AGE AND BODY WEIGHT AT PUBERTY IN MUTURU HEIFERS UNDER DIFFERENT FEEDING REGIMES

A.G.EZEKWE, AND T.M.KAMALU

Department of Animal Science, University of Nigeria, Nsukka, Nigeria.

**Department of Veterinary Physiology & Pharmacology*

University of Nigeria, Nsukka, Nigeria.

Received 02 February 1998; Accepted 08 August 1998

ABSTRACT

Age and body weight at puberty were studied in two groups of Muturu heifers aged 4 to 7 months and comprising 13 heifers in each group. Group I heifers received nutritional supplementation consisting of a mixture of dry brewer's spent grain and palm kernel cake in a ratio of 3:1 in addition to normal grazing. Group II heifers were grazed without any supplementation. From the age of 10 months and lasting for a period of 6 months, blood samples were collected twice weekly from each heifer via the jugular vein into heparinized vacutainer tubes. Samples were centrifuged within 30 minutes of collection and the plasma stored frozen until assayed for progesterone using coat-a-count solid phase 125 I radioimmunoassay kits. Body weights of all heifers were also recorded bi-weekly during the experimental period. Puberty was assumed to have occurred in any heifer when plasma progesterone values reached/exceeded 1 mg/ml. Results showed that Group I heifers were significantly younger ($P < 0.01$) at puberty than Group II heifers (12.25 ± 0.20 months vs. 14.60 ± 0.67 months) but their body weights did not differ significantly (90.50 ± 1.82 kg & 85.20 ± 0.87 kg for Groups I and II heifers, respectively). These results show that under improved feeding, puberty in Muturu heifers could be attained relatively at an early age.

Key words: Muturu, Heifers, Puberty, Nutritional supplementation, Radioimmunoassay, Progesterone.

INTRODUCTION

Age at puberty is an important determinant of reproductive efficiency. According to Peters and Lamming (1985), puberty, expressed as time of

first oestrus in the young female, is due to ovarian changes which are in turn controlled by complex endocrinological events. In the Muturu bull, Ezekwe (1992) observed that under improved husbandry and nutritional conditions, puberty was attained at an early age of 11 months and a body weight of 87 kg. The study also revealed that Muturu bulls could be used for breeding from the age of 15 months. Studies on female reproduction of indigenous Nigerian Cattle breed have concentrated largely on zebu (*Bos indicus*) cattle (Johnson and Gambo, 1979; Zakari *et al.*, 1981; Oyedipe *et al.*, 1982; Dawuda *et al.*, 1989). There is thus a dearth of information on the reproductive characteristics such as puberty of indigenous Nigerian non-zebu cattle like the Muturu. The Muturu, which is the most widely distributed indigenous non-zebu cattle in the southeastern states of Nigeria, has a population of 42,000 out of estimated total national population of 177,000. The Muturu is highly tolerant to trypanosomiasis and is also well adapted to the hot humid conditions prevalent in the southern rainforest areas.

Despite these obvious advantages, the Muturu is considered an endangered breed because of its rapidly declining numbers (Adeniyi, 1984). The need to document important aspects of its reproductive characteristics is therefore impelling. This study was thus undertaken to determine the age and body weight at which Muturu heifers attain puberty under improved husbandry and management conditions.

MATERIALS AND METHODS

Location

The study was conducted at the University of Nigeria Teaching and Research Farm, from 1994 to 1995. Nsukka is located on longitude $07^{\circ} 24' E$ and latitude $06^{\circ} 52' N$ and is on the derived savannah with mean annual temperature of 26.3° and rainfall of 150 cm which falls mainly from April to October.

Animals

A total of 26 Muturu heifer calves aged four to seven months were purchased from local Muturu cattle rearers. The calves were then allotted to two treatment groups of 13 animals each, care being taken to balance the animals in the two groups in terms of age and body weight. Group I heifers received nutritional supplement consisting of a mixture of dry brewer's spent grain and palm kernel cake in a ratio of 3:1 throughout the period of the study. Group II heifers on the other hand, were only grazed to mimic the traditional husbandry system common among Muturu cattle rearers in the Southeastern states.

