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PRODUCTIVITY OF NORTH KORDOFAN CATTLE

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ABSTRACT: *The present study focused on the sedentary cattle husbandry production system in North Kordofan (western Sudan). Seven farms (designated as A, B, C, D, E, F, and G) around El-Obeid city were randomly selected. Recently calved cows in each farm were closely monitored through a period of 365 days. The recently calved cows were monitored for post-partum ovarian activity using milk progesterone radioimmunoassay. Days to conception were taken as non-return to oestrus. The results revealed that there was a wide variation in both days to first ovulation and days to conception. The majority of cows showed delayed post-partum activity and days to conception with longest days to resumption of ovarian activity showed by farm G (167.00±59.68days) and lowest days in farm C (61.78±14.99 days). The interval to conception was longest in farm B (226.06±52.63 days) and lowest in farm C (102.67±48.93 days). Cows in all farms showed gradual increase in BW from calving up to 90 days. BCS was found to decrease from calving to 60 days. Dry season showed an adverse effect on fertility compared with the rainy season. Wet season showed significant negative correlation with BWT at calving, milk yield at 30, 60 and 90 days with days to ovulation. It could be concluded that, poor reproductive performance in cows kept under extensive traditional system was due to poor management practices, which ignored high-energy supplementation during late pregnancy and early lactation, especially during the dry season when rangeland pastures deteriorate drastically. Suckling further exacerbated the effect of poor nutrition resulting in extended post-partum anoestrus and low conception rates. Controlled mating and suckling together with good feeding strategies may greatly enhance reproductive performance of cows kept under extensive systems of management.*

Keywords: *Cattle, sedentary system, nutrition, reproductive performance, El Obeid, Sudan.*

ORIGINAL ARTICLE

INTRODUCTION

Sudan has a livestock population of 138 million; approximately 42 million are cattle (MAR, 2007). The majority of the cattle population is of the local beef type living under the pastoral system of management. Production from Sudan beef cows has remained comparatively lower than those from other areas of the world due to inadequate feed, both in quality and quantity, poor management of the available feed resources and the reproductive wastage due to low conception and calving rates, delayed age at puberty and first calving, high mortality due to diseases and inadequate health care. In mammals, nutrition exerts a significant influence on reproductive function through changes in body weight and condition (Downing and Scaramuzzi, 1991). Nutritional requirements shift abruptly at parturition as milk production rapidly increases and cows enter negative energy balance (NEB). The severity and duration of NEB is primarily related to dry matter intake which, in turn, is related to body condition at calving. NEB during the first 3–4 weeks postpartum is highly correlated with the days to first ovulation, because a shorter delay to first ovulation is positively associated with conception rate later during the breeding period. The length of the postpartum interval to first ovulation represents an important interaction of energy status on reproductive performance (Butler, 2003). Under-nutrition contributes to prolonged postpartum anestrous, particularly among cows dependent upon forages to meet their feed requirements (Montiel and Ahuja, 2005). Also the suckling stimulus is another factor affecting the duration of resumption of postpartum ovarian cycles (Williams, 1990; Das et al., 1999). In beef cattle, reducing the frequency and intensity of suckling reduces the duration of the postpartum anoestrous period (Mackey et al., 2000). Nutrition and suckling affect hypothalamic, pituitary and ovarian activity and thus inhibit follicular development and, finally, ovulation rate (Scaramuzzi et al., 2006). The present study was undertaken to investigate assessment effect of nutrition on the reproductive performance of cattle herders in North Kordofan state.

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MATERIALS AND METHODS

Study area

The present investigation focused on the reproductive performance of cows kept under sedentary husbandry system at peri-urban area around El Obeid city located at about 600 km west Khartoum capital (Latitude 11° 15. and 16° 30.N, Longitude 27° and 32°E). It lies within a semi-arid area: temperatures ranges between 30.35°C -40°C during the dry season (April to June). The rainy season extends from July to October. The dominant vegetation is a varying mixture of grasses and shrubs (Technoserve, 1987). The cattle farms are concentrated around urban centers and are the main suppliers of milk to the inhabitants.

Husbandry practice

Seven sedentary farms were randomly selected at different geographical sites around Elobied City. They were designated as group A, B, C, D, E and G. The study targeted the recently calved DerElreeh cows (DerElreeh is ecotype of zebu cattle). Mature animals were kept in open enclosures made from local materials or barbed wires, their sizes differed according to the number of the animals (Table 1).

