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Non-genetic Factors Affecting Gestation Length and Postpartum Intervals in Gudali Zebu Cattle of the Adamawa Highlands of Cameroon

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Summary

The effects of non-genetic factors (sex of calf, calf birth weight, age of cow, season of calving) affecting gestation length (GL) and open days period (OP) in the Ngaoundere Gudali cattle of the Adamawa (Cameroon) was investigated. Mean GL was 293.4 ± 0.4 d. Sex of the calf significantly (P< 0.05) affected GL, with male calves being carried in utero *approximately 3 days longer than the females (294.1 ± 1.2 vs 291.1 ± 1.2 d). Calf birth weight tended to increase as gestation lengthened. Parity and age of the cow had no significant (P> 0.05) effect on GL. The mean duration of the OP (from calving to conception) was 267.7 ± 7.4 d. Approximately 23.2% of the cows conceived within 90 days of calving and a total of 55.6% had conceived by 360 days. The distribution of the OP was bimodal, and could have been influenced by seasonal availability of feed, or long (6 months) mating season allowing cows to calve during the following mating season. Calving to conception interval was significantly (P< 0.001) affected by month of calving and parity. Sex of the calf did not affect significantly the duration of the postpartum period, although this period was 5 days longer following the birth of a male calf.*

Résumé

Facteurs non génétiques affectant la durée de la gestation et de l'intervalle post-vêlage chez les bovins zébus Goudali des hauts plateaux de l'Adamaoua, Cameroun

L'étude a porté sur les effets de certains facteurs non génétiques (sexe et poids à la naissance du veau, âge de la mère, saison de vêlage) affectant la durée de la gestation et de la période vide des bovins Goudali de Ngaoundéré en Adamaoua camerounais. La durée moyenne de la gestation était de 293,4 ± 0,4 j, significativement (P< 0,05) affectée par le sexe du veau: les mâles étant portés in utero *environ 3 jours de plus que les femelles (294,1 ± 1,2 contre 291,1 ± 1,2 j). Le poids à la naissance présentait une tendance à l'augmentation avec l'extension de la gestation. Le rang de vêlage et l'âge de la vache n'avaient pas d'effet significatif (P> 0,05) sur la durée de gestation. La durée de la période vide (du vêlage à la conception) était 267,7 ± 7,4 j. Environ 23,2% des vaches ont conçu dans les 90 jours suivant le vêlage, et 55,6% dans les 360 jours. La distribution de la période vide était bi-modale, et aurait pu être influencée par la disponibilité saisonnière des aliments, ou la longue saison de monte (6 mois) permettant aux vaches de vêler au cours de la saison de monte suivante. L'intervalle entre vêlage et conception était significativement (P< 0,001) affecté par le mois et le rang de vêlage. La période post-partum n'était pas affectée significativement par le sexe du veau même si elle était en moyenne plus longue de 5 j suite à la naissance d'un veau mâle.*

Introduction

Gestation length (GL) and duration of the postpartum interval (PPI) are among the most important cow efficiency traits in cow-calf operations. Although GL shows a limited range among breeds, it is typical for each breed and has to be characterised (23, 30). Reports on the GL of different *Bos indicus* breeds indicate a distribution range of between 285 and 294 days (4, 24, 26, 29, 37). These studies also show that *Bos indicus* calves are, on average, carried longer *in utero* than their taurine counterparts. Tropical cattle breeds generally have prolonged anoestrous (parturition to first observed oestrus or first service) periods. These lead to extended calving-to-conception intervals, which in turn cause long intercalving periods (9, 10, 21). The long PPIs observed in *Bos indicus* cattle can also be related to a number of factors such as nutrition (6), suckling (5, 22, 34, 36), and age/parity (8). The Ngaoundere Gudali is an indigenous breed of the Adamawa highlands of Cameroon. Its reproductive performance has so far received little or no attention in Cameroon (19, 20), despite the considerable amount of work published on its productive performance and that of its crosses with some exotic breeds (1, 9, 15, 16, 17, 19, 32, 35). The aim of the present study was to contribute to the characterisation of the Ngaoundere Gudali cattle by determining its gestation length and the duration of the postpartum open period, as well as some of the non-genetic factors that could significantly affect these parameters.

