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Research Application Summary

Effect of coat colour on feed efficiency and growth performance of boran cattle in Kenya

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Abstract

Coat colour of an animal has become an important trait of consideration due to its influence on adaptability of an animal to climate change. Certain coat colours in beef cattle have been perceived to confer an advantage to the animals in terms of adaptability to hot environmental conditions. The objective of this study was to evaluate the effect of coat colour on growth and feed efficiency traits with fixed effects in Boran cattle. Five traits were considered; birth weight (BW), weight adjusted to 205 days (WA205), Kleiber Index at 205 days (KI205) and pre-weaning average daily gain (ADG). Fixed effects fitted were sex, parity (6 classes), year season of birth or weaning, coat colour of animal (6 classes). Coat colours considered were red, grey and brown. The least square means for BW, WWT, WA205, KI205 and ADG for the improved Boran cattle in Kenya were 27.50±4.45 kg, 138.38±25.81 kg, 135.17±29.81 kg, 1.01±0.12 kg/kg0.75 and 0.43±0.12 kg/day, respectively. The coefficients of variation ranged between 11 % to 28%. Coat colour was significant for BW and WA205 ($P<0.05$), KI205 and ADG ($P<0.01$) while sex was significant ($P<0.05$) for all traits except KI205. Parity was significant for all traits except BW and WWT. Year and season of birth or weaning was significant for all traits ($P<0.001$). It is concluded that coat colour affects feed efficiency and growth traits and should therefore be considered in Boran cattle improvement due to its influence on Boran cattle production.

Key words: Adjusted weaning weight, average daily gain, climate change, Kleiber index

Résumé

La couleur du pelage d'un animal est devenue un trait important à prendre en compte en raison de son influence sur l'adaptabilité d'un animal au changement climatique. Certaines couleurs de pelage chez les bovins de boucherie ont été perçues comme conférant un avantage aux animaux en termes d'adaptabilité aux conditions environnementales chaudes. L'objectif de cette étude était d'évaluer l'effet de la couleur du pelage sur les caractères de croissance et d'efficacité alimentaire avec des effets fixes chez les bovins Boran. Cinq traits ont été considérés; poids à la naissance (PN), poids ajusté à 205 jours (PA205), indice de Kleiber à 205 jours (IK205) et gain moyen quotidien (GMQ) avant sevrage. Les effets fixes ajustés étaient le sexe, la parité (6 classes), l'année, la saison de naissance ou de sevrage, la couleur du pelage de l'animal (6 classes). Les couleurs de pelage considérées étaient le rouge, le gris et le brun. Les moyennes des moindres carrés pour PN, WWT, PA 205, IK205 et GMQ pour les bovins Boran améliorés au Kenya étaient de 27,50±4,45 kg, 138,38±25,81 kg, 135,17±29,81 kg, 1,01±0,12 kg/kg0,75 et 0,43±0,12 kg. /jour,

respectivement. Les coefficients de variation variaient entre 11 % et 28 %. La couleur du pelage était significative pour PN et PA 205 (P<0,05), IK205 et ADG (P<0,01) tandis que le sexe était significatif (P<0,05) pour tous les caractères sauf IK 205. La parité était significative pour tous les traits sauf PN et WWT. L'année et la saison de naissance ou de sevrage étaient significatives pour tous les caractères (P<0,001). Il est conclu que la couleur du pelage affecte l'efficacité alimentaire et les caractères de croissance et devrait donc être prise en compte dans l'amélioration des bovins Boran en raison de son influence sur la production de bovins Boran.

Mots-clés : Poids au sevrage ajusté, gain journalier moyen, changement climatique, indice de Kleiber

Introduction

Feed efficiency and growth traits in beef cattle production are important parameters of consideration since they affect the profitability in such an enterprise. These traits include birth weight, adjusted weaning weight, Kleiber Index and average daily gain (Utsunomiya *et al*., 2013; Branco *et al*., 2014). Due to importance of feed efficiency characteristic and the cost of measuring feed efficient animals, the Kleiber Index method that does not require measurement of individual feed intake to determine most efficient animals has been recommended by Kleiber (1936) and genetic parameters estimated by Manuel *et al*. (2019). Both growth and feed efficiency traits are affected by some factors which include year and season of birth, sex, parity of the cow and maternal effects among others and determine the level of performance of beef cattle (Ebangi *et al*., 2002).

