Recumbence syndrome around calving in cattle: A Study of Risk Factors of Milk Fever in Dairy units in Dar Es Salaam, Tanzania

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SUMMARY

A recumbency syndrome around calving in cattle was reported in Dar es salaam during the dry season and was thought to be associated with milk fever a disease common in high producing mature dairy cattle and is related to age, dry cow nutrition and general management. This study was conducted to establish the length of dry period of cows, determine the nutritive value of concentrate supplement fed to dry pregnant cows, levels of crude protein, calcium, phosphorus and magnesium and also to establish presence of other periparturient diseases in semi intensively kept dairy crosses cattle. The nutritive value was determined in 70 samples of concentrate supplement collected from purposively selected farms. Semi structured, pre tested questionnaires were used to get information on individual farms dry pregnant cows management including length of dry period of cows, feeding regime, supplement feeding also to establish presence of other periparturient diseases. Only 22.9% farmers dry cows around the recommended 60 days, 52 % dry cows between 60 – 90 days, about 21.4% of the farmers dry their cows more than 90 days, while 1.4% continue to milk their cows until the next calf is born. About 34% of the farmers reported to have experienced the problem of milk fever during the dry season. Daily intake of CP in concentrate supplement ranged from 110 – 245g, calcium 0 – 80 g, phosphorus 16 – 25.3 g and magnesium 5 – 10.2 g. Daily intake of nutrients from herbage was 3.7 g CP, 7.98 g Ca, 1.3 g P, and 0.6 g Mg. The daily recommended levels in dry cow ration are 150g, 20-40g, 5 g, and 10 g DM for crude protein, calcium, magnesium and phosphorus respectively. Periparturient diseases reported by farmers were mastitis 44%, retained placenta 43%, udder edema 20%, delayed estrus 24%, and repeated heat 24%. These findings indicated that dry period length and management of dry cows at close up period is variable among livestock farmers. Daily requirements of nutrients were within recommended limits. It is likely that the recumbency syndrome reported was due to hypocalcaemia but further studies should be conducted to assess plasma ionized calcium levels peripartum in Dar es salaam. Starvation ketosis in the dry season when herbage nutritive value is low may not be ruled out.

Key words: recumbency**,** milk fever, calcium homeostasis, dry cow

INTRODUCTION

Of the 18.6 million cattle, Tanzania has an estimated number of 500,000 dairy cattle most being crosses (F2) of exotic breeds with Tanzania Short horn zebu (TSZ) (National Livestock Policy, 2007). Of these dairy cattle 90% are owned by smallholder and 10% by commercial dairy producers (Kivaria *et al.*, 2006). Being in the tropical areas with seasonal variation in quantity and quality of natural pastures commonly

used these cattle produce 5 – 10 liters of milk per day. In Dar es salaam common grasses and legumes used for feeding livestock are *Chloris gayana, Hyparrhenia rufa, Brachiaria brizantha, Pannicum maximum, Centrosema pubescens, Pennisetum polystachyon and Cynodon dactylon* (Mwakatundu, 1979) and *Urochloa* pululans (Mellau *et al.,* 2002).

In recent years a recumbency syndrome suspected to be milk fever has been a challenge for both livestock keepers and veterinary professionals in private and public service providers in Dar es Salaam contributing to 4.5% mortality of high milk producing cattle. The prevalence of milk fever in urban and peri-urban smallholder dairy herds in Dar es Salaam region is not accurately known and research has been very limited and there are no recent data currently available. The recumbency syndrome has been reported to occur in high producing older dairy cattle, specifically, those with two parities and above. Retrospective analysis of disease cases reported and attended in various veterinary centers in Dar es salaam region between December 1998 and November 2006 indicated the prevalence of milk fever which does not respond to calcium therapy in Kinondoni to be 4%, Ilala district 3%, and Temeke district 2% (Assenga pers com 2006).