Materials and methods

Data collected over an 8-year period (1981-1988) in the Ngaoundere Gudali herds of the Wakwa Regional Centre of IRAD (Ministry of Scientific and Technical Research), and the Wakwa Animal Production Station (Ministry of Livestock, Fisheries and Animal Husbandry) were used for this study. These units are located on the Adamawa plateau, 10 to 12 km east of Ngaoundere at a latitude of 7°30'N and longitude of 13°30'E. Wakwa is situated at an altitude of approximately 1200 m above sea level. The climatic conditions and

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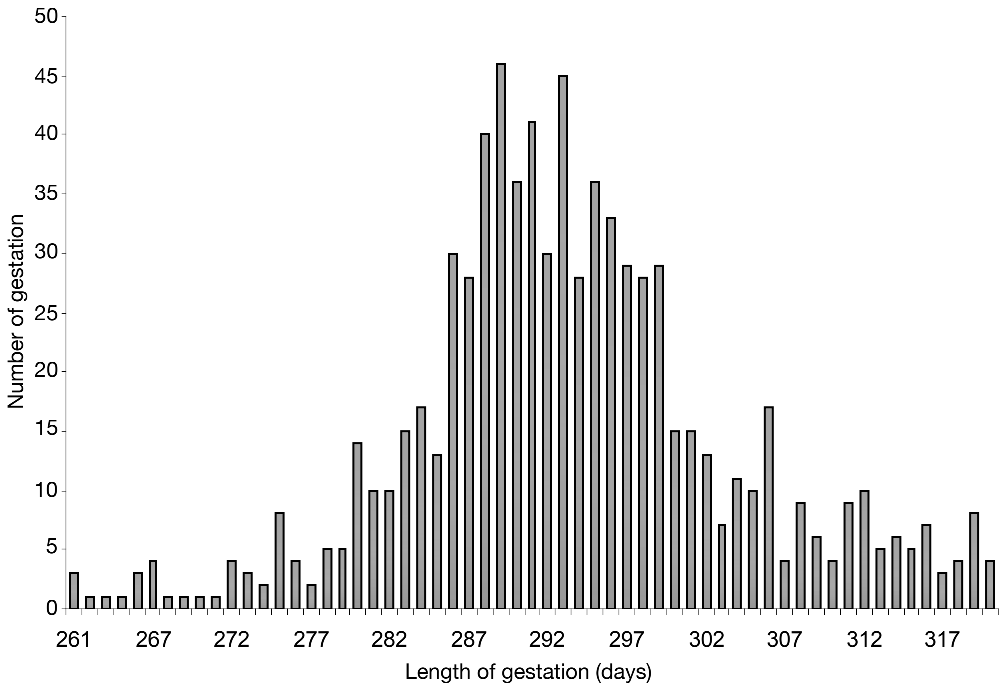

Figure 1: Frequency distribution of gestation length in Ngaoundere Gudali cattle.

management practices at the Wakwa units have been previously described (15, 16, 25, 27). A mating season of 6 months (early June to end of November) was enforced.

All the animals used (N= 885) were purebred Gudali cattle belonging to the Wakwa units. During the breeding season, the herds were observed closely by herdsmen, once a day (between 06:00 and 07:00) for about 30 minutes. All cows exhibiting oestrus signs and bred by a bull were identified and recorded. Gestation length was determined as the interval from the date of the last observed service and the date of subsequent calving. According to the methodology described by Plasse *et al.* (29), only gestation lengths between 260 and 320 days were accepted as reliable. Thus, only 697 gestation periods falling within this range were included in the final statistical analysis. Data were analysed using the generalised linear models procedures of the Statistical Analysis System (33). Variables included in the model for gestation length were: month, season and year of service, sex of current and previous calves and parity of the dam. Calf birth weight was introduced as a covariate. A stepwise regression was used to remove all variables from the model that did not meet the criterion ($P< 0.15$). Preliminary analyses did not show any significant effect of either the sex of the previous calf or possible interactions between the factors considered. Therefore, these effects and associated interactions were removed from the final model. Of the 697 oestrous observations in the study, only 578 were considered in the final model due to missing data.

Many cows having been used over the years, 534 calving to conception intervals (days open) were generated and used to calculate the time elapsing between the date of the last calving and the date of the last recorded natural service prior to conception. The variables used in the model for open period were: sex of current and previous calves, parity of dam and month of calving. Age at calving was introduced as a covariate. The sex of the previous calf was not significant ($P> 0.15$) in the stepwise regression analysis and was removed from the final analysis.

