

## Effect of Feeding Hay Supplemented with Concentrates on Feedlot and Reproductive Performance of Prepubertal Hassawi Heifers

S.A. Al-Shami

Department of Veterinary Public Health and Animal Husbandry,  
College of Veterinary Medicine and Animal Resources, King Faisal University,  
P.O. Box 1757, Al-Ahsa 31982, Saudi Arabia

**Abstract:** Feeding of hay supplemented with concentrates to Hassawi heifers improved feedlot performance and shortened the age to first estrus compared to animals fed hay alone. The intensity and length of estrus, size of follicles, diameter of corpus luteum and serum progesterone concentrations were significantly improved in animals fed concentrates compared to those fed hay alone.

**Key words:** Prepubertal, hassawi heifers, feedlot, reproductive performance, concentrate

### INTRODUCTION

Hassawi cattle breed is a mix of *Bos indicus* and *Bos Taurus*. The cattle are raised in the Eastern region of Saudi Arabia by farming families in mixed farming system. The breed numbers are declining very fast from 10449 head in 1986 to an estimated maximum of 4500 head at present (Ministry of Agriculture Year Book, 1998). The breed had never been described in the literature (Smith, 1980; Mason, 1996). Phenotypic characterization of the breed has been given recently (Mohammed, 1997). The animals are small in size, mature body weight is 210-270 kg for bulls and 150-200 kg for cows. They are known of being heat tolerant with good appetite even during hours of high temperature, resistant to the diseases in the region and with good mothering ability. In the absence of a systemic and coherent institutional policy to improve and conserve them, the Hassawi cattle will become extinct and a potentially valuable genetic material will be lost for ever.

An investigation was conducted to characterize the reproductive cycle of both lactating and non-lactating Hassawi cattle. Mean cycle length of the cycle ranged between 18-22 days. Duration of estrous symptoms, estrous intensity and concentration of serum progesterone were lower in lactating than non-lactating cows (AL-Shami, 2003). However, duration of estrous symptoms was shorter than that reported for other breeds (Rakha *et al.*, 1970; kanal and shimizu, 1983). Estrous intensity too, was lower than in other breeds (Dobson and Kamonpanta, 1986).

Supplementing low quality diets with concentrates can improve rumen fermentation, fiber digestibility and forage intake (Church and Santos, 1981 Lee *et al.*, 1985, McCollum and Galyean, 1985; El-Tayeb *et al.*, 1992)

demonstrated that supplementing a combination of forages with concentrates improves performance and reproductive traits of Sudanese crossbred dairy heifers.

The objectives of this study was to examine the performance and sexual development of Hassawi heifers fed low-quality hay supplemented with concentrate mixture.

### MATERIALS AND METHODS

**Animals:** Hassawi heifers (N = 18) were randomly divided into 3 equal groups as follows:

**Group 1:** Six heifers were offered hay (Rhodes grass) only, (diet A).

**Group 2:** Six heifers were given hay with 1kg concentrate (Arasco company), (diet B).

**Group 3:** Six heifers were given hay with 2kg concentrate, (diet C).

Heifers were penned and fed in pairs. The concentrate was obtained from Arasco company, Saudi Arabia. Concentrate was offered to heifers once a day at the morning.

**Estrous detection:** Estrous was detected with the aid of a bull which has free access to females four times daily in the presence of herdsman. Cows were in estrus when standing to be mounted by male, mating was prevented. The intensity of behavioural estrus was scored on a scale from 0 to 3 from the degree of expression of (1) restlessness and bellowing (2) mounting activity (3) swelling of vulva (4) mucus discharge and (5) uterine tone

(total score 0 to 15). During estrus animals were palpated per rectum, to measure the follicular size and diameter of C-luteum. Jugular blood sample (2 mL) was obtained every week by venipuncture. Serum was separated and stored at -20°C until analysis.

**Hormonal measurements:** Serum progesterone concentrations were measured by radioimmunoassay previously described and validated (Homeida *et al.*, 1988). The intra- and inter-assay coefficients of variation were 4.3 and 12.1%, respectively. Extraction efficiency and sensitivity were 85.7% and 48 pg mL<sup>-1</sup>, respectively.

