standard error
L.S = Level of Significance
N.S = Non significant
***:** Significant at level 0.05
Means bearing the same superscript are not significantly different.

Feed Conversion Efficiency:-

Many factors influence feed/forage efficiency including age, diet type, environmental temperature, breed, growth promoters, and many other management and environmental variables (NRC, 2000).

The present results in (Table, 2) showed that the feed conversion efficiency was significantly different among dietary treatments. It improved from (7.93kg DM/kg wt gain) for(H.H) group fed on high level protein and energy diet to (9.27kg DM/kg wt gain) for(M.M)group fed on medium of protein/energy diet , (14.40kg DM/kg wt gain)for L.L group fed on low protein /energy and(38.20kg DM/kg wt gain) for roughage group fed on very low protein /energy respectively. These findings in line with (El-Hag and Mukhtar, 1978) who concluded that the feed conversion efficiency was improved with the decrease in the roughage portion of the ration. Price *etal*., (1980), similarly, indicated that increasing the level of roughage from 20%to 80%in the diet resulted in a significant decrease in average daily gain, and an increase in feed intake and feed per kilogram gained to both slaughter weight of bulls and steers(450kg or 580 kg).

Gain in Body Weight:-

Table, (2) shows the mean values for body weight (initial and final) and total weight gain for the four experimental animal groups. Initial weight of the four groups at 3-3.5 years of age in this study was 125, 121, 124, 123 kg respectively. Final body weight at 4 - 4.5 years of age (after 48weeks) was 296, 261, 192 and 168 kg. This observed highly significant difference (p<0.01) on body weight gain among the treatment groups according to the levels of nutrition. Highest value of body weight gain was reported in group A (171.2kg) followed by group B (140.8kg), group C (68.6kg) and group D which had least body weight gain (46kg) respectively. This observation was in agreements with the finding of (Brosh *et al*., 2000) who noted that higher weight gain in male Holstein-Friesian calves fed high protein diet in comparison to feeding of medium or low protein diets. It also agreed with the reported (in buffalo calves) of (Singh *et al*., 1994) and (Verma, 1998). Increased BW gain on normal and high than low protein diets was reported, and it was suggested that the growth rate increases with an increased availability in protein and energy levels in diets, similar to the findings of (Dabiri and Thonney,

2004) in lambs. Previous studies (Tayler and Wilkison, 1972; Leaver, 1973; El-Tayeb and Gaber, 1987) also found that live weight gain increased as the rate of concentrate supplementation increased.

Biweekly body weight gain:-

The result in (Table, 3.1) indicated that the different protein/energy level in experimental diets had a significant (P<0.05) effect on biweekly body weight gain of experimental animal groups, and it was increased as protein / energy level increased in the diet. .Heifers that fed on ration contained high energy/protein level recorded higher significant (P<0.05) biweekly (8.2kg) gain than that of medium (6.7kg), low (4.3kg) and very low (1.7) energy/protein (Roughage**)** diets**.** The result of this study in line with **(**Cmarik *etal*., 1957) who showed that the average daily gain of steer, offered varying ratios of concentrate-to-roughage was increased as the level of concentrate increased. Similarly, (Leaver, 1973) found that increasing the level of concentrate supplementation gave linear increases in live weight gains of calves. Also he observed that the greatest response occurring with roughages of low digestibility**.**

Average daily growth rate:-

Table (2) illustrated that the average daily growth rate was affected significantly (P < 0.05) by the level of protein / energy. Average daily growth rate was highest in heifers fed high protein/energy diet (0.55kg) flowed by the heifers fed medium then low protein / energy diet and finally in the heifers fed roughage (o.44 kg, 0.28kg, 0.11kg) respectively. The obtained of this study agrees with that of (Saini *et al*., 1986) who studied the effect of management systems on the growth performance of Barbari kids under semi-intensive conditions. They found that the body weight gains and the growth rates of kids under intensive system were significantly higher than of those under semi- intensive system. This low protein content of tropical grasses leads to insufficient production of rumen microbial protein to support optimum growth rate (Oyedipe *et al*., 1982).

Reproduction performance

Age at first estrous:

As seen in (Table,3.2) below, time (weeks) at the puberty incidence of estrus for heifers in the high, medium, low and very low diet level, indicated that heifers that fed high level of concentrate reached puberty (first onset of estrus) at a significantly (P<0.05) younger age (20.4 ±5.73 weeks) and heifers live weight (201 kg) than heifers fed the medium and low level of concentrate (33.6± 8.9weeks and 223 kg, 47.3 ± 1.2weeks and 194.7 kg) respectively, however two of the group(low protein/energy) level and Heifers fed straw only in group (Very low protein/ energy) did not reach puberty during the experimental period.(no sign was detected at all), also through the onset of estrus of experimental animals under this study analysis results showed strong negative correlations between body weight and onset estrus of the experimental animals (-0.206). Such results indicate that Poor nutrition significantly delays puberty. Early research confirmed that nutrition played an important role in reproduction, but in most cases severe nutritional deficiencies were required to cause reproductive problems. Poor nutrition delays puberty matching with (Patterson *et al*., 1992, Schillo *et al*., 1992).who reported that age at puberty is negatively correlated with plane of nutrition. Similarly, (Malik,1987) indicated that buffalo heifers maintained on a higher plane of nutrition showed first estrus at an early age due to higher growth rate. Therefore, the onset of puberty seems to be determined by weight gain achieved during the post weaning period, rather than by the age of the animal. In another study, (Chaudhry *et al*., 1991) reported that age at puberty could be reduced by one month through additional concentrate feeding for a few months before the onset of puberty in Nili-Ravi buffalo heifers. However, mineral supplementation in this study did not reduce the age at puberty in buffalo heifers. Puberty is usually delayed in grazing cattle because grasslands do not provide enough protein and other nutrients (Topps, 1977). This low protein content of tropical grasses leads to insufficient production of rumen microbial protein to support optimum growth rate (Oyedipe. *et al*., 1982, Malik, 1987).

Table (3). Effect of nutrition level on onset of puberty in heifers (weeks)

Diet level	Mean ± SD	Range (weeks)
Very low protein/ energy	-	-
Low protein/ energy	47.3 ± 1.2	46-48
Medium protein /energy	33.6 ± 8.88	22-44
High protein/ energy	20.4 ±5.73	14-28

Number of services per conception:-

As (Table, 3.3), the percent of successful conception was 100%in diet high energy high protein, of which 80%was in the 1st and 20% after 2nd mating. In diet med energy, med protein, the successful conception was 40%. In diet B20% was in the first and 20% in the second mating, while in diet low energy, low protein, successful conception was obtain in the second mating, however no successful conception was recorded for diet very low energy, very low protein. The result above indicate that the percent of successful conception rate was effected by the feeding level , and these results matching with (Short and Bellows, 1971; Fleck *et al*., 1980; Lemenager *et al*., 1980) who reported that poor nutrition delays puberty, reduces conception rate and increases pregnancy losses in heifers.

Table (4) Percentage of successful conception of Erashy heifer's type according to the diet levels

Energy and protein level	Heifers group	Final	1st	2nd	1st	2nd	Total
High energy High protein	A	5/5	4/5	1/5	80	20	100
Medium energy Medium protein	B	2/5	1/5	1/5	20	40	40
Low energy Low protein	C	2/5	0	2/5	0	40	40
V. Low energy V. Low protein	D	0	0	0	0	0	0

REFERENCES:

1. Bhatti, S. A., Sarwar, M., Khan, M. S., & Hussain, S. M. I. (2007). Reducing the age at first calving through nutritional manipulations in dairy buffaloes and cows: A review. Pakistan Veterinary Journal, 27(1), 42.
2. Bartha, R. (1971). Studien zu Fragen der Zebu - Rinderzucht in den Tropen. Weltforum Verlag, Munich, Federal Republic of Germany. 172 pp.
3. Brosh, A., Aharoni, Y., Levy, D., & Holzer, Z. (2000). Effect of dietary protein concentration and source on the growth rate and on body composition of Holstein-Friesian male calves. Animal Science, 70(3), 527-536.
4. Productive and reproductive performance of Nili-Ravi buffalo heifers as influenced by mineral and concentrates mixture
5. Saini etal., 1986).
6. Cmarik, G. F., Webb, R. J., & Cate, H .A. (1957). The response of fattening yearling steers self-fed complete pelleting rations of varying rations of concentrate to roughage. J. anim. Sci. 16: 1085.
7. Cornelia Kreplin and Barry Yaremcio, (1992). Effects of Nutrition on Beef Cow Reproduction. Crossbred cows. Opin. Anim. Vet. Sci., 2012, 2(1), 49-54.,
8. Dabiri, N., & Thonney, M. L. (2004). Source and level of supplemental protein for growing lambs. J. Anim. Sci. 82, 3237-3244.
9. El Hag, G. A., & Mukhtar, A.N.S. (1978). Varying levels of concentrates in the rations of Sudan desert sheep .World Rev. Anim. Prod. 14:73.
10. El Khidir, O. A. (1977). A pilot study for the effects of improved nutrition on growth and sexual maturity of local type heifers. M. Sc. Thesis, University of Khartoum.
11. El-Tayeb, A. E., Nour El Din, A. A., & Tibin, I. M. (1987). Effect of two different roughage to concentrate rations on carcass traits of Sudan Desert sheep. Sudan J. Vet. Sci. Anim. Husb, 26(1), 83-90.
12. Books, B. (2010). Assistant Professor, Botanist. In Workshop in Course Portfolio. Self-Assessment Administration and Quality Assurance. Sudan University of Science and Technology (Vol. 21, p. 3).
13. Fleck, A. T., Schalles, R., & Kiracofe, G. H. (1980). Effect of growth rate through 30 months on reproduction performance of beef heifers. Journal of Animal Science 51: 86.
14. Guilbert, H.R., Hart, G. H., Wagnon. R.A., & Goss, H. (1944). The importance of continuous growth in beef cattle. Calif. Agri. Exp. Bull. 688.
15. Heinrichs, A. J. (1993). Raising dairy replacements to meet the needs of 21st century. J. Dairy Sci., 76:3179-3187.
16. IFAD (International Fund for Agriculture Development). (2003). Republic of the Sudan . Gash Sustainable live hoods regeneration project .Volume:11: Working papers. Report No. 14 62-SD.
17. Leaver, J. D. (1973). Effect of concentrate supplementation on the live- weight gain and feed intake of calves offered roughage adlibitum. J. Anim. Prod. 17, 43.
18. Lemenager, R P., Smith, W. H., Martin, T. G., Singleton, W. L., & Hodges, J. R. (1980). Effects of winter and summer energy levels on heifer growth and reproductive performance. Journal of Animal Science 51, 83 7.
19. MAFF, (1975). Ministry of Agriculture, Fisheries and Food Energy Allowance and Feeding systems for Ruminants; Technical Bulletin 33. HMSOL. London, ISBN 01124049x.
20. Malik, M. Y. (1987). Reproductive performance of buffaloes as affected by nutritional imbalances. Proceedings of International Symposium on Milk Buffalo Reproduction, Islamabad, Pakistan, p. 35. 37.
21. McCullough, T. A. (1970). A study of the effect of supplementing a concentrate diet with roughages of different quality on performance of Friesian steers. 1: Voluntary food intake and food utilization. J. Agric. Sci. (Camb.) 75, 327-333.
22. NRC, (National Research Council). (1989). Nutrient Requirements of Dairy Cattle. 6th Rev. Ed., National Research Council. Natl. Acad. Sci. Washington, DC, USA.Oyedipe, E. O., Osori, D. I. K., Akerejola, O. and Saror, D., (1982). Effect of level of nutrition on onset of puberty and conception rates of zebu heifers. Theriogenology18: 525-539.
23. Patterson, D. J., Perry, R. C., Kiracofe, G. H., Bellows, R. A., Staigmiller, R. B., & Corah, L. R. (1992). Management considerations in heifer development and puberty. Journal of Animal Science, 70(12), 4018-4035.
24. Penzhorn, E J. (1975). Wintering levels and reproduction in Africander heifers. Agroanimalia 7: 49-59 (Animal Breeding Abstracts 45: 3777).

25. Post, T. B., & Reich, M. (1980). Puberty in tropical breeds of heifers as monitored by plasma progesterone. Proceedings of the Australian Society of Animal Production 13: 61-62 practices in the United States.
26. Price, M. A., Jones, S. D. M., Mathison, G. W., & Berg, R. T. (1980). The effects of increasing dietary roughage level and slaughter weight on the feedlot performance and carcass characteristics of bulls and steers. Canadian Journal of Animal Science, 60(2), 345-358.
27. Roberts, S. J., (1971). Veterinary obstetrics and genital diseases. 2nd edition. Published by the author. Distributed by Edwards Brothers, Ann Arbor, Michigan, USA. 776 pp.
28. Saini, A. L., Khan, B. U., Prakash, B.,. & Vihan, V. S. (1986). Effect of management systems on the growth performance of Barbari kids under semi-intensive conditions.
29. Schillo, K. K., Hall, J. B., & Hillman, S. M. (1992). Efects of nutrition and season on the onset of puberty in the beef heifer. J. Anim. Sci., 70, 3994-4005.
30. Short, R. E., & Bellows, R .A. (1971). Relationships among weight gains, age at puberty and reproductive performance in heifers. Journal of Animal Science 32, 127-131.
31. Singh, R. K., Verma, D. N., & Husain, H. Q. (1994). Estimating the requirement of protein for maintenance and growth of female buffalo calves. Indian J. Anim. Nutr. 11, 97-100.
32. Steele, R. G. D., & Torrie, J. H. (1980). Principles and Procedures of Statistics: A Biometrical Approach. 2nd edition McGraw- hill. London, U.K. 633 pp.
33. Tayler, J.C., & Wikson, J.M. (1972).The influence of level of concentrate feeding on the voluntary intake of grass and on live weight gain by cattle. Anim. Prod., 14: 85.
34. Topps, H. J. (1977). The relationship between reproduction and under nutrition in beef cattle. World Review of Animal Production 10, 43-49.
35. Verma, D. N. (1998). Studies on protein requirement of buffalo calves. Buffalo Bulletin. 17:10-13.
36. Wiltbank, J. N., Gregory, K. E., Swiger, L. A., Ingalls, J. E., Rothlisberger, J. A., & Koch, R. M. (1966). Effects of heterosis on age and weight at puberty in beef heifers. Journal of Animal Science, 25(3), 744-751.