In Dar es Salaam dry pregnant cows are often supplemented with either locally compounded concentrate or by commercially available dry cow ration obtainable from various feed processing companies. However, the composition of commercial feed ingredients is often unknown. Due to variation in amount of feed ingredients included in concentrate compounded by farmers, it is assumed that addition of commercially available mineral/vitamin mix could suffice the body requirement and would reduce the chances of deficiencies and clinical milk fever occurrence. It is believed that if goes unchecked the addition of minerals in concentrate could increase the available mineral over and above the requirement which can expose the animal to the risk of milk fever (Husband, 2005). In the current scenario the recumbency syndrome could be true milk fever or transient hypocalcaemia, and it should be associated with nutritional risk factors and the general management of pregnant cows before calving because, milk production in Dar es salaam is not high especially in non pure breeds of dairy cows which make the great majority to warrant susceptibility to milk fever.

This study was designed to identify the management and nutritional risk factors associated with milk fever or transient hypocalcaemia with special emphasis on dry period length, levels of crude protein, calcium, phosphorus and magnesium in concentrate fed to the animals during lactation period and around calving in Dar es salaam, Tanzania.

MATERIALS AND METHODS

Study location

The study was conducted in Ilala and Kinondoni Districts, Dar es Salaam region, Tanzania. Dar es salaam is located on the East Coast of Tanzania around latitude 6°48' S and longitude 39°17' E. Most of the livestock farmers in this area practice semi intensive and few practice the intensive livestock farming system (zero grazing).The Ilala and Kinondoni districts were purposively selected because of the abundance of dairy units, high numbers of recumbence cases reported and willingness of farmers and livestock service providers to cooperate. The

Ilala district has 7,500 dairy cattle and Kinondoni district had 19,232 cattle making a total of 26,732 dairy cattle (Livestock census). The majority of cattle used in this limited study were crosses (F1 and F2) of Friesian and Ayrshire with Tanzania Shorthorn Zebu (TSZ).

Participated farmers

A total of 70 farmers were purposively chosen for the study. Depending on herd sizes farmers were stratified into small scale for those with 1 – 10 dairy cows, medium scale for those with 11 – 50 dairy cows and large scale farmers for those keeping over 50 dairy cows. Most farms had at one time experienced recumbence syndrome in cattle around calving during the previous one year. Average milk production per animal per day in the study was is 5 – 10 liters and all farmers routinely provide concentrate to their animals during the dry period.

Management system in the study areas

In selected farms cattle were fed adlibitum with mixture of grasses and legume pastures at an average of 10.5 kg dry matter (DM) per day. Sometimes the pasture grasses are carried from areas far from the area where animals are kept. Common grasses and legumes in Dar es salaam are *Chloris gayana, Hyparrhenia rufa, Brachiaria brizantha, Pannicum maximum, Centrosema pubescens, Pennisetum polystachyon and Cynodon dactylon* (Mwakatundu, 1979) and *Urochloa pululans* (Mellau *et al*., 2002). The grasses are cut and carried from natural pasture surrounding the area. Calculated levels of calcium (Ca), phosphorus (P), magnesium (Mg) and crude protein (CP) in grams per cow in herbage provided per cow were 7.98, 0.57, 0.63 and 3.82 respectively.

Probably by understanding mineral deficiency in herbage, dry pregnant cows and those lactating were supplemented with concentrate twice a day, given early in the morning during milking and during afternoon milking. Dry pregnant and lactating cows were supplemented with 2 - 3 kg of concentrate per day. In this case concentrate refers to a feed ration given to the animal which comprises of maize bran, mineral powder, and either cotton seed cake or sunflower cake.

Secondary data

Semi structured, pre tested questionnaire was used to gather information pertinent to dairy cattle management for example length of the dry period, general management of the lactating and dry pregnant cow, disease control, prevention and utilization of veterinary services. All 70 farmers purposively chosen for the study were interviewed. Farmers' responses were filled in the form using Kiswahili the local vernacular for those farmers who does not speak English. Ten veterinary practitioners from 10 Veterinary centers (4 from Ilala district and 6 from Kinondoni district) were also interviewed in order to get some information on endemic periparturient diseases and their associated post calving problems in the study area.

