Effect of Breed and Non-genetic Factors on Lactation Length of Dual-purpose Cattle in Ashanti Region

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Abstract

The study was conducted to determine the effect of genotype and non-genetic factors on lactation length (LL) of on-farm dual-purpose cows at smallholders' farms in Ashanti-Region. The dates of calving to the time of drying-off of milk in 124 cows were monitored from June 2012 to April 2013. Analysis of data indicated that breed, feed supplementation and body condition score (BCS) significantly ($p<0.01$) influenced LL. Average LL across breed was 246.4 days with minimum and maximum being 155 and 303 days, respectively. Mean LL for Sokoto Gudali, White Fulani, Sanga-Gudali cross, Sanga, WASH and N'dama were 278.1, 255.7, 262.5, 260.7, 214.5, and 261.2 days, respectively. WASH had the least LL whilst similar ($p>0.05$) observations were made in all the other breeds. Cows that were provided with regular, occasional, and no feed supplementation recorded mean values of 265.7, 259.1 and 241.5 days ($p<0.01$), respectively. The least mean LL was observed in cows provided with no supplementation whilst regular and occasional supplemented cows had similar ($p>0.05$) LL. Lactation length of 270.7, 257.6 and 237.9 days ($p<0.01$) were recorded for BCS 4, 3, and 2, respectively. Thus, LL significantly increased as body condition score increased. Farm location, season of lactation, parity of cow and sex of calf had little ($p>0.05$) effect on LL. It was concluded that breed had great influence on LL and could be considered when selecting dairy cows for breeding. Adequate feeding by way of providing feed supplementation is necessary to increase LL, and therefore milk production.

Key words: body condition score, cow genotype, feed supplementation, milk production, parity of cow, season of lactation, sex of calf, smallholder herd.

INTRODUCTION

Lactation length (LL) and milk yield are two important traits of dairy animals which are influenced by genotype and environmental/non-genetic factors (Gergovska *et al*., 2011; Kugonza *et al*., 2011). Lactation length has positive influence on total milk yield per lactation (Bajwa *et al*., 2004; Endris *et al.*, 2012) and therefore, profitability of the dairy industry (Lissow, 1999). Feed supplementations, parity of cow, sex of calf, and season of calving also have influence on LL (Bajwa *et al*., 2004; Darfour-Oduro *et al*., 2010). Several studies have been conducted on LL of some local, exotic breeds and their crosses on-station (Aboagye, 2002; Darfour-Oduro *et al*., 2010). Very little is however known about the factors affecting LL of the various dual-purpose cattle breeds of smallholder herds in Ahanti Region, Ghana.

The objective of this study was to determine the effect of genotype and non-genetic factors on the LL of on-farm dual-purpose cattle at smallholders' farms in Ashanti-Region.

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METHODOLOGY

The study was conducted in four Districts of Ashanti Region from June 2012 to April 2013. The Ashanti Region is centrally located in the middle belt of Ghana. It lies between longitudes 0° 9'W and 2° 15'W, and latitudes 5° 30'N and 7° 27'N. The region has a population density of 148.1 persons per square kilometre, and ranks third in population size after Greater Accra and Central Regions (Ghana Districts, 2006). More than half of the region lies within the wet, semi-equatorial forest zone. Bushfires occur in the dry season, and has reduced the forest vegetation of parts of the region, to savannah, particularly the north-eastern portion. The detailed description of Ashanti Region's vegetation and seasons had been done in Coffie *et al.* (2013).

A total of 124 dual purpose cows of various breeds were purposively selected from 18 farms within 4 Districts (Atwima-Nwabiagya, Ejisu-Juaben, Sekyere South and Ejura-Sekyedumasi) in Ashanti Region in order to monitor their LL. The breeds of cattle used for the study included WASH (n=18), Sanga (n=43), White Fulani (n=25), Sokoto Gudali (n=12) Sanga-Gudali crossbreed (n=13) and N'dama (n=13)

Measurements were taken on cows on the date of calving, body condition score (BCS) at calving or the day of calving, parity cow, season of calving, location of calving and date of weaning. Weaning of calves were observed to be characterized by dams unwillingness to allow their calves to suckle, marked reduction in daily milk yield to less than 0.1 litre/day, calves reluctance to suckle, and in some breed loss of mothering abilities of cows and hostilely wild to herdsman. LL was defined as the interval (days) between day of calving and weaning.