Table 1. Herd structure of farms under study

Farms	Lactating cows	Dry cows	Heifer	Calve	Bull	Total
A	78	97	35	45	5	250
B	72	21	114	28	3	238
C	15	9.0	15	7.0	2	48
E	10	7.0	12	5.0	1	35
D	8.0	11	15	8.0	1	42
F	18	12	16	8.0	1	46

During the rainy season cattle spend around 6-9 h grazing during the day, moving over small distances (3.4 km). Surface water from natural ponds and catchment areas is their source of drinking water. During the dry season, more time is spent in grazing (8.10 h) moving over longer distances (7.8 km) in search of good quality forage. They come back to the farms and then move another 1.2 km to find drinking water from deep wells in the city.

Calves were kept in separate sheds with roofs for protection against the sun. Except for farm A which was kept under the open space. During the night each animal was tethered to a wooden peg. Milking was done twice day with calf at food, in the morning before animals leave for grazing and in the evening on their return. Calves were allowed to suckle for milk let down, and then were kept apart from their dams, but were allowed to graze during the day light hours not far from the farms. In farm C cows sometimes were milked once to enhance earlier conception and this called (Towgeeb), weaning was natural, insemination was also natural with bulls running freely with dams all times. Vaccine against Rindderpest and Anthrax were done only when outbreak were expected. Prevailing disease were pneumonia internal and external parasites.

Milk Sampling

Milk samples (10 ml) were collected into tubes containing sodium azide at weekly intervals beginning at 10 days from parturition and every week thereafter until the animal was confirmed pregnant by non-return to oestrus. Milk samples were centrifuged for 10 minutes at 2500 r to remove fat and then stored in a sealed plastic container at 20C° until assayed for progesterone. Concentrations of progesterone in the defatted milk were measured using the solid-phase RIA system supplied by the Joint FAO/IAEA Division (Plazier, 1986). Progesterone concentrations greater than 1 nmol/l were considered to indicate cyclic ovaries.

Body weight and body condition score

Body weight was determined by measuring the heart girth using a weigh band. Body condition score was carried out according to one-to-nine scale (1 emaciated, 9 obese) (Nicholson and Butter Worth, 1986). The above parameters were measured at calving and at 30, 60 and 90 days post calving. In addition to measuring the milk progesterone profile, body weight, body condition score and milk yield were also recorded, whenever possible.

Statistical analysis

The data were treated with the analysis of variance with the general linear model procedure of (SAS, 1994) and least significant difference (LSD) was used to detect statistical significance between means.

RESULTS

Resumption of ovarian activity and conception

There was a wide variation in the resumption of ovarian activity between farms. All cows in farm G showed 100% interval to 1st progesterone (P_4) rise above 90 days, 50% were observed in farms D and E, 40% in farms B and E, while 28% of the cows that resumed ovarian activity above 90 days were in farm A (Table 2). Interval or days

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from calving to first P_4 rise for cows in the different farms are shown in (Table 4). It could be seen that longest days to 1st P_4 rise were shown by farm G followed by farms B, D and F, then A and E and finally farm C (Table 4).

In (Table 3), it was shown that longest days (above 120 days) was exhibited by cows in farm G where 60% of the cows conceived within 121-300 days and 20% did not conceive, followed by farm D. Cows in all other farms conceived with decreasing order for conception rates within 121-300 days (Table 2). Days to conception for cows in the different farms were illustrated in (Table 3). Longest days to conception was recorded by farm B followed by farms D, G, F then A and E and finally C with lowest days to conception (Table 3).

Body weights and body condition score

Body weight was lowest in farm G compared to the other farms. The body weight than decline with entire milk production (Table 5). The body condition score declined progressively up to 60 days in farms A, B, D, E and C and G ($P<0.05$) compared to farm C and F (Table 6).

