THE INCIDENCE RATES AND RELATIONSHIPS BETWEEN ENDOMETRITIS AND OVARIAN INACTIVITY OF POSTPARTUM DAIRY COWS IN A TROPICAL AREA

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SUMMARY

The reproductive function of 150 postpartum dairy cows raised in Tanzania was monitored by weekly gynaecological examinations and progesterone concentration determinations. In cows undergoing normal postpartum, the mean (± s.d.) time from calving to complete uterine involution and to resumption of normal ovarian cyclicity was 31 ± 12 and 46 ± 17 days, respectively. Incidence rates for endometritis and ovarian inactivity were 35.3 and 32.5 per cent, respectively. These rates are being reported for the first time in Tanzania. The occurrence of ovarian inactivity was significantly higher ($p < 0.01$) in cows with endometritis. The findings implied that endometritis and ovarian inactivity are interrelated, probably through a common causal factor.

INTRODUCTION

The reproductive performance of dairy cows raised in the tropics is characterized by prolonged calving intervals (Vandeplassche, 1982; Kiwuwa e tal., 1983; Katyega, 1988). Long calving intervals are in turn associated with lowerd fertility during the postpartum period (Dobson and Kamonpatana, 1986). Investigators have suggested that attempts to improve fertility of dairy cows seldom give consistent results because many factors associated with this phenomenon are not so well understood Erb and Smith, 1987; Jubb *et al.*, 1989). The rates of change for uterine involution and for initiation of ovarian function during the postpartum period in cows raised in the tropics are among the poorly understood factors.

Other factors commonly associated with lowered fertility in postpartum cows, include uterine and ovarian disorders namely, endometritis and ovarian inactivity (Zemjanis, 1961; Mutiga *et al.*, 1978; Francos and Meyer, 1988). Comprehensive studies seeking to establish incidence rates for these disorders have been conducted elsewhere outside East Africa (Erb and White, 1981; Glatzel and Chadli, 1985; Kumar *et al.*, 1986). Literature on this subject with regard to East African environment is apparently scanty.

Studies have revealed large variations in incidence rates for the uterine

and ovarian disorders (El Naggar 1977; Steinbauer 1987). The occurrence of these variations have been explained by a wide variety of factors including those associated with breed, health status, standard of management, climate and area specific environmental factors (Mujuni *et al.*, 1993). Because of these differences it was considered pertinent to determine the occurrence of these disorders in an East African environment. This study, therefore, monitored the reproductive status of postpartum cows in order to determine:

The time for complete uterine involution and resumption of ovarian activity.

The incidence rates for endometritis and ovarian inactivity, the effect of breed and the relationships between the two groups of disorders.

MATERIALS AND METHODS

Study area

The study was conducted in dairy farms located within a radius of 40 Km of Morogoro township. Morogoro is situated at latitude 6^0 20' south and longitude 37^o 39' East. Its altitude is 528 metres above sea level. Day length varies from 11 to 13 h and small temperature variations are experienced throughout the year. The average maximum and minimum temperatures are 32.4 and 14.8°C in February and July, respectively. The annual rainfall is more than 800 mm.

Animals

The animals studied were Friesian, Ayrshire and crosses of these with Tanzania Short Horn Zebu. The animals were at a pasture during the day and in loose houses at night. In addition to pasture grazing, cows were supplemented with concentrates during milking. Milking was done between 06.00 and 08.00 h and between 16.00 and 18.00 h. All animals received regular veterinary care which included acaricide spraying against ticks, chemoprophylaxis against trypanosomiasis and routine vaccinations. The animals were confirmed to be free from brucellosis, campylobacteriosis, and trichomoniasis. Breeding was effected by artificial insemination or by hand mating.

Field study

One hundred and fifty pluriparous cows, calving between July 1st, 1989 and June 30th, 1990, were examined per rectum once a week, commencing within one week after calving. This weekly examination continued until each animal was either diagnosed as pregnant or had remained open up to Day 150 post partum. Pregnancy was determined by rectal palpation between 54 and 60 days after the last insemination or mating. Jugular blood samples for progesterone concentration determination were taken twice weekly, every other sample being collected at each examination.