Concentrate samples collection methods

One sample of concentrate (about 0.5 kg) was collected during the afternoon

milking from each dairy farm, packed in labeled sealed plastic bags which were later transported to Sokoine University of Agriculture for analysis. Collectively, 70 feed samples were taken and they comprised of 45 samples from small scale farms, 24 samples from medium scale farms and 1 sample large scale farm. The feed samples were taken at the time of feeding in the afternoon.

Concentrate samples analysis

Each feed sample was analyzed for its dry matter content, crude protein, calcium, phosphorus and magnesium concentration.

Crude protein determination

Crude protein content of the feed sample was estimated by the nitrogen determination using Kjeldahl method (Tector, 1979). The protein and nitrogenous compounds were converted into ammonium sulphate by boiling with conc. sulphuric acid in the presence of catalysts. Liberated ammonium was collected in a weak acid (boric acid) and the actual amount determined by titration with another standardized weak acid (Hydrochloric acid).
The percentage values of nitrogen and protein were calculated by using the following formulas:

$$\text{Nitrogen \%} = \frac{14.01 \times \text{titre value mls} - \text{blank value mls} \times \text{conc. of acid used}}{\text{Sample weight used} \times 1000} \times 100\%$$

Where, 14.01 is the atomic weight of Nitrogen.

Crude protein (%) was obtained by multiplying the obtained value of Nitrogen in percentage with factor for plant samples which is 6.25. Thus, Crude protein was given by:

(%) = %N x 6.25.

Dry matter and ash determination

Dry matter is composed of the organic and inorganic fraction of the feed. The procedure used was of drying the feed samples at 105°C for 24 hr to constant weight of 2gm to evaporate the water.

$$\text{DM \%} = \frac{\text{Weight of dry sample (g)}}{\text{Initial wt of sample}} \times 100$$

Ash was determined by ignition of the feeds sample in the furnace at 500^0C for 3h and during the process the organic matter was burnt out and the residue was taken as ash or inorganic matter. Ash was calculated as percentage of dry matter, that is :

$$\text{Ash \%} = \frac{\text{Weight of ash (g)}}{\text{Weight of dry sample}} \times 100$$

Determination of calcium and magnesium

The procedure for ash and dry matter determination was the first step in the analysis of calcium, magnesium and

phosphorus levels. The ash of each feed sample was covered with 20 ml warm hydrochloric acid (1:1) and the mixture was allowed to stand overnight. The solution was filtered quantitatively into a standard flask. The residue was washed and the total filtrate made up to a concentration in the range between the weakest and strongest solution.

The absorption spectrophotometer was fitted with a hollow cathode lamp designed specifically for the element to be measured. Adjustment to the wavelength designed was made to 422.5nm for calcium and 285.2nm for magnesium. A little of the blank sample was atomized in the flame and the apparatus adjusted to zero absorption. A little of the concentrated standard solution was then atomized in the flame, and the digital indicator was set at the corresponding parts per million (ppm). The apparatus was checked by measuring the remaining standard solutions, atomized them in the flame in order of decreasing concentration.

The unknown solutions were atomized in the flame and the contents of the element in question were read directly in ppm from the digital indicator. According to the amount of material available, the results on the digital indicator were expressed as an average of 100 measurements. After each element de-ionized water was atomized in the flame in order of decreasing concentration.
Calculations to obtain the percentage level of calcium and magnesium from each feed sample were performed as follows:

$$\text{Parts per million (ppm) of the element} = \frac{\text{R x dilution factor}}{\text{Weight of dried sample}}$$

Where:

R is the reading taken from digital display of the Atomic absorption Spectrophotometer. The data obtained in ppm was converted into percentage as follows:

% level of the element = ppm x 10^4

Determination of phosphorus

For phosphorus determination 20 ml of warm 1:1 hydrochloric acid was poured in a crucible containing ashed sample and left for complete digestion until next day. The solution was then filtered quantitatively into measuring flask (100 ml) using distilled water and filled up to mark and mixed thoroughly. About b ml of the solution corresponding to 0.3 – 0.4 mg (b max =35ml) was pipetted into a 50ml measuring flask. The readings obtained were computed using the standard curve.