Grazing of Animals

Groups I and II animals were grazed either in fenced paddocks containing a mixture of guinea grass (*Panicum maximum*) and giant star grass (*Cynodon dactylon*) or in open natural grassland twice daily, from 0830 hr to 1200 hr and 1430 hr to 1800 hr. After the afternoon grazing, Group I calves were separated from Group II calves and fed the spent grain/palm kernel mixture at the initial rate of 400 - 500 g/calf/day with a gradual upward adjustment as the animal grew up to a maximum of 0.8 - 1.0 kg/calf/day. Water was provided *ad libitum*. All animals were routinely dewormed and sprayed for the control of endo- and ectoparasites, respectively. Each calf was identified with a numbered neck-tag and their body weights were taken every 14 days. Heifers were also observed regularly for mounting activity and other signs of estrus.

Blood Sample Collection and Progesterone Analysis

Blood samples were collected via the jugular vein into heparinized vacutainers tubes twice weekly from calves from the age of 10 months until calves were 16 to 18 months of age. The samples were centrifuged within 30 minutes of collection and the plasma stored frozen until assayed for progesterone. Progesterone assay was done using the coat-a-count solid phase ^{125}I radioimmunoassay kit (Diagnostic Products Corporation, Los Angeles, CA, USA), a procedure which is very precise with a detection

limit of 0.03 ng/ml (0.1 nmol/l) progesterone, and is highly specific to progesterone with very little cross reacting to other naturally occurring steroids. Standard curves using processed human serum and representing 0, 0.1, 0.5, 2, 10, 20 and 40 ng/ml of progesterone were plotted by the logit-log technique.

Statistical Analysis

Data on body weight and age at puberty for the two groups of heifers were tested for significance using the student t-test. Age and body weight at puberty were interpolated from the age and weights immediately preceding or after puberty. Puberty was assumed to have occurred in any heifer when plasma progesterone values reached/exceeded 1 ng/ml (Post and Reich, 1980; Little *et al.*, 1981). The regression of body weight on the age of heifers in Group I and Group II was also carried out. All statistical analyses were done in line with the procedures outlined by Steel and Torrie (1980).

RESULTS AND DISCUSSION

The relationship between the age and body weights of the two groups of heifer calves as well as the regression lines for the two groups of calves are shown in Fig. 1. Body weights of calves in Group I and II were not significantly different ($P > 0.05$) during the first two months of study (i.e. 5 and 6 months). But from the age of seven months, Group I heifers were significantly heavier ($P < 0.05$) than their Group II counterparts, and this superiority was maintained until the

Figure 1: Relationship between age and body weights of Muturu heifer calves (—) Group 1, (---) Group 2

PUBERTY IN MUTURU HEIFERS

TABLE 1: AVERAGE AGE AND BODY WEIGHT AT PUBERTY OF SUPPLEMENTED (GROUP I) AND UNSUPPLEMENTED (GROUP II) MUTURU HEIFERS.

Parameter	Group I	Group II	Level of significance
Number of animals	9	5	
Age (MO)	12.25 ± 0.20* (11.8-13.3)#	14.60 ± 0.69 (13.7-16.1)	**
Body weight (kg)	90.50 ± 1.82 (84-99)	85.20 ± 0.87 (83-88)	NS

values in parenthesis indicated the range

+ = Mean SE

** = P < 0.01

NS = Not significant

termination of the study. Whereas Group I heifers made an average monthly weight gain of 7.55±0.64 kg (6.0 kg - 9.4 kg range), during the period of study, Group II heifers made an average gain of 4.85 kg/month with a range of 2.2 - 6.6 kg. The superior growth performance of Group I heifers over their Group II counterparts is consistent with earlier reports (Taylor and Wilkinson, 1972; Asuquo, 1981; Martin *et al.*, 1981). Rastogi (1979) had reported that grazing alone was not adequate enough to support sustained growth of calves during their period of active growth.