Monitoring the reproductive status

At rectal examination, size, tonicity, position and contents of the uterus were assessed. The character of the lochia was recorded with regard to its colour, amount and consistency. These features, were used to monitor the progress of the

involution of the uterus. Complete uterine involution was recorded when both horns had become small, nearly identical in size, devoid of palpable intraluminal fluid and when the whole organ was over the pelvic brim or intrapelvic.

Animals having a foetid, purulent vaginal discharge, with delayed involution of the uterus, characterized by lack of tone, large size and presence of exudate in the lumen, were classified as having metritis. Animals having no detectable changes in the uterus but having opaque mucus or clear mucus with flakes of pus were categorized as having endometritis. For purposes of this study, and in view of the difficulty in making a clear distinction betwen the two, cases of metritis and endometritis were grouped together and designated as endometritis cases.

Ovaries were examined in order to detect ovarian structures namely, normal cycle follicles, cystic follicles and corpora lutea. Smooth fluid filled structures with an estimated diameter of less than 2.5 cm were considered to be normal oestrous cycle follicles whilst those with a diameter greater than 2.5 cm were considered as cystic structures. Ovarian cysts were confirmed when these structures persisted through four sequential examinations carried out at three day intervals. The diagnosis of a corpus luteum was based on finding an enlarged ovary with a structure that had a uniform liver like consistency and finding a demarcation line between this structure and the rest of the ovarian stroma or detection of distinct protuberance on the surface of the ovary.

Blood sampling and analysis

Jugular blood samples for progesterone concentration determination were collected into heparinized vacutainer tubes. The samples were cooled on ice immediately after collection and centrifuged at $4^{o}C$ and 1500 x g for 30 min. Plasma was then harvested within two hours of blood sample collection and stored at - $20^{o}C$ until assays were carried out.

Progesterone concentrations were determined using solid phase radioimmunoassay kits that employ ^{125}I as tracer, supplied by the International Atomic Energy Agency, Seibersdorf, Austria. The sensitivity of the assay was 0.025 nmol/l while the intra- and inter assay coefficients of variation were 8.3 and 11.2 %, respectively. These coefficients were within the range given by kit suppliers.

For purposes of interpretation, a progesterone value of 0.31 nmol/l of plasma was taken as borderline for luteal activity. Progesterone concentration equal to or greater than 0.31 nmol/l of plasma indicated presence of luteal activity whereas progesterone concentration of less than 0.31 nmol/l indicated its absence.

Progesterone results were compared with rectal palpation data in order to confirm the diagnosis. The first rise in plasma progesterone concentrations above the basal value coupled with detection of the first corpus luteum indicated the beginning of ovarian cyclicity. Animals having plasma progesterone values greater than 0.31 nmol/l at one examination but with values

less than this at the next examination were considered to be cycling. Animals with no palpable corpus luteum, with low progesterone values and not exhibiting oestrous cyclicity were considered to have physiological ovarian inactivity up to 90 days after calving, beyond which the animals were regarded as having pathological ovarian inactivity.

Statistical analysis

Descriptive statistics were calculated according to methods outlined by Martin *et al.*, (1987). Statistical analyses were carried out according to methods described by Snedecor and Cochran (1980). Chi-square (X^2) tests were used to determine the significance of observed differences between groups.

RESULTS

Uterine status in the animals studied, according to the progress of the postpartum period, is presented in Table 1. The cumulative percentage of cows with complete uterine involution was 24.7, 77.3 and 95.3 % by days 21, 35 and 63, respectively. The mean (± sd) time to complete uterine involution was 31 ± 12 days.

Table 1: Uterine status according to progress of the postpartum period.