Statistical analysis

Descriptive statistics were summarized using the SPSS version 12 for windows where as parametric data were analyzed using the GraphPad Prism 3.0 (San Diego, CA, 92130 USA).

RESULTS

The length of dry period for cows in study farms

About 22.9% (n = 70) of the farmers dry their pregnant cows for recommended 60

days or slightly less, 52% dry cows between 60 to 90 days, 21.4% of the farmers dry the cows for more than 90 days, while 1.4% of farmers do not dry cows at all, which means they continue to milk cows until the next calf is born.

Crude protein level in concentrates

About 42.9% of concentrate samples contained CP level of 110 - 149 g, 32% samples had 150 – 170 g CP and 24.3 % of samples had CP of 171 to 245 g/kg of concentrate.

Calcium level in concentrates

From Figure 2, 94.3% of samples contained calcium levels between 0 – 19g/kg concentrate, 4.3% samples contained 20.1 – 30g calcium and 1.4% contained 30.1 – 40g of calcium/kg of concentrate.

Magnesium level in concentrates

About 5.7% of concentrate samples contained magnesium level of 2.5 – 3 g/kg, 75.7% contained between 3.1 – 4g magnesium, 17.1% contained 4.1 – 5g Mg and 1.4% contained more than 5g of magnesium (Figure 3).

Phosphorus level in concentrates

According to Figure 4, about 35.7% of concentrate samples contained phosphorus level of 8.1 – 9.3 g/kg, 22.9% contained between 9.6 - 10.5 g, 18.6% contained 10.6 - 11.5 g, 12.9% contained 11.6 - 12.5 g and 10% contained more than 12.6 g of phosphorus per kg.

Table 1 summarizes disease syndromes commonly encountered in study farms. These syndromes have been reported worldwide where milk fever and hypocalcaemia are endemic.

DISCUSION

In this study, 22.9% of farmers dry their pregnant dairy cows for the period less or equal to the recommended 60 days (NRC, 1989, Smith and Hogan, 1989), others had longer dry period between 60 – 90 days (52.9%) over 90 days (21.4%) and less than 2% of the farmers continue milking their cows until the next calf is born. Studies have shown that cows cow with a 70 day or longer dry period may have a slightly higher milk production but it cannot be economically justified because the cost to feed the dry cow are not recouped by the slightly increases seen in milk production. Longer dry period produce cows with body condition score of 4 to 5. Such cows usually succumb to metabolic conditions and could be the case in Dar es Salaam. The influence of the length of the dry period on milk fever was reviewed by (Houe *et al.*, 2001). Cows with long non-lactating periods are predisposed to becoming excessively fat, since cows do not regulate intake according to their physiological requirements (Morrow *et al.*, 1979, Davicco *et al.*, 1992). Besides obesity, a long dry period may result in a more quiescent calcium homeostasis. Davicco *et al.* (1992) found a less profound post parturient drop in blood calcium of cows with a mean dry period of 4 days only as compared to a period of 8 weeks.

Edwards *et al.* (1980*)* recommended the crude protein level of 15% appropriate for cow producing at most 25 kg of milk per day. Goff and Horst (1997) suggested that the production of just 10 kg of colostrum on the day of calving requires 140g of protein, 23 g of calcium, 9 g of phosphorus and 1g of magnesium be supplied from the diet or be brought to the mammary gland from body stores. In this study, when the feed analysis results obtained were

analyzed and grouped based on the recommended nutritive value range of 15 - 17% CP (150 - 170g/day), only 24.3% of the farm give their animals dry cow ration of more than 17% CP (170g/day) plus 3.82 g from herbage which becomes more than the recommended value. Our study shows that crude protein level provided by the majority of farmers was within the normal range of 15 – 17 % an amount that is desirable for optimum productivity.