**Other production measurements:** Feed eaten and refusals were recorded daily. Animals were weighed every two weeks. Water and salt licks were available at all times. Feedlot performance included initial body weight, final finished body weight, length of finishing period, body weight gain and feed conversion ratio.

**Statistical analysis:** Data will be analyzed by one way ANOVA, using GLM procedure of SAS.

## RESULTS

Results of feedlot performance are given in Table 1. Final body weight, average daily gain and feed conversion ratio were significantly ( $p < 0.05$ ) higher in heifer fed diet C than diet A or B.

The effect of feeding hay supplemented with concentrate on some reproductive traits are summarized in Table 2. Age at first estrus was significantly ( $p < 0.05$ ) shorter in heifers fed diet C compared to those fed diet A or B. Estrus intensity such as mating activity and uterine

Table 1: Feedlot performance of Hassawi heifers fed hay supplemented with concentrate for 120 days

Type of diet	Diet A	Diet B	Diet C
Initial Live weight (Kg)	99.2±1	98.6±1	99.1±1
Final Live weight (Kg)	122.1±3a	145±4b	186.1±5c
Average daily gain (Kg)	0.16±0.02a	0.51±0.06b	0.76±0.12c
Feed conversion ratio (Kg feed Kg <sup>-1</sup> weight gain)	20.1±2.1a	9.1±0.66b	6.2±0.32c

a-b, Means in same row with different letters are different ( $p < 0.05$ )

Table 2: Effects of feeding hay supplemented with concentrate on some reproductive traits of Hassawi heifers

Type of diet	Diet A	Diet B	Diet C
Age at first estrus (month)	13.2±0.6a	10.1±0.7b	8.1±0.4c
Estrus intensity score (0-15)	9.1±1a	11±1b	12.2±1b
Estrus length (h)	12±1.6a	15.1±1.5b	17.1±1.2b
Estrus cycle length (days)	19.3±1.1a	20.1±1.2	20.2±1.2
Maximum follicular size (cm)	1.6±0.2a	1.5±0.2a	2.1±0.3b
Diameter of mature corpus luteum (cm)	1.2±0.2a	1.1±0.1a	1.8±0.2b

a-b, Means in same row with different letters are different ( $p < 0.05$ )

Table 3: Effects of feeding hay supplemented with concentrate on serum progesterone concentration after detection of first estrus for 3 consecutive cycles

Type of diet	Diet A	Diet B	Diet C
Sample of day 10 of first estrus cycle	1.3±0.3a	2.1±0.3 b	4.1±0.6 c
Sample of day 10 of second estrus cycle	1.4±0.2a	1.9±0.2b	3.4±0.4c
Sample of day 10 of third estrus cycle	1.4±0.3a	1.8±0.2b	3.8±0.4c

a-b, Means in same row with different letters are different ( $p < 0.05$ )

tone and estrus length were significantly improved in heifers fed diet C compared to those of diet A or B. Diameters of follicles and corpus luteum were significantly ( $p < 0.05$ ) greater in heifers fed diet C compared to those fed diet A or B. Likewise serum progesterone concentrations at day 10 of estrus cycle during three consecutive cycles were significantly higher in heifers fed diet C compared to those fed diet A or B (Table 3).

## DISCUSSION

Feeding hay supplemented with concentrate improved body weight, live weight gain and feed conversion ratio in Hassawi heifers. Similar findings were reported in Western Baggara and Kenanna heifers of Sudan (Khalifa *et al.*, 1976; EL-Tayeb *et al.*, 1990) and Hassawi bulls in Saudi Arabia (Mohammed and AL-Shami, 2003). It is expected that concentrates would provide nutrients which may be lacking or deficient in hay (EL-Tayeb *et al.*, 1992).

Feeding of hay supplemented with concentrates significantly shortened age at first estrus and improved estrus intensity and length. Size of follicle, diameter of corpus luteum and serum progesterone concentration improved too. These findings agree with previous studies (Rakha *et al.*, 1970; Short and Bellows 1971; Little and Kay 1979; Stewart *et al.* 1980; EL-Tayeb and Gaber 1987; EL-Tayeb *et al.*, 1992) which showed that improved nutrition have direct impact on onset of puberty in cattle. In previous study (AL-Shami, 2003) it was found that estrus intensity in Hassawi cows was much lower than in other breeds. Feeding of concentrates in diet C animals intensified behavioural estrus in which animals mount each other, an important reliable sign of estrus for stockman. Such sign was absent in animals fed diet A or B.