Postpartum Interval (Days)	Complete involution		Endometritis	
	Number	Percent	New[1]	Status[2]
< 15	4	2.7	7	7
15-21	37	24.7	12	19
22-28	90	60.0	23	33
29-35	116	77.3	3	25
36-42	128	85.3	-	18
43-49	134	89.3	-	13
50-56	137	91.3	-	9
57-63	141	95.3	-	7
64-70	150	100.0	-	-

[1] = Number of new cases
[2] = New plus old cases less those that recovered

Ovarian status during the postpartum period is presented Table 2. The number (proportion) of cows showing normal oestrous cyclicity was 88 (58.7 out of which thirteen (8.7 %) animals were already pregnant by Day 90. The mean (± s.d.) time to re-establishment of normal oestrous cyclicity was 46 ± 17.

Table 2: Ovarian status according to progress of the postpartum period.

Postpartum interval (Days)	Number (percent) of animals			
	Cycling normally	Pregnant	Inactive ovaries	Ovarian cysts
15-21	11 (7.3)	–	139 (92.7)	–
22-28	26 (17.3)	–	121 (80.7)	3 (2.0)
29-35	36 (24.0)	–	109 (72.7)	5 (3.3)
36-42	42 (28.0)	–	102 (68.0)	6 (4.0)
43-49	46 (30.6)	1 (0.7)	96 (64.0)	7 (4.0)
50-56	47 (31.3)	3 (2.0)	93 (62.0)	7 (4.7)
57-63	48 (32.0)	5 (3.3)	89 (59.3)	8 (5.3)
64-70	50 (33.3)	10 (6.7)	82 (54.7)	8 (5.3)
71-77	54 (36.0)	10 (6.7)	75 (50.0)	11 (7.3)
78-84	68 (45.3)	12 (8.0)	60 (40.0)	10 (6.7)
85-90	75 (50.0)	13 (8.7)	53 (35.3)	9 (6.0)
>90	33 (22.0)	64 (42.7)	42 (28.0)	11 (7.3)

Out of 150 cows monitored, 45 cases had endometritis, 42 had ovarian inactivity, 26 had ovarian cysts and 5 were cyclic non breeders (repeat breeders). The remaining 32 cows (21.3 %) in this study did not develop any uterine or ovarian abnormality and became pregnant within 150 days after calving. Post partum incidence rates for endometritis and ovarian inactivity were calculated according to Martin *et al* (1987). The formula used for calculation of these rates was number of new cases divided by average population at risk and the population at risk (P) was given by:

$$P = \frac{P_a + (P_a - n)}{2}$$

Where P_a = number of animals at risk in the beginning of the study, and n = animals that acquired the disorder. Incidence rates for endometritis and ovarian inactivity were 35.3 and 32.5 %.

Table 3:Variations in uterine and ovarian disorders according to breed.

Parameter	Breed		
	Friesian (n = 58)	Ayrshire (n = 26)	Crosses (n = 66)
Time ((X ±Sd) tp:			
Uterine involution	37 ± 14	31 ± 12	26 ± 8
Resumption of cyclicity	53 ± 16	51 ± 17	38 ± 11
Cases (%) with:			
Endometritis	20 (34.5)	9 (34.6)	16 (24.2)
Ovarian inactivity	24 (41.4)	11 (42.3)	7 (10.6)

The effect of breed on all parameters studied is shown in table 3. Crossbred cows had comparatively less ($P<0.05$) time to complete uterine involution and to resumption of ovarian cyclicity. Fewer cases of endometritis and ovarian inactivity were also recorded in these cows. Breed effects between Friesian and Ayrshire were not significant ($P > 0.05$).

Table 4: Effect iof endometritis on occurrence of ovarian disorders.

Condition	Cows (n)	With inactive ovaries	
		Number	Proportion
With metritis	45	23	51.1%
Without metritis	86	19	22.1%
Total	131	42	32.1%

$X^2 = 11.33$ was significant at $P < 0.01$

The relationships between endometritis and ovarian inactivity was analyzed using a 2 x 2 Chi square test and results are shown in Table 4. This analysis was restricted to 131 out of 150 cows monitored because the remaining 19 cows developed abnormalities that could confound the results. Ovarian inactivity appeared to be common in animals with a history of endometritis.

