Characterization of Growth Performance of Namchi and Kapsiki Endangered Cattle Breeds of Cameroon

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Key words

Namchi cattle – Kapsiki cattle – Calf – Liveweight gain – Endangered breed – Cameroon.

Summary

The growth performance of 80 Kapsiki and 83 Namchi calves was monitored at quarterly intervals, between 1985 to 1990, from birth to one year of age. The calves were maintained at the Yagoua Station of the Institute of Agricultural Research for Development. The birth weight (BWT) and liveweight at three (TWT), six (SWT), nine (NWT) and twelve (YWT) months were evaluated using the SAS general linear model procedure. Means were 13.2 and 15.5 kg, 42.9 and 58 kg, 68.3 and 75.2 kg, 85.9 and 97.6 kg, and 104.7 and 115.5 kg for BWT, TWT, SWT, NWT, and YWT, in Namchi and Kapsiki calves, respectively. Cumulative daily weight gains were 0.32 and 0.48 kg, 0.25 and 0.39 kg, 0.21 and 0.35 kg, and 0.21 and 0.32 kg, between BWT and TWT, TWT and SWT, SWT and NWT, and NWT and YWT, for Namchi and Kapsiki, respectively. The growth performance of the Kapsiki breed was significantly ($P < 0.001$) higher than that of the Namchi breed for all traits. The seasonal effect was not significant ($P > 0.05$), except for six-month and yearling weights ($P < 0.05$) in both breeds. Sex did not affect the traits ($P > 0.05$). However, male calves were heavier and grew faster than female calves. The rainy season and cold dry season were favorable as calving periods for the production of heavier and faster growing Namchi calves, while the hot dry season favored heavier and faster growing calves in the Kapsiki breed.

■ INTRODUCTION

The Namchi (Namshi or Doayo) and Kapsiki (Kirdi) cattle are two taurine (Savanna Shorthorn) breeds of Cameroon whose origin is as complex as is the case for most African cattle populations. According to Rege *et al.* (14), Staw and Hoste (17), and Oliver (13), Cameroon Shorthorns might have been introduced from the center of domestication in Asia through Egypt along the Nile River or through the Horn of Africa or through East Africa (Ethiopia or Kenya). These Shorthorns then moved towards Morocco where the northern population spread into France and the southern population spread between the Sahara and the Atlantic coast to the Guinea coast and Nigeria hinterland, with Cameroon forming the extreme eastern and southern limits of their distribution. Hempo (unpublished document), however, indicated that the Namchi originated from Doayo, as there was no document to provide any information about the foreign origin of the breed.

The Namchi and Kapsiki have been identified with specific geographical locations (18) and cultural heritage of the people of Faro (Poli) and Tsanaga (Mokolo) divisions. They are found in the Sudano-Sahelian ecological zone between 750 and 1250 mm isohyet. They are milked, commercialized, used for draughting activities and for special feasts and rituals. They were suspected to be trypanotolerant (7), but Achukwi *et al.* (2) showed that only the

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Namchi breed was trypanotolerant. The Kapsiki, on the other hand, though shown to be trypanosusceptible (2), exhibits a fairly good growth performance in an environment that is stressful in terms of climate and nutrition (Abba, unpublished results).

The Namchi are predominantly found in the Sudanian side within the Poli mountains in the Faro division of the North province (8). The Kapsiki are found predominantly on the Sahelian side, in the Mandara mountains at an altitude of about 600 to 900 m, between Mokolo and Bourrah, in the Tsanaga division of the Far North province of Cameroon (3, 8, 15). Population estimates for the two breeds have continued to dwindle. The Namchi population was estimated to range between 1060 and 7000 head (4, 14, 18), representing between 0.02 to 0.14% of the 4.9 million head of African Shorthorns. The Kapsiki population was estimated to range between 3000 and 4098 head (8, 18), representing between 0.06 and 0.08% of the African Shorthorns. These estimates fall within levels of threat (1000 to 5000 breeding females) defined by various conservation groups (7) and they may therefore be considered endangered.

The low population estimates have been attributed to indiscriminate slaughter for traditional ceremonies, inappropriate husbandry techniques, neglect and continuous interbreeding with the predominant zebu breed (1), resulting in decrease in the trypanotolerance trait. In addition, increase in the human population has caused serious geographical, climatic, hydrological and vegetative changes, which are more favorable to trypanosusceptible zebu populations. This has substantially reduced the natural habitat of the shorthorn and has facilitated interbreeding between the two populations.