Data on LL were subjected to least squares analysis using GLM Type III procedure of SAS on the fixed model below:

$Y_{ijkmnqrt} = \mu + D_i + B_j + S_k + L_m + P_n + X_q + C_r + e_{ijkmnqrt}$; where,

$Y_{ijkmnqrt}$ = traits being measured; μ = population mean; D_i = the effect of i^{th} District/location, i =1, 2, 3, 4; B_j = the effect of j^{th} Breeds, j = 1, 2, …, 6; S_k = the effect of k^{th} sex of calf, k = 1, 2; L_m = the effect of m^{th} season, m 1, 2, 3; P_n = the effect of n^{th} parity, p= 1, 2, …, 5; X_q = the effect of q^{th} supplementation, q =1, 2, 3; C_r = the effect of r^{th} body condition, r = 1, 2, 3; and $e_{ijkmnqrt}$ = the residual effect.

Differences between means of significant effects were separated by the probability of difference (PDIFF) procedure of SAS (SAS, 2008).

RESULTS AND DISCUSSION

The overall mean of LL across breeds was 246.4 days with minimum and maximum values of 155 and 303 days, respectively (Table 1). This finding is comparable to 248 days reported by Bajwa *et al*. (2004) in Sahiwal cattle in Pakistan, and falls within ranges reported by Aboagye (2002) (29-261 days), and Kugonza *et al*. (2011) (165-255 days) on local breeds in Africa. It is however higher than the mean LL reported by Darfour-Oduro *et al*. (2010) for Sanga (164.1 days) and Friesian-Sanga (201.1 days) cows in Ghana, but far lower than averages of 305, 305, and 327 days observed for Friesian-WASH, Jersey-Gudali and Friesian-Gudali in Ghana (Annor, 1996).

The differences observed may be attributed to varied genetic merits in terms of milk production performances of the various individual breeds. The crossbred cows might have inherited the longer lactation periods from Zebu or foreign breeds in addition to the local breeds' adaptability to humid climate. This might have been achieved presumably through heterosis and breed complementarity. Whilst breed complementarity involves the additive combination of adaptation of the tropical breed with the productivity of the improved exotic breed, heterotic effects are accounted for by dominance and epistatic gene effects which are non-additive (Aboagye, 2002).

Table 1: Least square means and standard errors for the effects of fixed factors on Lactation Length of the dual-purpose cows

Fixed factors	Number of observation	Means Values of Lactation Length (days)
DISTRICT[1]		*0.4425*
Ejura Sekyedumase	24	253.6 ± 6.3
Sekyere South	50	251.2 ± 5.0
Ejusu Juabimg	15	255.8 ± 7.8
Atwima Nwabiagya	31	261.1 ± 5.9
BREEDS[1]		*0.0001*
Sokoto Gudali	12	278.1 ± 13.0[a]
White Fulani	25	255.7 ± 5.1 [a]
Sanga X Gudali	13	262.5 ± 11.2[a]
Sanga	43	260.7 ± 4.4[a]
WASH[2]	18	214.5 ± 6.9[b]
N'dama	13	261.2 ± 10.8[a]
SEX OF CALVES[1]		*0.3919*
Male	66	253.7 ± 4.8
Female	58	257.1 ± 5.0
SEASON[1]		*0.0963*
Major	52	262.8 ± 5.1
Minor	40	254.3 ± 6.2
Dry	32	249.1 ± 6.1
PARITY[1]		*0.0530*
1	51	250.4 ± 5.9
2	25	243.4 ± 5.8
3	25	254.1 ± 5.8
4	19	252.6 ± 6.4
5	4	276.5 ± 11.1
SUPPLEMENTATION[1]		*0.0004*
Regular	25	265.7 ± 6.5[a]
Occasional	37	259.1 ± 5.5[a]
No supplementation	62	241.5 ± 5.4[b]
CONDITION SCORE[1]		*0.0011*
2	35	237.9 ± 6.0[a]
3	65	257.6 ± 5.2[b]
4	24	270.7 ± 7.1[c]
Overall	**124**	**246.3 ±1.7**

[1] *=Probability value of main effects*

Effect of district
District had little or no influence ($p>0.05$) on LL (Table 1). This is an indication that management practices such as feeding, routine disease control and feed supplementation are similar in the various Districts (Ngongoni *et al.,* 2006).