DISCUSSION

In this study, both intervals of 31 ± 12 days for complete uterine involution and of 46 ± 17 days for resumption of normal ovarian cyclicity were found to be within the range recorded for cattle in temperate environment (Marrow *et al.*, 1966; Marion and Gier, 1968; Callahan *et al.*, 1971; EL Naggar, 1977; Lamming *et al.*, 1981). These observations suggested that some dairy cows kept in a tropical environment are capable of returning to re-breedable state within a time similar to that of cows kept in temperate climates. However, owing to high incidence rates of uterine and ovarian disorders the proportion which promptly return to breeding is small, represented in this study by 32 (21.3 %) animals.

The postpartum incidence rate for endometritis was 35.3 %. There are apparently no East African studies in which such rates are given or from which they can be calculated. This rate is, therefore, being recorded for the first time in this region.

As expected from the self cure theory for the uterus (Arthus, 1975; Morrow *et al.*, 1969; Murray *et al.*, 1990), only nine cases of endometritis were present during the eighth week after calving, 36 others having recovered spontaneously. Animals with endometritis did not promptly return to breding and this could be due to partial resolution of the problem, persisting thereafter in subclinical form or having "carry over" effects. Whatever the case, failure to return to breeding calls for improved methods of treatment and prevention of the condition.

The incidence rate for pathological ovarian inactivity was 32.5 %. Comparison of this rate with those found in the literature is complicated by differences in the definition of the disorder. Ovarian inactivity has hitherto been encompassed in the term: anoestrus, defined as absence of oestrus in the postpartum period (Zemjanis, 1961). This definition has included anoestrus due to unobserved oestrus (silent oestrus) and true anoestrus (ovarian inactivitiy). Researchers restricting the definition of anoestrus to true anoestrus have reported incidence rates that are lower than the one reported here for ovarian inactivity (Munro *et al.*, 1982; Claus *et al.*, 1983; Markusfeld, 1987). This could imply that ovarian inactivity is more serious in animals kept under conditions similar to the ones described in this report.

Crossbred cows had less time to complete uterine involution and to resumption of ovarian cyclicity. Cases of endometritis and ovarian inactivity were also fewer in this group. This could be due to better adaptation of these animals to the environment in which they were kept.

The present study indicated that there is a time lag of about 10 days between completion of uterine involution and resumption of oestrous cyclicity in postpartum cows. it also indicated that there is a remarkable increase in frequency of ovarian inactivity in cows which have had endometritis (Table 4). Both findings suggest that a utero-ovarian pathway may be involved in regulating the post partum ovarian function. Endometritis and ovarian inactivity could also be interrelated through a common causal factor.

In conclusion the results of this study can be interpreted to indicate incidence rates for endometritis and ovarian inactivity are rather high. But owing to lack of scheduled herd health examinations, cases of these disorders often go undetected. The finding that endometritis and ovarian inactivity are interrelated imply that controlling endometritis could also reduce the occurrence of ovarian inactivity and consequently lead to improved reproductive performance of dairy cows raised in the tropics.

REFERENCES

Arthur, G.H. 91975). Veterinary Reproduction and Obstetrics. 4th ed. London, U.K; Baillier0 Tindall, 339 - 403.

Callahan C.J.; Erb, R.E.; Surve, A.H. and Randel, R.D. 1971. Variables influencing ovarian cycles in postpartum dairy cows. J. Anim. Sci. 33: 1053-1059.

Claus, R.; Karg, A.; Zwiauer, D.; Von Buttler, I.; Pirchiner. F. and Rathenberger, E. 91983). Analysis of factors influencing reproductive performance in the dairy cow by progesterone assay in milk fat. Br. Vet. J. 139: 29 - 37.

Dobson, H. and Kamonpatana, M. (1986). A review of female cattle reproduction with special reference to a comparison between buffaloes, cows and zebu. J. Repr. Fert. 77: 1 - 36.

Erb, H.N. and Smith, R.D. (1987). Effect of periparturient events on breeding performance of dairy cows. *Veterinary Clinics of North America* 3: 501-512.

Erb, H.N. and white, M.E. (1981). Incidence rates of cystic follicles in holstein cows according to 15 day and 30 day intervals. Cornell Vet. 71: 326-331.