The Cameroon government, cognizant of the special attributes and risk of extinction of the breeds, placed them in the so-called Very High Priority (VHP) area of the National Biodiversity Strategy Plan (NBSP) for restoration and rehabilitation of threatened livestock species. These breeds might be "living museums" that may one day serve as genetic gold mines in periods of changing environmental circumstances and consumer attitudes. Consequently, the Institute of Agricultural Research for Development was mandated to formulate improvement strategies to ensure better growth and wider genetic variation of the two breeds, while maintaining their originality. At the present time, information available on the breeds is based mainly on coat color description and linear body measurements (3, 4, 9, 10, 12, 18, 19, 20). No attempts have been made to evaluate preweaning and postweaning growth traits or to quantify factors affecting them. The objective of the study was to quantify growth performance and to evaluate environmental factors affecting growth in calves from zero to twelve months of age.

■ MATERIALS AND METHODS

Breed description

The Kapsiki cattle are robust and possess horns, which are of medium length (20 to 40 cm), black in color, horizontal in the young and raised in the old. The head is usually refined, triangular in females and massive in males. The forehead is rectilinear, the nose black and eye sockets more prominent in females. The coat color is predominantly black pied but there are cases of solid black, red pied, solid white, fawn, brown pied, red, dark brown, wheat gray and molted black pied. The Namchi cattle are also robust but smaller than the Kapsiki. The horns are also short and black, refined and sharp, with a lot of variations in the length. The nose is black and the head short and massive, and the forehead is rectilinear. There are many variations in the coat color. It can be uniformly black or black and white or black with spotted white or brown or spotted brown. Description details have been given by Tayou and Ngwa (20), and Aboagye *et al.* (1).

Management of experimental animals

The parent stock consisted of 31 Kapsiki cattle (four bulls and 27 cows) and 17 Namchi cattle (two bulls and 15 cows) of ages one to nine years. They were purchased from local livestock farmers in Mayo Tsanaga (Sahel zone) and Faro (Sudan zone) divisions, respectively. They were maintained at the Yagoua Research Station of the Institute of Agricultural Research for Development, located in the stressful environment of the Far-North province of Cameroon. The year is divided into three seasons: a cold dry season (CDS) from October to January, with temperatures of 21.5 to 33.59°C and rainfall of 0 to 1.18 mm, a hot dry season (HDS) from February to May, with temperatures of 30.04 to 38.42°C and rainfall of 0 to 72.80 mm, and a rainy season (RS) from June to September, with temperatures of 21.1 to 27.5°C and rainfall of 85.90 to 214.30 mm (6, 11).

The breeds were maintained separately on natural pastures of the Savannah type, predominated by *Monechma ciliatum*, *Cassia mimosoides* and *Loudetia togoensis* vegetations. The two breeds were lodged in separate paddocks to avoid crossbreeding. Mating was natural with only one sire per herd during the breeding period. The animals were supplemented with cottonseed cake, rice bran and groundnut haulms during the hot dry season.

Data collection

Data were collected on breed, parentage, sex, year of birth and season of birth, birth weight (BWT) (weighed within 24h) and subsequent monthly weights. Adjusted weights at three (TWT), six (SWT), nine (NWT) and 12 months (YWT), and cumulative average daily weight gains (kg/d) were estimated from the data. Absolute growth rates were obtained by taking the difference in weight within the period and dividing it by the time interval. The absolute gain rate was calculated over four periods: birth to three months (ADG1), three to six months (ADG2), six to nine months (ADG3), and nine to 12 months (ADG4), respectively. The adjusted weights were estimated as follows:

Three months (TWT) = ADG1 x 90 + BWT

Six months (SWT) = ADG2 x 90 + TWT

Nine months (NWT) = ADG3 x 90 + SWT

Twelve months (YWT) = ADG4 x 90 + NWT

Statistical analyses

The SAS general linear model computer program (16) was used to quantify factors affecting BWT, adjusted weights and cumulative average daily weight gains. Due to the confounding effect between breed and herd, the latter was eliminated from the model. The mathematical linear model was then presented as:

$$Y_{abcde} = \mu + B_a + S_b + P_c + G_d + (BS)_{ab} + (BG)_{ad} + b(x_{abcde} - \bar{X}) + e_{abcde}$$

where Y_{abcde} is the growth trait (BWT, TWT, SWT, NWT, YWT, ADG1, ADG2, ADG3, ADG4) of the e^{th} calf;