Recently, animal characteristics such as coat colour and type have become traits of interest on how they could affect the productive and reproductive traits in beef cattle (Okeyo *et al*., 2005; Lukefahr, 2017; Kirui *et al*., 2020). This could be due to influence of coat colour and type on suitability and adaptability of cattle breeds in different environmental conditions especially in hot areas where animals are prone to heat stress due to climate change (Lees *et al*., 2019). According to Lee *et al*. (2016), traits such as longevity can also be influenced by coat colour in the tropics.

Some studies have been done which show that the colour of the coat of an animal may or may not influence production and reproduction traits in beef cattle. In a study done by Peters *et al*. (1982), coat colour in beef cattle was shown not to have a significant effect on traits such as weaning weight of the calves and individual cows' weight. However, in Okeyo *et al*. (2005) work on beef cattle in Kenya, coat colour was found to have an effect on age at first calving and stillbirth rates although to very small extents. Also, Lukefahr (2017), indicated that coat colour could have an influence on weaning weight of calves although at minimal levels.

Since global temperatures are expected to keep on rising due to global warming and the expected negative impact on livestock especially beef cattle (Nardone *et al*., 2010; Koirala and Bhandari, 2019), hence an increase on emphasis on beef cattle traits that could be favourable for survival and production under the changing climatic conditions, there is a need for more studies to determine whether coat colour could determine growth and feed efficiency traits performance in beef cattle. This is important especially on traits that are economically important in beef production. Moreover, a trait such as Kleiber Index has not yet been considered on how it could be influenced by different coat colours of Boran cattle in Kenya. This study therefore evaluated the effect of coat colour on

feed efficiency and productive performance traits of Boran cattle in Kenya.

Methodology

Data source and traits. Data was collected on 1506 animals which were born between the year 1992 and 2020, in Beef Research Institute, Lanet, Kenya. The farm keeps pure and crossbred Boran cattle which are reared under ranch production system with registered (in the Kenya Study Book) and unregistered animals. Continuous breeding is practiced where calves are born and weaned throughout the year. Animals were weighed from birth and weaned at seven months. Coat colour was classified as Red, Grey and White. The traits that were considered were birth weight (BW), adjusted weaning weight (WWT), weight adjusted to 205 days (WA205), Kleiber Index at 205 days (KI205) and average daily gain (ADG). Different parameters were calculated as follows (Kleiber, 1936; Manuel *et al*., 2020);

$$\text{Kleiber Index} = \frac{ADG}{Live\ metabolic\ \ weig\,ht}$$

where ADG = Average Daily Gain

Coat colour was classified into four different scores; red, white, grey and, brown. Analysis of variance was conducted in SAS software using GLM procedure to determine whether the different coat colours had an effect on the parameters in consideration.

Results and Discussion

The least square means for Birth Weight (BW), weaning weight (WWT), weaning weight adjusted to 205 days (WA205), Kleiber Index (KI205) and pre-weaning average daily gain (ADG) are presented in Table 1. Average BW, WWT, WA205, KI205 and ADG for the improved Boran cattle in Kenya were 27.50±4.45 kg, 138.38±25.81 kg, 135.17±29.81 kg, 1.01±0.12 kg/kg0.75 and 0.43±0.12 kg/day. The coefficients of variation ranged from 11 % to about 28% and was highest for ADG and lowest for KI205. Effect of fixed factors on birth weight (BW), weaning weight (WWT), weaning weight adjusted to 205 days (WA205), Kleiber Index (KI205) and pre-weaning daily gain (ADG) are presented in Table 2.