Results and discussion

It was obvious from the frequency distribution of the gestation length (Figure 1) that the raw data could have included errors - the curve is skewed towards a length of gestation of over 300 days. Given the conditions under which the oestrous/service observations were made, mating resulting in conception may have occurred one or more cycles after the last recorded service prior to calving and were missed - resulting in calculated gestation lengths longer than the actual period.

The mean GL recorded in the Ngaoundere Gudali cows was 293.4 ± 0.4 d (Table 1).

This is in agreement with other reports in zebu cattle (4, 24, 29). The sex of the calf significantly ($P< 0.05$) affected the GL, with males being carried *in utero* approximately 3 days longer than their female counterparts (294.1 ± 1.2 versus 291.1 ± 1.2 d). These results are in agreement with the findings of Nadarajah *et al.* (23) with Holsteins, and Browning *et al.* (4) on Brahman. However, Reynolds *et al*. (30) and Obese *et al.* (24) found sex of the calf to have no effect on GL. Birth weight, when introduced as a covariate, tended to increase as the gestation period lengthened.

The month during which service and conception took place seems to play a significant ($P< 0.01$) role in GL, but no clear trend could be determined in this study, as the GL fluctuated from year to year. This significance may have resulted from the variability in the accuracy of detection of the successful mounts by the staff involved, as natural service detection was only performed once daily. Given the low frequency of mounting behaviour usually reported among tropical cattle (20 to 28%) and some evidence that oestrus is better detected during the late hours of the night and early hours of the morning (11, 13, 18), it is possible that a significant number of services went undetected.

The parity (and subsequently the age of the cow) at breeding had no significant effect on the GL. These findings were similar to those of Obese *et al.* (24) in Sanga cattle in Ghana. However, it has been reported (2, 23) that GL tended to increase with the parity and age of the cow in the Holstein.

Nadarajah *et al*. (23) found GL to be more dependent on the servicing sire than on the dam through her sire, whereas Azzam and Nielsen (3) reported GL to have an average heritability estimate of 0.40, which could indicate

Table 1
Effect of sex of calf, parity and month of calving on gestation length and postpartum interval (LSM ± SE) in Gudali cows of the Adamawa Highlands of Cameroon

Source of variation	Number	Gestation length (days)	Number	Length of period open (days)
Overall	697	293.4 ± 0.4	534	266.7 ± 7.4
Sex		*		NS
Male		294.1 ± 1.2		243.2 ± 13.0
Female		291.1 ± 1.2		238.5 ± 12.1
Parity		NS		***
1		294.1 ± 1.2		320.7 ± 13.5
2		292.6 ± 1.9		250.8 ± 14.4
3		294.7 ± 1.2		224.9 ± 18.6
4		294.7 ± 1.4		207.9 ± 20.9
5		290.9 ± 1.6		200.2 ± 25.8
6		289.7 ± 2.4		-
7		294.6 ± 3.1		-
8		293.0 ± 4.6		-
Month of calving				***
March		-		315.7 ± 20.1
April		-		265.8 ± 12.3
May		-		213.5 ± 14.4
June		-		216.4 ± 18.7
July		-		211.1 ± 27.2
August		-		222.7 ± 37.8
Month of service		***		-