μ is the overall mean, B_a the effect of the a^{th} breed (a = 1, 2), S_b the effect of the b^{th} season of calving (b = 1, 2, 3);

P_c is the effect of the c^{th} year of calving (c = 85, 82...90);

G_d is the effect of the d^{th} progeny sex (d = 1, 2);

$(BS)_{ab}$ and $(BG)_{ad}$ are the first order interactions for breed by season of calving and breed by sex of calf;

b is the linear regression of the calf birth weight as covariate on three, six, nine and 12 month weights; calf weight at three months as covariate on six, nine and 12 month weights; calf weight at six months as covariate on nine and 12 month weights; and calf weight at nine months as covariate on 12 month weights, respectively; x_{abcde} is the exact calf weight at birth, three, six and nine months; $\bar{X}$ is the mean weight at birth, three, six and nine months; and e_{abcde} is the random error associated to the growth trait of the e^{th} calf.

■ RESULTS AND DISCUSSION

The various sources of variation of liveweight measurements and cumulative daily weight gain are presented in Tables I and II. Growth curves are presented in Figure 1. Breed significantly ($P < 0.05$ or $P < 0.001$) affected the liveweight and cumulative daily weight gain from birth to yearling. Kapsiki calves outperformed their contemporaries of the Namchi breed in all liveweight measurements and grew faster from birth to yearling (Tables I and II). The results corroborate reports by Abba (pers. commun.) indicating a better growth performance in the Kapsiki than in the Namchi. The better performance in the Kapsiki may be explained by the fact that the Kapsiki are reared in their natural Sahelian environment. The Namchi, on the other hand, were moved from their natural Sudanian environment to Yagoua (Sahel). Their performance, therefore, could be affected by the effect of genotype environment interactions. In addition, the higher performance in Kapsiki could be attributed to their level of crossbreeding that approaches that of the *Bos indicus* Gudali breed (2).

Daily weight gain was maximum between birth and three months of age (Table II). This may be due to an early increase in the maternal effect favoring increase growth rate as was reported by Ebangi *et al.* (5) for Gudali calves. Lurz (pers. commun.) also reported that younger calves tended to be associated with maternally derived antibodies, which decreased as the calves reached weaning age. This may also be a favorable factor for early increase weight gain. This trend might indicate that supplementation of the calf after three months of age could result in higher weight gain.

Table I

Least squares means of growth traits (kg) for Namchi and Kapsiki cattle breeds

Effect	N	BWT (SE)	TWT (SE)	SWT (SE)	NWT (SE)	YWT (SE)
μ	163	14.25 (0.40)	50.20 (1.00)	72.94 (1.50)	91.07 (3.80)	109.66 (1.90)
Breed		***	***	***	***	***
Namchi	80	13.23 (0.30)	42.87 (1.07)	68.34 (1.22)	85.86 (1.76)	104.73 (1.36)
Kapsiki	83	15.46 (0.36)	57.99 (1.27)	75.19 (1.42)	97.56 (2.23)	115.46 (1.49)
CS		NS	NS	NS	NS	**
CDS	70	13.91 (0.34)	49.78 (1.18)	72.12 (1.19)	93.48 (1.85)	109.75 (1.36)
HDS	49	14.68 (0.37)	50.77 (2.27)	73.90 (1.27)	93.02 (1.98)	107.50 (1.35)
RS	44	14.45 (0.42)	50.74 (1.43)	69.28 (1.44)	88.55 (2.28)	112.97 (1.51)
Sex		NS	NS	*	NS	NS
Male	68	14.22 (0.33)	51.29 (1.26)	73.66 (1.13)	91.57.(1.99)	108.80 (1.19)
Female	95	14.48 (0.28)	49.57 (0.97)	69.87 (0.97)	91.80 (2.23)	111.40 (1.02)
Calving year		**	***	**	***	NS
Breed*calving season		NS	NS	*	NS	*
CDS*Namchi	24	12.94 (0.53)	42.39 (1.85)	68.34 (1.96)	89.58 (3.10)	106.53 (2.08)
HDS*Namchi	29	12.84 (0.52)	41.50 (1.84)	67.88 (1.97)	86.50 (3.13)	102.08 (2.12)
RS*Namchi	27	13.90 (0.49)	44.72 (1.70)	68.66 (1.75)	82.64 (2.77)	105.59 (1.93)
CDS*Kapsiki	46	14.88 (0.41)	57.17 (1.42)	76.00 (1.52)	97.36 (3.39)	112.96 (1.66)
HDS*Kapsiki	20	16.51 (0.58)	60.04 (2.08)	79.80 (2.23)	99.53 (3.57)	113.05 (1.93)
RS*Kapsiki	17	15.00 (0.68)	56.76 (2.35)	69.93 (2.39)	94.46 (3.73)	120.35 (2.53)
Sex*breed		NS	NS	NS	**	NS
Namchi male	35	13.27 (0.44)	59.11 (1.52)	77.45 (1.62)	94.56 (2.93)	113.09 (2.01)
Namchi female	33	12.16 (0.50)	43.48 (1.77)	69.87 (2.51)	88.57 (2.51)	104.50 (1.71)
Kapsiki male	45	13.19 (0.42)	56.87 (1.49)	66.72 (1.88)	99.68 (2.44)	117.83 (1.73)
Kapsiki female	50	15.76 (0.40)	42.27 (1.39)	73.03 (1.59)	83.91 (2.48)	104.97 (1.74)
BWT			***	NS	***	NS
TWT				***	***	NS
SWT					***	**
NWT						***