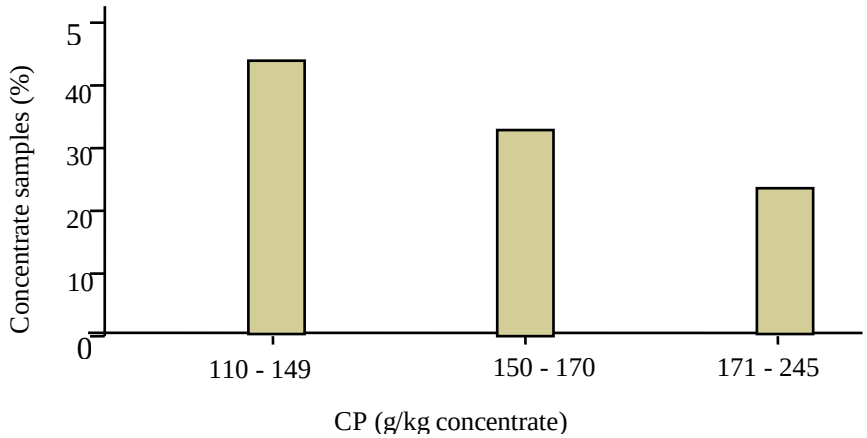

Figure 1. Amount of CP (g/kg concentrate) supplemented to dry pregnant and lactating cows in selected farms.

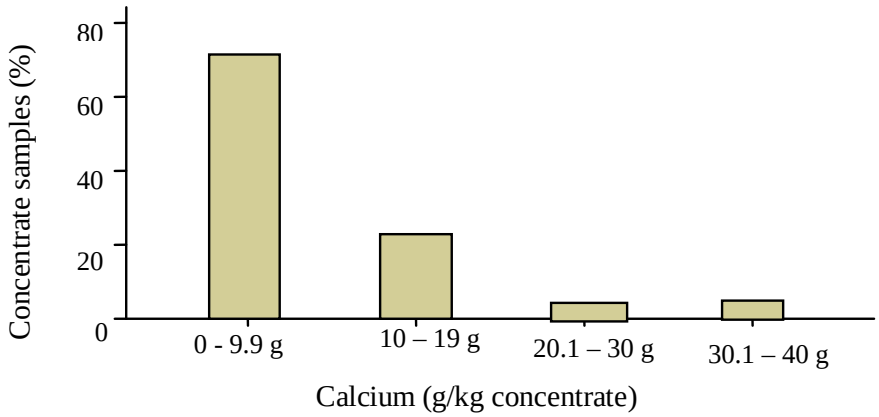

Figure 1. Amount of calcium (g/kg concentrate) supplemented to dry pregnant and lactating cows in selected farms.

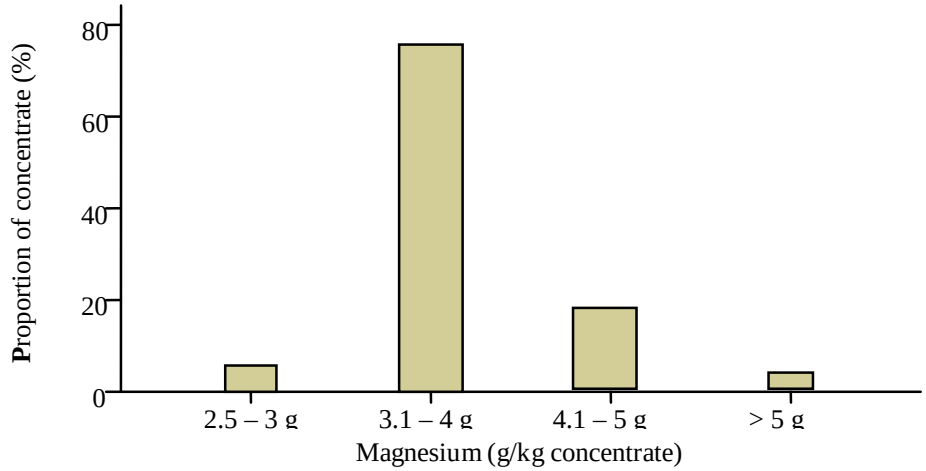

Figure 2. Amount of magnesium (g/kg concentrate) supplemented to dry pregnant and lactating cows in selected farms.