The regression of body weight (Y) on the age (X) of calves was described by the following equation:

Group I: $Y = 1.96 + 7.41X$ ($r^2 = .998$)

Group II: $Y = 1.24 + 4.85X$ ($r^2 = .994$).

The mean age and body weight at puberty for Group I and Group II heifer calves are presented in Table 1. Group I heifers (supplemented group) were significantly younger ($P < 0.01$) at puberty than the unsupplemented group (Group II), but the body weights of the two groups were not significantly different even though Group I heifers were about 5.3 kg heavier at puberty. These results are consistent with the observations of Little *et al.*, (1981) and Oyedipe *et al.*, (1982) that age at puberty was inversely related to the level of nutrition but body weight was not. The wide ranges in body weights and ages at puberty which were manifested in this study are also in accord with the report of Shotton *et al.*, (1978) and would suggest that improvement of Muturu cattle could be achieved through careful selection and breeding.

It is worth nothing however, that the relatively early attainment of puberty by Muturu heifers contrasts with results obtained from other breeds of tropical cattle. For example, Rakha *et al.*, (1970) reported that local breeds of cattle in Central Africa, namely; Angoni, Mashona and Afrikander attained puberty at about the age of 20, 19 and 20 months, respectively.

Corresponding body weights of these cattle breeds were 193 kg, 192 kg and 210 kg, respectively. In Nigeria, Oyedipe *et al.*, (1982) reported that Sokoto Gudali heifers on a high plane of nutrition reached puberty at the age of 19 months, while those on medium and low planes did so at 21.3 and 23.5 months, respectively. With N'dama heifers, Akpokokje and Zwandor (1990) reported age and body weight at puberty of 336 11.74 days and 166.83 2.59 kg respectively. In Kenya, Ronningen *et al.*, (1972) observed that Boran cattle reached puberty at the age of 16.6 months while McDowell *et al.*, (1976) found that the age of puberty of Red Sindhi cattle in India was 36.7 months. From these reports, it is clear that there are considerable variations in the age and body weight at which different breeds of cattle attain puberty. It is well known that small temperate cattle breeds attain puberty earlier than larger breeds (Edqvist, 1988). Therefore, the relatively early attainment of puberty by Muturu cattle which is considerably a small breed indeed compared to larger tropical cattle is consistent with observations in temperate cattle. This is significant because in commercial cattle production the age of puberty in relation to the life span of the animal influences the achievement of

optimum reproductive performance of the breed (Schillo et al. 1992). Early attainment of puberty also shortens the generation interval as well as reduces the overhead cost per animal. Exploitation of this important reproductive trait of Muturu cattle would therefore have significant effect on beef production and its availability in Nigeria. It would also help to reverse the threat of extinction which the Muturu cattle appears to be facing at the moment.

ACKNOWLEDGEMENT

This study was made possible through grant No. B/1108-2 from the International Foundation for Science (IFS). The assistance of this organization is therefore gratefully acknowledged.