N: sample size; BWT, TWT, SWT, NWT and YWT: weight at birth, three, six, nine and 12 months, respectively

CS: calving season; CDS: cold dry season; HDS: hot dry season; RS: rainy season

NS: $p > 0.05$; * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Table II

Least squares means for cumulative daily weight gain (kg/day) in Namchi and Kapsiki cattle breeds

Effect	N	ADG1 (SE)	ADG2 (SE)	ADG3 (SE)	ADG4 (SE)
μ	163	0.40 (0.01)	0.33 (0.01)	0.28 (0.01)	0.27 (0.01)
Breed		***	***	***	***
Namchi	80	0.32 (0.01)	0.25 (0.01)	0.21 (0.01)	0.21 (0.01)
Kapsiki	83	0.48 (0.01)	0.39 (0.01)	0.35 (0.01)	0.32 (0.01)
CS	NS	NS	*	NS	
CDS	70	0.39 (0.01)	0.32 (0.01)	0.29 (0.01)	0.26 (0.01)
HDS	49	0.40 (0.01)	0.33 (0.01)	0.30 (0.01}	0.26 (0.01)
RS	44	0.41 (0.02)	0.32 (0.01)	0.25 (0.01)	0.26 (0.01)
Sex		NS	**	NS	NS
Male	68	0.41 (0.01)	0.34 (0.01)	0.29 (0.01)	0.27 (0.01)
Female	95	0.39 (0.01)	0.31 (0.01)	0.27 (0.01)	0.26 (0.01)
Calving year		***	***	***	***
Breed*calving season	NS	***	**	**	
CDS*Namchi	24	0.31 (0.02)	0.25 (0.02)	0.23 (0.01)	0.21 (0.01)
HDS*Namchi	29	0.30 (0.02)	0.24 (0.02)	0.21 (0.01)	0.20 (0.01)
RS*Namchi	27	0.34 (0.02)	0.27 (0.01)	0.21 (0.01)	0.22 (0.01)
CDS*Kapsiki	46	0.48 (0.02)	0.39 (0.01)	0.35 (0.01)	0.31 (0.01)
HDS*Kapsiki	20	0.51 (0.02)	0.44 (0.02)	0.39 (0.02)	0.34 (0.01)
RS*Kapsiki	17	0.47 (0.03)	0.35 (0.02)	0.31 (0.02)	0.31 (0.01)
Sex*breed		NS	NS	NS	NS
Namchi male	35	0.50 (0.01)	0.14 (0.01)	0.35 (0.01)	0.32 (0.01)
Namchi female	33	0.32 (0.01)	0.26 (0.01)	0.23 (0.01)	0.22 (0.01)
Kapsiki male	45	0.47 (0.01)	0.37 (0.01)	0.35 (0.01)	0.32 (0.01)
Kapsiki female	50	0.31 (0.01)	0.24 (0.01)	0.20 (0.01)	0.20 (0.01)

N: sample size; ADG1, ADG2, ADG3 and ADG4: average daily weight gains at three, six, nine and 12 months, respectively
CS: calving season; HDS: hot dry season; CDS: cold dry season; RS: rainy season
NS: not significant; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