Table 2 - Percentage of cows ovulating within different ranges in all farms

Range (days)	Farms														All farms n=73	
	A n=25		B n=15		C n=9		D n=8		E n=5		F n=6		G n=5			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
15-45	8	32	2	13.3	1	11.1	2	25	2	40	2	33.3	-	-	17	23.3
46-60	7	28	3	20	3	33.3	1	12.5	-	-	1	16.7	-	-	15	20.5
61-90	3	12	4	26.7	5	55.6	1	12.5	1	20	-	-	-	-	14	19.2
91-120	4	16	2	13.3	-	-	3	37.5	2	40	2	33.3	2	20	14	19.2
121-300	3	12	4	26.7	-	-	1	12.5	-	-	1	16.7	4	80	13	17.8

Table 3 - Percentage of cows conceived within different ranges in all farms during the study period

Range (days)	Farms														All farm n=73	
	A n=25		B n=15		C n=9		D n=8		E n=5		F n=6		G n=5			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
30-60	4	16	-	-	1	11.1	-	-	-	-	-	-	-	-	5	6.8
61-90	5	20	-	-	4	44.4	1	12.5	1	20	-	-	-	-	11	15.1
91-120	7	28	1	6.7	2	22.2	1	12.5	4	80	2	33.3	1	20	18	24.7
121-300	9	36	14	93.3	2	22.2	4	50	-	-	2	33.3	3	60	34	46.6
NC	-	-	-	-	-	-	2	25	-	-	2	33.3	1	20	5	6.8

NC: Not conceived

Table 4 - Days from calving to first progestrone (P_4) rise and conception

Farms	Intervals from calving to P_4 rise (Mean±SD)	Intervals from calving to conception (Mean±SD)
A	71.72±44.6^{bc}	111.32±46.07^{bcd}
B	92.13±54.3^{b}	226.06±52.63^{a}
C	61.78±14.99^{bc}	102.67±48.93^{bcd}
D	85.5±39.17^{b}	174.17±81.60^{b}
E	71.2±35.87^{bc}	103.2±16.21^{bcd}
F	74.5±48.74^{bc}	112.2±21.83^{bcd}
G	167.00±59.68^{a}	165.75±57.16^{bc}

^{abcd,} values with the same column bearing different superscript vary significantly at $P<0.05$

Table 5 - Body weight (kg) changes in all farms under study period

Farms	Body weight (BWT kg)			
	1	2	3	4
A	320.36±41.4^{a}	306.4±38.24^{a}	307.00±39.76^{a}	313.44±39.43^{a}
B	312.53±46.95^{a}	297.2±45.44^{a}	295.8±38.33^{a}	297.2±48.13^{a}
C	286.22±23.62^{a}	270.56±25.56^{a}	282.44±21.39^{a}	293.00±26.1^{a}
D	298.5±29.33^{a}	286.63±34.85^{a}	282.75±35.97^{a}	287.00±35.81^{a}
E	295.8±50.24^{a}	290.00±49.33^{a}	289.6±44.07^{a}	296.6±45.01^{a}
F	291.5±37.78^{a}	278.67±34.55^{a}	287.00±24.35^{a}	294.17±23.56^{a}
G	240.4±91.14^{b}	239.2±92.23^{b}	217.4±93.71^{b}	225.2±101.6^{b}

^{a,b} Values with the same column bearing different superscript vary significantly at $P<0.05$. 1,2,3 and 4:Representing parturition,30,60 and 90 days from parturition

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Table 6 - Body condition score (1-9 scale) in all farms under study period

Farms	Body condition score (BCS)			
	1	2	3	4
A	5.08±1.15[b]	4.08±0.10[b]	4.32±1.35[b]	5.12±1.09[b]
B	4.73±1.16[a]	4.07±0.16[b]	4.0±0.93[b]	4.67±1.05[b]
C	5.56±0.53[a]	4.67±0.71[a]	5.22±0.97[b]	5.78±0.76[a]
D	5.0±1.07[b]	4.13±0.64[b]	3.88±0.83[b]	4.63±0.92[b]
E	5.0±1.41[b]	4.4±1.14[b]	4.0±0.71[b]	5.2±0.45[a]
F	5.67±0.82[a]	4.67±0.82[a]	5.17±0.75[a]	5.5±0.55[a]
G	5.0±1.00[b]	4.0±1.00[b]	3.8±0.45[b]	4.8±1.10[b]

[a,b] Values with the same column bearing different superscript vary significantly at P <0.05. 1,2,3 and 4:Representing parturition,30,60 and 90 days from parturition