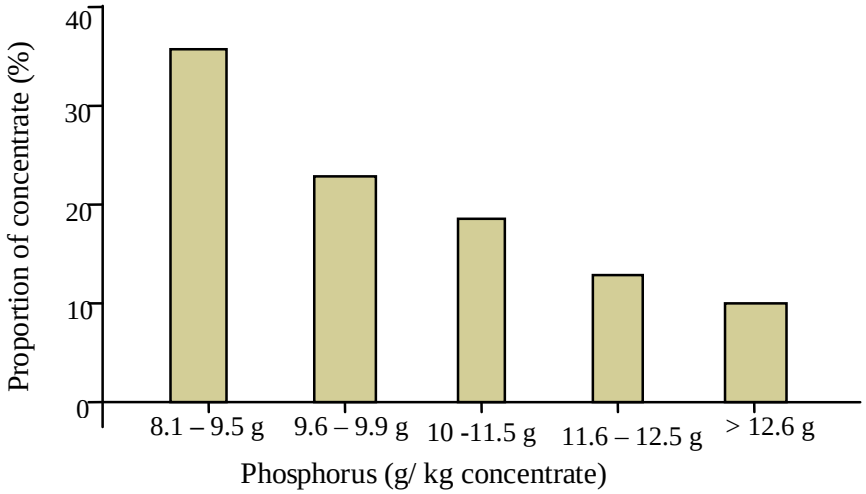

Figure 3: Amount of phosphorus (g/kg concentrate) supplemented to dry pregnant cows and the lactating cows in selected farms.

Table 1. Response of farm owners on the occurrence periparturient disease in their farms

Disease	Response	Frequency (N=70)	Percentage
Retained placenta	Encountered	40	57.1
	Not encountered	30	42.9
Udder oedema	Encountered	56	80
	Not encountered	14	20
Mastitis	Encountered	39	55.7
	Not encountered	31	44.3
Delayed Oestrus	Encountered	53	75.7
	Not encountered	17	24.3
Repeat heat	Encountered	53	75.7
	Not encountered	17	24.3

The deficiency symptoms of calcium and associated problems include rickets, slow growth and poor bone development, easily fractured bones, and reduced milk yield (Schroeder, 2004). For effective control of milk fever and hypocalcemia peripartum recommended levels in dry pregnant cows ranges between 20 - 80 g per day (NRC, 1989) and should be met especially in the 40 – 60 days also termed close up period. In this study, 94.3 % of the farmers (Figure 2) provide concentrate feed ration to their animals with calcium not more than 20 g/kg DM per day. However, together with concentrate feeding, animals are also fed with forages which according to Mwakatundu, (1979) contains calcium level of 7.98 g/kg DM. In view of this amount, the total calcium given to these animals was 28 -80 g per day which accordingly would be sufficient to prevent milk fever in cattle. Low prepartal calcium diets are known to prevent milk fever and hypocalcaemia (Jonsson *et al*., 1999). The 4.5% prevalence of milk fever in Dar es salaam is considered similar to milk fever prevalence in other parts of the world where preventive measures are undertaken (Goff *et al*., 1987).

Studies have shown that milk fever prevention should include limiting the daily intake of calcium and phosphorus during the last two weeks of gestation to less than 80 g calcium and less than 60 g phosphorus. The phosphorus level recommended is 10 g/kg DM (NRC, 1989). According to Mwakatundu (1979) the level of phosphorus found in the tropical forages to be extremely low being 0.56% (5.6 g/kg DM) but Mellau *et al.* (2002) observed that phosphorus levels in Morogoro was 0.13% in Urochloa grass hay harvested at Melela Catholic Community pasture paddocks. Such great variation could be due to concentration of phosphorus in the soil. In this study herbage and concentrate supplemented to cows could provide 16 g/cow/day which is very low than the cut off limit for effective productivity in cattle.