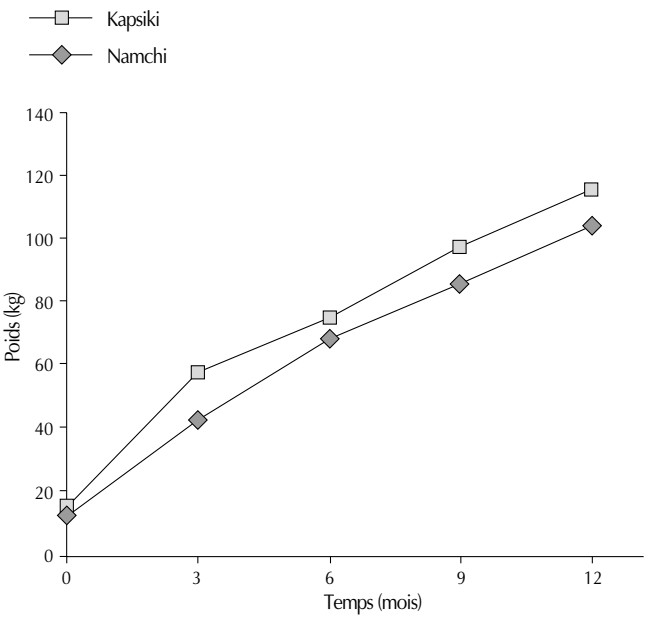

Figure 1: *Evolution of liveweights in Namchi and Kapsiki calves.*

With the exception of the adjusted yearling weight, the calving year significantly ($P < 0.05$ or $P < 0.001$) affected all other traits. The significant effect of the year of calving on weight traits could be attributed to the very short and inconsistent annual rainfall, which generally affects the quality and quantity of feed (forage) available for animal growth.

Apart from adjusted liveweights at six and nine months that were affected by sex ($P < 0.05$), and by sex by breed ($P < 0.01$), respectively, the other liveweight traits were insensitive ($P > 0.05$). Male calves of both breeds, generally outperformed their female contemporaries in liveweights from three months to yearling age and in cumulative daily gain from birth to yearling age (Tables I and II).

With the exception of the adjusted yearling weight ($P < 0.01$), the other liveweight traits were insensitive ($P > 0.05$) to the calving season. However, the calving season by breed first interaction significantly ($P < 0.05$) affected the adjusted liveweights at six and 12 months. The cumulative daily weight gains from three to six months (ADG2), six to nine months (ADG3), and nine to 12 months (ADG4) were significantly ($P < 0.001$; Table II) affected by the season of calving by breed interaction. The Namchi calves generally grew faster and gained more weight when

dropped in the rainy season (October to January breeding), when feed (forage) was nutritious, readily available and contributed directly or indirectly to preweaning growth (birth to six months). Namchi calves also grew faster and gained more weight during their postweaning growth (nine to 12 months) during the cold dry season (February to April breeding) than Kapsiki calves that were heavier and grew faster from birth to yearling when dropped in the hot dry season. The inherent advantage acquired by breeding females in the previous rainy season (June to September breeding), when forage was abundant and nutritious, contributed directly or indirectly to this performance.

The calf birth weight, as a covariate, was quite sensitive ($P < 0.001$) on liveweights at three and nine months, but not subsequently. This might indicate that calves with heavier birth weights tended to maintain this superiority throughout the preweaning period. The calf weight at three months was a highly sensitive ($P < 0.001$) covariate for liveweights at six and nine months. The effect of the liveweight at six months as a covariate was significant for the liveweight at nine months ($P < 0.05$) and twelve months ($P < 0.01$). The nine-month weight as a covariate was quite sensitive ($P < 0.001$) for the twelve-month weight (Table I). Consequently, preweaning weights as covariate significantly affected the weaning weight (nine months). This might be attributed to an early increase in the maternal effect and derived maternal antibodies on calf growth as reported above. Contiguous liveweights traits also tended to affect each other more as covariates than did non-contiguous traits.

■ CONCLUSION

Kapsiki calves outperformed Namchi calves in the harsh stressful Sahel environment, characterized by an inconsistent pattern of rainfall and a very long and severe dry season. However, both breeds indicated encouraging weight gains between zero and twelve months of age. Both breeds were also well adapted to seasonal changes as indicated by the non-significant effect of the season on the liveweight. The rainy season was more favorable for the production of heavy and fast growing Namchi calves. The hot dry season was favorable for the production of heavy and fast growing Kapsiki calves. In progressive management systems within the Sahelian region, it might be necessary to breed Namchi and Kapsiki females for rainy and dry season calvings, respectively. Although the sex effect was inconsequential, male calves tended to be heavier and grew faster than female calves from three to yearling.