NS= Non significant; *= Significant, ***= Highly significant

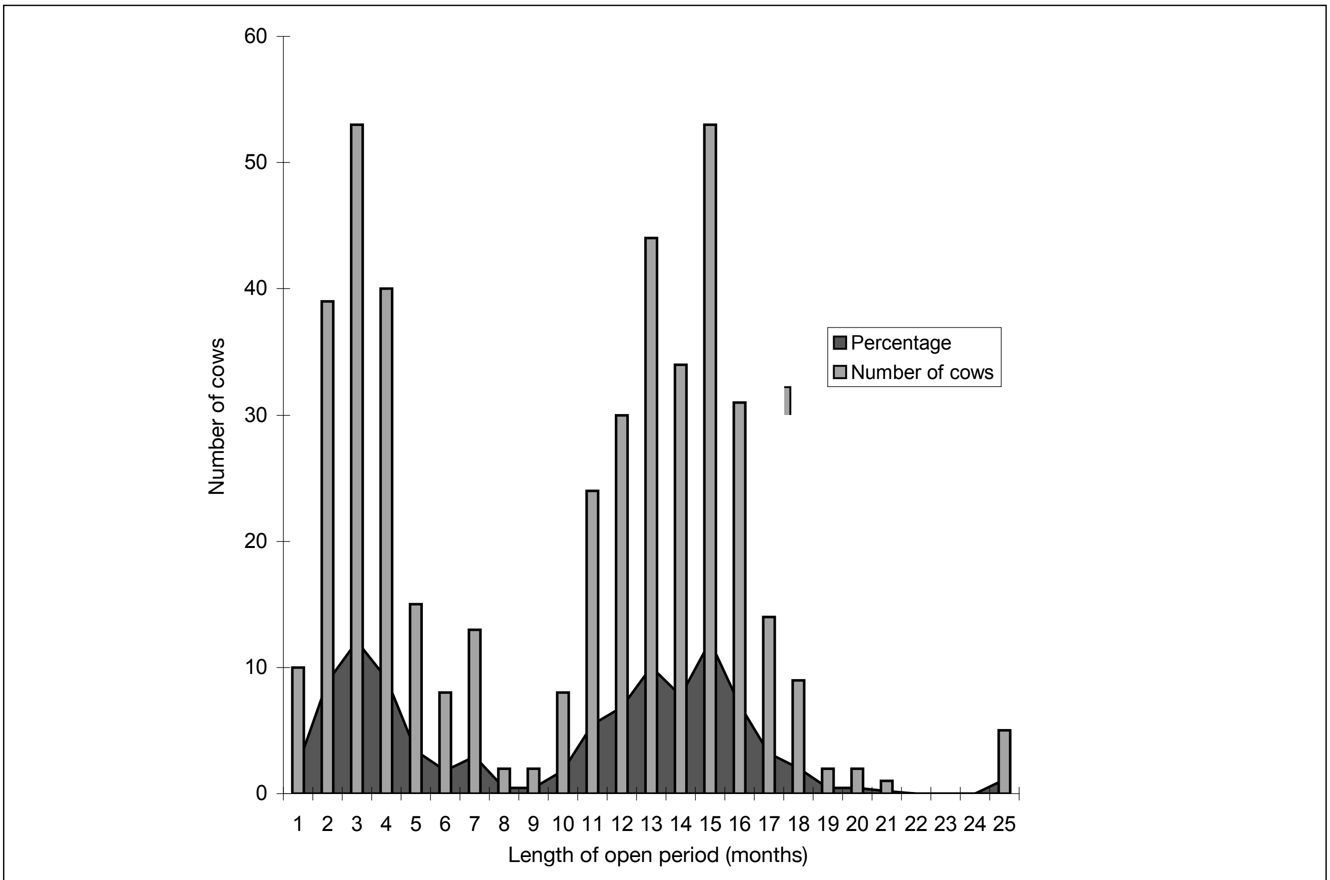

Figure 2: Frequency distribution of the duration of the open day period (from calving to conception) in Ngaoundere Gudali cows.

the possibility for selection for a shorter GL in cattle. Thus, the genetic make-up of the calf carried *in utero* may have a considerable effect on GL, and this trait could be worth selecting for. However, selecting for shorter GL would in turn reduce calf size and weight (4, 23). This reduction in weight may not be desirable in the Ngaoundere Gudali breed that already experiences a low calf birth weight (23 to 24 kg).

The distribution of the length of the open period (OP) (from calving to conception) is shown in figure 2.

The mean open period recorded was 267.7 ± 7.4 d, with a range of 37 to 749 d. While 23.2% of the cows conceived within 90 d after calving, only 55.6% conceived within 360 d, and the rest (44.4%) did not conceive within a year. This may partially explain the long intercalving period of the breed reported in the breed. Plasse *et al.* (28) found an interval from parturition to conception of 65.3 d in Brahman cattle, whereas an interval of 203.9 d was reported in Holstein-Friesian cattle under central Sudan conditions (2).