El Naggar, M.A. 91977). The effect of different treatments upon the post partum involution of the uterus and retention of the placenta in Dairy cows. Vet. Med. Rev. No. 1:36-43.

Francos, G. and Meyer, E. 91988). Analysis of indices of cows with extended postpartum anoestrus and other reproductive disorders compared to normal cows. Theriogenology 22:109 - 125.

Glatzel, P. and Chadli, M. (1985). Reproductive problems among dairy cows imported into Morocco from Europe. Vet. Bull. 55: 7995 Abstr.

Jubb, T.F.; Brightling, P.; Malmo, J. Larcombe, M.; Anderson, G.A. and Hides, S.J. 1989). Evaluation of a regimen using progesterone releasing

intravaginal devise (CRDR) and PMSG as treatment of postpartum anoestrus in dairy cattle. Aust. Vet. J. 66: 334 - 336.

Katyega, P.M.J. (1988). Tanzania: Performance of Jerseys on the slopes of mount Meru. Wrld. Anim. Rev. 65: 24 - 50.

Kiwuwa, G.H.; Trail, J.C.M.; Kurtu, M.; Anderson, F. and Durkin, J. (1983). Crossbred dairy cattle productivity in Arsi region of Ethiopia. ILCA Research Report No. 11, 29 pp.

Kumar, S.; Agarwal S.K. and Purbery, L.N. (1986). Studies on reproductive disorders in nondesript cattle. Ind. Vet. Med. J. 10: 174 - 175.

Lamming, G.E.; Wathers, D.C. and Peters, A.R. (1981). Endocrine patterns of the postpartum cow. J. Reprod. Fert. (Supp) No 30: 155 - 170.

Marion, C.B. and Gier, H.T. (1968). Factors affecting bovine ovarian activitiy after parturition. J. Anim. Sci. 27: 1621 - 1626.

Martin, W.S.; Meek, A.H. and Willeberg, P. (1987). Veterinary Epidemiology. Lowa State University Press. Ames.

Markusfeld, O. (1987). Inactive ovaries in high yielding dairy cows before service: Aetiology and effect on conception. Vet. Rec. 121: 149 - 153.

Morrow, D.A.; Roberts, S.J. and McEntee K. (1969). A review of postpartum ovarian activity and involution of the uterus and cervix in cattle. Cornell Vet. 39: 134 - 154.

Morrow, D.A.; Roberts, S.J.; McEntee K. and Cray, H.G. (1966). Postpartum ovarian activity and uterine involution of dairy cattle. J. Am. Vet. Med. Assoc. 149: 1596 - 1609.

Munro, C.D.; Watson, E.D.; McBride, B.; Martin, B.; Booth, J.M. and Holdsworth, R. (1982). Monitoring preservice reproductive status in dairy cows. Vet. Rec. 110: 77-81.

Mutiga, E.R.; Kiptoon, J.H. and Mosha J.B. (1978). Puerperal diseases of dairy cattle in Kenya. Modern. Vet. Pract. 59: 45 - 46.

Murray, R.D.; Allison, J.D. and Gard, R.P. (1990). Bovine endometritis: comparative efficiency of alfaprostol and intrauterine therapies and other factors influencing clinical success. Vet. Rec. 127: 86 - 90.

Snedecor, G.W. and Cochran, W.G. (1980). Statistical methods. 7th Ed. Ames USA. Lowa State University Press, 215 - 238.

Steinbauer, M. (1987). Occurrence of ovarian cysts in cows after parturition. Vet. Bull. 57: 1539 Abstr.

Vandeplassche, M. (1982). Reproductive efficiency in cattle. FAO, Rome, Animal Production and Health Paper. No. 25: 45 - 47.

Zebracki, A.; Glazer, T.; Zdunczky, S.; Kurcharcki, J. and Kretkiwecz, G. (1986). Fertility disorders in dairy and beef breeds of cattle. Trier ztl. Umsch. 41: 294 - 298.

Zemjanis, R. (1961). Incidence of anoestrus in dairy cattle. J. Am. Vet. Med. Assoc. 139: 1203 - 1211.