## ACKNOWLEDGEMENT

The author thanks the Deanship of Scientific Research of King Faisal University for financial support.

## REFERENCES

- AL-Shami, S.A., 2003. Estrous behaviour and hormonal profiles during estrous cycle of Hassawi cow. *Alexandria J. Vet. Sci.*, 19: 49-54.
- Church, D.C. and A. Sanios, 1981. Effect of graded levels of soybean meal and of a ncaprofein nitrogen-molasses supplement on consumption and digestibility of wheat straw. *J. Anim. Sci.*, 53: 1609-1615.
- Dobson, H., M. Kamonpanta, 1986. A review of female cattle reproduction with special reference to a comparison between buffaloes, cows and zebu. *J. Reprod. Fert.*, 77: 1-36.
- El-tayeb, A.E. and S.S. Gaber, (1987). Effects of concentrate supplements to forages on some production traits of dairy heifers. *Sudan J. Vet. Sci. Anim. Husbandry*, 27: 70-77
- EL-Tayeb, A.E., T.A. Mohammed and H.K. Mohammed, 1990. Growth performance, feed intake and Nutrients digestibility by Western Baggara cattle fed sorghum Stover with different levels of concentrates. *Sudan J. Anim. Prod.*, 3 : 69-79.
- EL-Tayeb, A.E., T.A. Mohammed, A.M. Homeida and A.A. Mohammed, 1992. The complementary of feed resources for animal production in Africa. *Proceeding of Feed Network* 300-305 .
- Homeida, A.M., M.G.R. Khalil, A.A.M. Taha, 1988. Plasma concentrations of progesterone, oestrogens, testosterone and LH-Like activity during the oestrous cycle of the camel (*Camelus dromedaries*) *J. Reprod. Fert.*, 83: 593-598.
- Khalifa, H.A., O.A. Khidir and T.A. Mohammed, 1975. Intake of food and water requirements of growing kenana Heifers (A northera Sudan Zebu). *Acta Vet. Beograd*, 5: 261- 267.
- Kanai, Y., H. Shimizu, 1983. Chatacteristics of the estrous cycle of the swamp buffalo under temperate conditions. *Theriogenol*, 19: 593-603.
- Lee, G.L., D.W. Hennessy, P.J. Williamson, J.V. Nclan, R. J. Kempton and R.A. Leng, 1985. Responses to protein meal supplements by lactating beef cattle given a low quality pasture hay. *Australian J. Agric. Res.*, 36: 729 .
- Little, W. and R.M. Kay, 1979. The effect of rapid rearing and early calving on the subsequent performance of heifers. *Anim. Prod.*, 29: 131-142.
- Mason, I.L., 1996. *World Dictionary of Livestock Breeds Types and Varieties*. (4th Edn.), CAB International.
- McCoilum F.T. and M.L. Galyean, 1985. Influence of cottonseed meal supplementation on voluntary intake, rumen fermentation and rate of passage. *J. Anim. Sci.*, 60: 570-577 .
- Ministry of Agriculture Year Book, 1998. Riyadh, Saudi Arabia.
- Mohammed T.A., 1997. Phenotypic characterization of the Saudi Arabian Hassawi cattle breed. *Animal Genetic Resources information*, 21:35-424.
- Rakha, A.M., G. Igboeli and D. Hale, 1970. The estrous cycle of zebu and sanga breeds of cattle in central Afr. *J. Reprod. Fertile*. 23: 411-414.
- Short, R.E. and R.A. Bellows, 1971. Relationships among weight gains, age at puberty and reproductive performance in heifers. *J. Anim. Sci.*, 32: 127-131.
- Smith, A.B., 1980. Domesticated Cattle in the Sahara and Their Introduction into Western Africa. In M.A.J. Williams and H. Faure Eds. *The sahara and the Nile: Quaternary Environments and Prehistoric Occupation in Netherlands*, Balkema.
- Stewart T.S., C.R. Long and T.C. Cartwright, 1980. Characterization of cattle of a five-breed diallel. 3 Puberty in bulls and heifers. *J. Anim. Sci.*, 50: 808.