DISCUSSION

Fertility of cows kept under traditional extensive systems was shown to be low as indicated by long post-partum anoestrus period and long days to conception in the majority of cows investigated. This was largely correlated with nutritional and other environmental stress. Similarly, other studies revealed the low fertility of zebu cattle in tropical and subtropical areas (Fitzpatrick, 1994). Other factors, which might have influenced fertility, included, body condition score (BCS), body weight (BWT) and health disorders (Mukasa-Mugerwa, 1989; Williams, 1990). In the study, farm C showed the shortest days to ovulation and conception as this farm used controlled suckling. Similarly, it has been shown that calf creep feeding strategies improved conception through reduced suckling (Schlink et al., 1988). The effect of body weight on fertility was clearly demonstrated by farm G where all cows in this farm had significantly low body weight, which was reflected on extended post-partum anoestrus and long days to conception. Similarly, the studies of Singh (1990) on the combination effect of age and body weight revealed that conception rate depended largely on body weight than age. Low body weight at birth and slow growth rate during pre-pubertal period may have been responsible for the poor fertility of these cows.

Numerous studies have shown that the inhibitory effect of suckling is mediated by inhibition of luetinizing hormone (LH) secretion (Peters and Lamming, 1990; Williams et al., 1987) through a reduction of pulsatile secretion of hypothalamic Gonadotropin releasing hormone (GnRH) (Carruthers et al., 1980). On the other hand weaning was shown to hasten oestrus (Short et al., 1990; Carter et al., 1980).

During the rainy season animals were allowed to graze the native pasture without additional supplemental feeding, which failed to fulfill the requirement for meat and milk production. Milking cows were supplemented with concentrate diets during the dry season only. Cows in their pre-partum period received no supplementation and hence were likely to calve in poor condition. Due to significant negative correlation between body condition score after calving and entire lactation period, it has been shown that cows, which calve in poor body condition, have only a small pool of recruitable (2.5 mm) follicles and few if any growing (6.9 mm) follicles for a prolonged period post-partum (Fitzpatrick, 1994).

Prolonged post-partum anoestrus in lactating cows under extensive systems may reflect an adaptive mechanism, which prevents re-conception until nutritional, or other environmental conditions become favorable for reproduction. Furthermore, it has been shown that during the wet season significant negative correlation existed between body weight at calving and post-partum resumption to ovarian activity. This results on line with Buck and Light (1982). Furthermore, it has been shown that responses to pre-partum body weight change may depend on body condition score at parturition, since pregnancy rate of cows in good body condition at calving is affected little by minimal body weight changes either before or after parturition (Dun and Kaltenbach, 1980; Rakestraw et al., 1986) whereas dramatic body weight losses after calving can reduce pregnancy rate (Rakestraw et al., 1986).The negative correlation between milk yield and fertility parameters could be related to body weight and body condition score which were affected milk production at different stages of lactation and rate of mobilization of body fat reserves which contributed to fix milk production (Dominguez et al., 1996).

Days to conception were significantly longer and conception rates were significantly lower in the dry season compared to the wet season where ambient temperatures exceeded 40C^{o}. Similar findings were reported by other workers (Thatcher et al., 1986), which could be related to the inhibitory effect of thermal stress resulting in reduced hypothalamic GnRH secretion, lack of LH secretion and consequently affecting ovarian follicle development (Peters, 1991). This condition might also be exacerbated by poor nutritive value of the pasture. Although concentrates offered by farmers were of good quality, they were not offered in adequate quantities as they were sometimes given every other day due to their high cost. This could place cows in negative energy balance and thereby affecting the calving to conception interval and conception rates. Farms A and B did not seem to benefit from extra night grazing during the dry season. Most of the cows in both farms (A and B) showed long days to conception which could be attributed to poor quality of the pasture and extra energy expenditure during grazing. Heat stress seemed to impose an adverse effects on the cross breeds as reflected on longer days to conception and lower conception rates. Poultry/manure molasses used as a complete diet showed to reduce intervals to resumption of ovarian activity.

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CONCLUSION

Management of post-partum anoestrus under extensive tropical environments should focus on the conservation of body weight and body condition score by strategic and adequate supplementation during late pregnancy and early lactation. Restricted suckling would reduce stimulus of cow-calf interaction and hence reduce days to conception.

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