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Résumé

Ebangi A.L., Mbah D.A., Abba D. Caractérisation de la performance de croissance des Namchi et des Kapsiki, races bovines camerounaises menacées de disparition

De 1985 à 1990, les performances de croissance de 80 veaux Kapsiki et de 83 veaux Namchi ont été suivies tous les trois mois de la naissance à un an à la station de Recherche agricole pour le développement de Yagoua. Les performances de croissance ont été analysées par la procédure du modèle linéaire général de SAS pour les poids à la naissance (PN) et aux âges de trois mois (PTM), six mois (PSM), neuf mois (PNM) et 12 mois (PDM). Les moyennes ont été de 13,2 et 15,5 kg, 42,9 et 58 kg, 68,3 et 75,2 kg, 85,9 et 97,6 kg, et 104,7 et 115,5 kg respectivement pour les PN, PTM, PSM, PNM et PDM chez les veaux Namchi et Kapsiki. Les gains de poids quotidiens cumulés ont été de 0,32 et 0,48 kg, 0,25 et 0,39 kg, 0,21 et 0,35 kg, et 0,21 et 0,32 kg respectivement entre les PN et PTM, PTM et PSM, PSM et PNM, et PNM et PDM, chez les veaux Namchi et Kapsiki. La performance de croissance a été significativement supérieure ($P < 0,001$) chez les veaux Kapsiki par rapport aux veaux Namchi pour tous les caractères considérés. La saison n'a pas eu d'effet significatif ($P > 0,05$) sur la croissance, excepté sur les PSM et PDM ($P < 0,05$) chez les deux races. Le sexe n'a pas influé ($P > 0,05$) sur les traits étudiés. Cependant, les veaux mâles des deux races ont eu un poids plus élevé et leur croissance a été plus rapide que ceux des femelles. La saison pluvieuse et la saison sèche froide ont été des périodes favorables pour la production de veaux Namchi plus performants et à croissance plus rapide tandis que la saison sèche chaude a eu les mêmes effets chez les veaux Kapsiki.

Mots-clés : Bovin Namchi – Bovin Kapsiki – Veau – Gain en poids vif – Race en danger – Cameroun.

Resumen

Ebangi A.L., Mbah D.A., Abba D. Caracterización del rendimiento en el crecimiento de razas de ganado Namchi y Kapsiki en peligro de extinción en Camerún

Se siguió, a intervalos trimestrales, el rendimiento en el crecimiento de 80 terneros Kapsiki y 83 Namchi, entre 1985 y 1990, desde el nacimiento hasta un año de edad. Los terneros fueron mantenidos en la estación de Yagoua en el Instituto de Desarrollo de la Investigación Agrícola. Se evaluaron el peso al nacimiento (BWT) y peso vivo a los tres (TWT), seis (SWT), nueve (NWT) y doce (YWT) meses, mediante el procedimiento del modelo linear general SAS. Los promedios fueron de 13,2 y 15,5 kg, 42,9 y 58 kg, 68,3 y 75,2 kg, 85,9 y 97,6 kg, y 104,7 y 115,5 kg para BWT, TWT, SWT, NWT, y YWT, en terneros Namchi y Kapsiki, respectivamente. Las ganancias de peso diarias acumulativas fueron de 0,32 y 0,48 kg, 0,25 y 0,39 kg, 0,21 y 0,35 kg, y 0,21 y 0,32 kg, entre BWT y TWT, TWT y SWT, SWT y NWT, y NWT y YWT, para Namchi y Kapsiki, respectivamente. El rendimiento del crecimiento de la raza Kapsiki fue significativamente ($P < 0,001$) más elevado que el de la raza Namchi para todos los caracteres. El efecto de la estación no fue significativo ($P > 0,05$), excepto para los pesos a los seis y doce meses ($P > 0,05$) en ambas razas. El sexo no afectó los caracteres ($P > 0,05$). Sin embargo, los terneros machos fueron más pesados y crecieron más rápidamente que las hembras. La estación lluviosa y la estación fría seca fueron favorables como periodos de parto para la producción de terneros Namchi más pesados y con un crecimiento más rápido, mientras que la estación seca y caliente favoreció en la raza Kapsiki la producción de terneros más pesados y de crecimiento más rápido.

Palabras clave: Ganado bovino Namchi – Ganado bovino Kapsiki – Ternero – Ganancia de peso vivo – Raza en peligro de extinción – Camerún.