REFERENCES

- ADENIYI, K. O. (1984). Recommendations for specific breeds and species for conservation by management and preferred techniques. In: *Animal Genetic Resources Conservation by Management, Data Banks and Training*. FAO Animal Prod. & Hlth. Paper 44/1. pp. 89 - 98.
- AKPOKOKJE, J.U. and ZWANDOR N.J. (1990). Age and weight at puberty in N'dama heifers under small scale holding system. *Trop. Vet.* 8: 79 - 81.
- ASUQUO, B.O. (1981). A comparison of creepfed and non-creep fed beef calves in a humid tropical environment. M. Phil Thesis. University of Nigeria, Nsukka.
- DAWUDA, P.M., EDUVIE, L.O., ESIEVO, K.A.N. and MOLOKWU, E.C.I. (1989). Silent oestrus manifestation in Nigerian Bunaji cows. *Anim. Reprod. Sci.* 21: 79 - 85.
- EDQVIST, L.E. (1988). Puberty in farm animals. *Proc. Joint Int. Sem. Anim. Reprod. ILCA - Ethiopia*. Oct. 18 - 28, 1988.
- EZEKWE, L.E. (1992). Growth, puberty and early reproductive traits of N'dama and Muturu bulls in the humid tropics. Ph.D Thesis. University of Nigeria, Nsukka.
- JOHNSON, A.O. and GAMBO, A. (1979). Oestrus behaviour in Bunaji (White Fulani) heifers. *J. Agric. Sci.* 92: 689 - 694.
- LITTLE, W., MALLINSON, C.E., GIBBONS, D.N. and ROWLAND, G.J. (1981). Effect of plane of nutrition and season of birth on age and body weight at puberty of British Friesian heifers. *Anim. Prod.* 33: 273 - 279.
- MARTIN, T.G., LEMENAGER, R.P., SRINIVASAN, G. and ALEND, R. (1981). Creep feed as a factor influencing performance of cows and calves. *J. Anim. Sc.* 53: 33 - 39.
- MCDOWELL, R.E., HOLLON, B.F., CAMOENS, J.K. and VANVLECK, L.D. (1976). Reproductive efficiency of Jersey, Red Sindhi and Crossbreeds. *J. Dairy Sci.* 59: 127 - 136.
- OYEDIPE, E.O., OSORI, D.I.K., AKEREJOLA, O. and DAROR, D. (1982). Effect of level of nutrition on onset of puberty and conception rates of zebu heifers. *Theriogenology* 18: 525 - 539.
- PETERS, A. and LAMMING, E. (1983). Hormone patterns and reproduction in cattle. In: *Practice* 5(5): 153 - 157.
- POST, T.D. and REICH, M.M. (1980). Puberty in tropical breeds of heifers as monitored by plasma progesterone. *Proc. Aust. Soc. Anim. Prod.* 13: 61 - 62.
- RAKHA, A.M., HALE, D. and IGBOELI, G. (1970). Age at puberty in local breeds of cattle in Central Africa. *J. Reprod. Fertil.* 22: 369 - 370.
- RASTOGI, R. (1979). Prewaning growth performance of Santa Gertrudis, Jamaica Red and Guernsey crossbred calves in St. Lucia, West Indies. *Trop. Agric.* 56: 321 - 325.
- RONNINGEN, K., LAMPKIN, K. and GRAVIR, K. (1972). Zebu cattle of East Africa. I. The influence of environmental factors on some traits in Boran cattle. *Swedish J. Agric. Res.* 2: 209 - 217.
- SCHILLO, K.K., HALL, J.B. and HILEMAN, S.M. (1992). Effect of nutrition and season on the onset of puberty in the beef heifers. *J. Anim. Sci.* 70: 3994 - 4005.
- SHOTTON, S.M., ROY, J.H.B. and POPE, G.S. (1978). Plasma progesterone concentration from before puberty to after parturition in British Friesian heifers raised on high planes of nutrition and inseminated at first estrus. *Anim. Prod.* 27: 89 - 98.
- STEEI, R.G.D. and TORRIE, J.H. (1980). *Principles and Procedures of Statistics*. 2nd Edition. McGraw-Hill Book Company Inc. N. Y.
- TAYLER, J.C. and WILKINSON, J.M. (1972). The influence of level of concentrate feeding on the volume intake of grass and on live-weight gain by cattle. *Anim. Prod.* 14: 85 - 87.
- ZAKARI, A.Y., MOLOKWU, E.C.I. and OSORI, D.I.K. (1981). Effect of season on the oestrous cycle of cows (*Bos indicus*) indigenous to Northern Nigeria. *Vet. Rec.* 109: 213 - 215.