From Figure 2, it is apparent that the distribution of the calving to conception interval in Ngaoundere Gudali cows is bimodal, with a group of intervals concentrating between 60 and 150 d postpartum (33.5%) and another group between 12 and 17 months PP (43.7%). As this interval was significantly ($P < 0.001$) affected by month of calving and parity, but not by sex of the calf, it is thought that the second group was comprised mostly of cows that calved too late in the season and could not be rebred during the same season. They skipped a breeding season, and had to wait another 6 to 12 months to be re-bred and conceive. These conditions are partly a result of the long (6 months) mating season, allowing cows to calve during the following year's mating season. The combined effects of the seasonal availability of feed and variation in management could also be a possible explanation for these two peak intervals, almost 12 months apart. As can be deducted from table 1, cows that are bred at the beginning of the mating season (i.e. in June) will calve at the end of the dry season (March). These cows will thus be lactating when feed scarcity is at its highest, and will need a longer time to restore their body reserves mobilised to nurse their calves, that will only be weaned 8 months later (around November-December), when the breeding season is nearing its end. Very few of these cows may be bred then and most would skip a year, until the following breeding season. These cows have the longest OP (315.7 ± 20.1 d), compared to cows conceiving later in the breeding season. Cows bred later in the middle of the rainy season (July, August or September) start calving from the end of April to the end of August, do not need to mobilise their body reserves in excess for lactation and therefore stand a better chance of re-conception during the same breeding season, as pasture availability in quantity and quality is at the highest when the nursing cows are at their peak of production. From these results, the best calving period for a shorter PPI would therefore be the early in the rainy season, from May to July. This would mean a 3-month breeding season extending from late July/early August to late October/ early November.

The sex of the calf born did not significantly ($P > 0.05$) affect the duration of the OP, although this period was on average 5 d longer after the birth of a male than that of a female calf. This difference was expected, as male calves are reported usually heavier at birth (12) and tend to grow faster (30). This faster growth, which is achieved through a larger intake of milk, increases the nutritional stress on the cow, resulting in additional inhibitory action on the resumption of the ovarian activity and therefore lengthens the OP and the ICP (inter-calving period).

Parity significantly ($P < 0.001$) affected the duration of the OP. Cows on their first parity had the longest open period (320.7 d) which tended to decrease as the cows got older (200.2 d at the 5th parity). Young cows tend to have the longest calving intervals, due to their concurrent nutrient requirements for growth and lactation (8, 22). When the conditions are sub-optimal, the primiparous heifers are more at risk of not conceiving during a limited mating season than multiparous cows. In this case, the gain in the form of an early lighter calf may be outweighed by a longer calving interval. Therefore, under the traditional low-input low-output husbandry systems of the Adamawa highlands of Cameroon, early breeding of heifers before the age of 24 months may not be advisable.

The seasonal availability and quality of feed plays an important role in the period from calving to conception. It has been reported that lactating cows are in a phase of negative energy balance during the first few weeks following parturition as the feed consumption does not meet the nutritional needs of lactation (31). This negative energy balance would be exacerbated in Ngaoundere Gudali cows calving at the end of the rainy season or at the beginning of the dry season, when the availability and quality of forage are limited, causing an excessive weight loss in the dams (15). Nutritional management during the transition period – preferably 3 weeks before and 3 weeks after parturition – is thus of great importance as it may have significant carry-over effects on reproductive efficiency during the subsequent mating season.

Conclusion

Month of service and sex of calf were found to be significant sources of variation in the gestation length of the Ngaoundere Gudali cattle, whereas parity did not affect this parameter. Male calves were carried 3 days longer *in utero* than their female counterparts, but this difference was not significant. The significant effect of season on the gestation length was attributed to the variability of the accuracy of oestrous/service detection, as the observations were not done frequently enough. It is therefore suggested that in future studies, a minimum of 3 observations per day for periods of at least 30 minutes each be performed for more accurate oestrus/service observations.

The duration of the open period was significantly affected by month of calving and parity, but not by the sex of the calf. Primiparous cows had the longest open period, and this reduced as parity increased. Cows calving in March and April (at the end of the dry season/ beginning of the rainy season) had longer open periods than those calving later particularly as from May to July. This latter group stands a better chance of being rebred during the subsequent breeding season than the former. The mating season should be reduced and planned in such a way that cows would start calving in May. This implies starting the mating season two months later (late July/early August) and ending it one month earlier (late October/early November) than currently. Early breeding of heifers under the extensive traditional husbandry systems of the Adamawa highlands is not advisable as the loss in reproductive performance outweighs the gain in early light-born calves.

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