Table 1. Least square means, number of animals (N), coefficient of variation (CV) for Birth Weight (BW), weaning weight (WWT), weaning weight adjusted to 205 days (WA205), Kleiber Index (KI205) and Average Daily Gain (ADG) in improved Kenyan Boran cattle

Trait	N	Mean±SD	CV (%)
BW, kg	1506	27.50±4.45	16.18
WWT, kg	1506	138.38±25.81	18.65
WA205, kg	1506	135.17±29.81	22.06
KI205, kg/kg0.75	1506	1.01±0.12	11.76
ADG, kg/day	1506	0.43±0.12	27.72

SD=standard deviation

Coat colour was significant for BW and WA205 (P<0.05), KI205 and ADG (P<0.01) (Table 2). Sex was significant (P<0.05) for all traits except KI205, while parity was significant for all traits except BW and WWT. Year of season of birth or weaning was significant for all traits (P<0.001).

Table 2. Effect of fixed factors on birth weight (BW), weaning weight (WWT), weaning weight adjusted to 205 days (WA205), Kleiber Index (KI205) and pre-weaning daily gain (ADG) in improved Kenyan Boran cattle

Trait	R2	Sex	Parity	Coat colour	Year-season of birth	Year-season of weaning
BW, kg	0.49	***	ns	*	***	
WWT, kg	0.32	***	ns	ns	***	***
WA205, kg	0.65	**	*	*	***	***
KI205	0.89	ns	**	**	***	***
ADG, kg	0.64	*	*	**	***	***

Effects with asterisk (*) are significantly different as follows *=P<0.05 **=P<0.01; ***=P<0.001

From the results, the colour of the coat of an animal has an influence on the feed efficiency and growth traits in beef cattle. The effect on WA205, average daily gain and Kleiber Index could be due to the influence of coat colour on grazing behavior of the animals since lighter coloured animals spend more time grazing rather than seeking shade (Finch *et al*., 1984). Lighter colours which are found in Boran cattle gives them an advantage under the hot tropical conditions (Bayssa *et al.,* 2020) as compared to darker animals (Decampos *et al.,* 2013). This is because the light grey, fawn, brown and white colours accompanied by high skin pore density enables in Boran cattle to regulate high environmental temperatures (Bayssa *et al*., 2020). This is similar to results that were obtained in (Finch *et al.,* 1984) whereby colour was found to have a significant effect on growth in Brahman, Shorthorn and their crosses such that white steers had a higher growth rate as compared to dark red ones. The reason for this was given as more time being spent in the sun and not under a shade.

The results are however contrary to what was found by Okeyo *et al.* (2005), whereby coat colour was found to have no effect on 270 days adjusted calf weight, calving interval, and calving rate among other traits in Boran cattle. According to Lukefahr, (2017), the expression of coat colour genes depends also on the type of coat type of an animal whereby slick animals which are light coloured tend to be less affected in performance in productive traits such as weaning weight as compared to animals with hairy coats. In a study done in West African dwarf sheep (Decampos *et al*., 2013), coat colour genes were found to have a significant effect on rump and tail length parameters. In this study animals with brown skin were found to have more ability to adapt and survive in tropical conditions which was associated with the ability of the brown sheep to adapt more to heat stress as compared to black coated sheep. The effect on birth weight can be associated with the calves' inheritance of high weights from the dams which could be due to the positive influence of coat colour of the Boran dams especially white and red colours considered in the current study. This is because calves which are heavier tend to be born from heavier dams (Paputungan and Makarechian, 2000).

Conclusions

It is concluded that coat colour influences growth and feed efficiency traits in Boran cattle. Coat colour should therefore be considered in genetic evaluation and improvement of Boran cattle breeding programmes alongside other fixed effects due to its effect on adaptability of cattle to changing climatic conditions. It would therefore be important for research institutions that breed Boran cattle to consider breeding for colours that favour the animals that have a higher tolerance to high temperatures which are found in Arid and Semi-Arid Areas.

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