Effect of breed
Breed effects on LL were significant ($p<0.01$). Mean LL for Sokoto Gudali, White Fulani, Sanga-Gudali, Sanga, WASH, and N'dama cows (Table 1) are comparable to on-station average values of 244.8 and 220.0 days reported for Sokoto Gudali and White Fulani, respectively (Tawah and Rege, 1996) and 220.0 for Sanga (Okantah, 1992). The observed values are however, lower than LL reported for N'dama (283.0 days) (ILRI, 2009) and exotic breeds (300.0 days) (Oppong-Anane, 2013). Lactation period for WASH (Table 1) falls within the on-station range of 29-261 days (Aboagye, 2002). The least LL of WASH in this study can be explained by their inability to let down milk in the absence of their calves coupled with their lower milk yield potential (Aboagye *et al.,* 1994).

The differences in LL between the Zebu and their crosses on one hand and WASH on the other hand might have resulted from the genetic superiority of the Zebu and their crosses over the indigenous WASH. The WASH is known to have poor milk attributes. Evidence to this effect is the recorded lowest total milk yield of 44kg/lactation in 29 days lactation period reported by Aboagye (2002).

Effect of sex of calf and season of calving
Sex of calf had little ($p>0.05$) effect on LL. Cows with female calves had slightly higher LL than those with male calves (Table 1). Similar findings were reported by Afzal *et al*. (2007). Season of calving also had little ($p>0.05$) effect on LL. This finding contradicts that obtained by Bajwa *et al.* (2004) and M'hamdi *et al*. (2012). They observed that calves calving in the rainy season had longer LL than those calving in the dry season. The difference between the finding in this study and that of the other authors may due to feed supplements provided to about one-half of the cows in this study, which might had offset the harsh seasonal effect that results from imbalance of feed.

Effect of parity
Cows did not differ ($p>0.05$) in LL with respect to parity. This finding is similar to that reported by M'hamdi *et al*. (2012). However, Epaphras *et al.* (2004), Darfour-Oduro *et al*. (2010) and Watters *et al.* (2010) reported that parity has influence on LL. They observed that LL increases with increasing parity. These disparities may be due to different parity levels used in the various studies.

Effect of feed supplementation
Supplementation of lactating cows significantly ($p<0.01$) influenced LL. It is worth considering that feed supplementation is one of the environmental factors which can mask genetic potential for production. It is not surprising to realise longer lactation duration for cows that were given regular and occasional supplementations than those provided with no supplement (Table 1). This result is comparable to findings of Epaphras *et al.* (2004) and M'hamdi *et al.* (2012). The yields of farm animals are the result of the combined effects of genotype and environmental conditions which include nutrition and all other management routines (Darfour-Oduro *et al*., 2010). Supplementation of

lactating cows improves inadequate nutrients in feed or fodder in the lean seasons and thereby increases daily milk yield and lactation longevity (Epaphras *et al.*, 2004; M'hamdi *et al*., 2012).

Effect of body condition score

Body condition score (BCS) was found in this study to be one of the determinants of LL. This outcome is comparable to the findings of Watters *et al.* (2010), and Gergovska *et al*. (2011). High mean lactation duration at calving recorded in descending order for BCS 4, 3, and 2 (Table 1) is an indication that the higher the BCS at calving the longer the LL. This may due to fact that, in early lactation increase in feed intake is not adequate to meet energy requirement of milk production, and therefore lactating cows resort to mobilization of their body reserves which cause them to lose BCS. Similar observation was noticed in Holstein Friesian and it is considered a normal physiological state for cows in early lactation (Loker *et al*., 2010). Gergovska *et al*. (2011) noted that milk yield and lactation period of cows with low body condition score (≤2.5 points) have 1400 kg lower than that of cows with BCS greater than 3.5 points. Cows with lower body condition score at calving cannot achieve their genetic milk yield potentials due to lack of body reserves that may support increasing milk yield at the beginning of lactation (Samarutel *et al.*, 2006). It can be asserted that BCS 3 and 4 of the dual-purpose cows had enough body reserves for lengthier lactation length.

CONCLUSION AND RECOMMENDATIONS

It was concluded that breed had great influence on LL and could be considered when selecting dairy cows for breeding. Adequate feeding by way of providing feed supplementation is necessary to increase LL, and therefore milk production. Maintaining a good body condition score will improve LL.

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