The recommended levels of magnesium in feed ration of dry cow are 5 g/kg DM (NRC, 1989). In this study, 98.6% of the farmers provide this mineral to their animals not more than 5 g/kg DM. Only 1.4% of the farmers give their animals more than 5 g/kg DM of magnesium per day (Figure 3). The level of magnesium in the tropical forages according to Mwakatundu (1979) is 0.06% (0.6 g/kg DM). In this study cows fed concentrate and forage received 5.6–12.6g of magnesium per day was normal to higher than recommendation. Studies have shown that feeding high magnesium diet tended to have higher blood pH and plasma concentration of total calcium but lower plasma concentration of phosphorus (Wang and Beede, 1992). It was possible that the milk fever like syndrome observed in Dar es salaam could have been triggered by higher magnesium intake.

The 9 out of 10 interviewed veterinary practitioners reported to attend less than 5 cases of milk fever per week. This could be due fact that some farmers attend their sick animals in their farm, others do not report the problems of their sick animals to the veterinary centers due to the high cost of treatment. Among the post parturient diseases attended by veterinary practitioners, about 80% were retained placenta, 30% were udder edema, 50% were mastitis, 40% were delayed oestrus and 20% for repeated heat. Likewise periparturient diseases reported by the farmers in this study include retained placenta 43%, udder edema 20%, mastitis 44%, delayed oestrus 24%, and repeated heat 24%. These observations indicate that the most post parturient diseases encountered in the study are related to the occurrence of hypocalcaemia. It has been reported cows that recover from milk fever

not only have impaired reproductive performance, but they also produce about 14% less milk in the subsequent lactation (Oetzel, 1996). They are less productive and more susceptible to other health disorders such as ketosis, mastitis, retained placenta, displaced abomasum, and uterine prolapse (Bethard *et al*., 1998). Reduced feed intake and milk yield which occur due to transition stress may lead to ketosis as a result of an imbalance between energy intake and output and the cow experience a metabolic shortage of gluconeogenic precursors and excessive fat mobilization that leads to formation of ketone bodies (Wentink *et al.*, 1996).

About 24% farmers reported to experience the problem of delayed oestrus and the same percentage had the problem of repeated heat. Jonsson and Daniel (1997) reported significant decline in ovarian blood flow with a decrease in plasma ionized calcium. There is a great loss in term of productivity since the calving interval will be prolonged, which will affect availability of milk in the expected next lactation.

The effect of periparturient diseases on reproductive performance have been reviewed by Oetzel (996), as the cause of cystic ovaries. The problem of repeated heat encountered in this study could be explained by the fact that the ovaries of the cows in question had a reduced blood flow during the post calving period as explained by other researchers (Wentink *et al*., 1996). This condition lead to underdevelopment of the ovaries, however, since the follicles are functioning they were able to produce estrogen hormone at a low level that could not rupture the mature cyst which could lead to conception on insemination. Fischer *et al*. (1992) reported follicular development to be sensitive to blood flow fluctuation due to low oxygen pressure level in the developing follicles. The effect of cattle productivity in term of repeated heat is almost the same as that of delayed oestrus. However, there is more loss in terms of productivity since the animal will show heat signs repeatedly and each time the farmer will incur cost for insemination. A relationship of delayed uterine involution (uterine contractility and blood flow to the organ) and the occurrence of clinical hypocalcaemia has also been suggested by other researchers which impair parturient uterine smooth muscle contraction thus affect reproductive performance (Jonsson and Daniel, 1997; Risco *et al.*, 1994).

It can be concluded that there are periods of dry spell which occur within the months of September – December in Dar e salaam and all over Tanzania. During the period cattle suffered low plane of nutrition in terms of quality and quantity of pastures. This is the time where most of the farmers report to have the problems of milk fever and recumbency syndrome. Over 85% of the farmers supplement their animals with home compounded rations during the period in late gestation and may be continue to lactation. Metabolic problems reported in this limited study could have resulted from imbalances in elements known to prevent periparturient diseases in prone animals. Further studies are necessary especially to assay levels of ionized calcium, inorganic phosphate and magnesium in cattle at late gestation to confirm the magnitude of hypocalcaemia in Dar salaam.

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