APRW -23

Pre-Weaning Growth Rate and Thermoregulatory Parameters of Friesian X Bunaji Calves as Influenced by Different Ratios of Soy:Cow Milk

I.U. Gadzama[1], S.M. Yashim[2], S.B. Abdu[2], S. Abubakar[1] and S.O. Ereke[1]
[1]National Animal Production Research Institute, Shika-Zaria, Nigeria; [2]Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria
Corresponding author: I.U. Gadzama; E-mail: iugadzama@napri.gov.ng; Mobile no: +2349055569839

Abstract
The study was carried out to evaluate the effect of feeding different ratios of soybean (*Glycine max* (L.) Merril) milk and Friesian x Bunaji cow milk on pre-weaning growth rate, weaning weight and thermoregulatory parameters of Friesian x Bunaji calves. Sixteen (16) calves with average body weight of 34.8±0.7 kg were randomly assigned to four dietary treatments with 4 calves per treatment in a Completely Randomized Design. Results showed that calves had significantly ($p<0.05$) different weights at birth. There was also significant ($p<0.05$) difference in pre-weaning growth rate (PWGR), pre-weaning average daily weight gain (PWADWG) and weaning weights (WW) of calves across the treatments. Calves fed diet containing 25:75 ratio of soy:cow milk had higher PWGR (108.75 g), PWADWG (109.41 g) and WW (109.75 kg) followed by those on treatment containing 50:50 ratio of soy:cow milk (105.00 g, 105.73 g and 106.00 kg), respectively. There was no significant ($p>0.05$) difference in rectal temperature (RT) of calves across the treatments, but heart rate (HR) and respiratory rate (RR) differed significantly ($p<0.05$) as the level of soymilk increased in the diet. The highest and lowest HR (97.43 bpm) and (90.00 bpm) were observed in calves fed diets containing 75:25 and 25:75 ratios of soy:cow milk, respectively. While the highest (43.43 brpm) and lowest (40.86 brpm) respiratory rates were recorded in calves fed diets containing 75:25 and 50:50 ratios of soy:cow milk, respectively. All the thermoregulatory parameters measured were within the normal range for healthy calves. Therefore, feeding calves with 25:75 ratio of soy:cow milk is recommended for better weaning weight than feeding cow milk alone.

Key words: Bunaji, Friesian, soymilk, cow milk, calves

Introduction

The low productivity of ruminants in developing countries is characterized by high calf mortality, poor growth rate, delay in onset of puberty, and long interval between successive parturition all of which are largely attributable to poor feed resources, feeding and management (Masum *et al*., 2009). Post-natal feeding of calves is very important for better health and growth especially in commercial as well as smallholder dairy farms (Khan *et al*., 2012). The indigenous breeds of dairy cattle in Nigeria have poor genetic capacity for milk production. They naturally produce low milk. Shortage of milk especially during the early stage of life results in starvation with a consequence of stunted growth and mortality in calves which also affects their productive and reproductive performance. Feeding milk replacer to calves is an alternative approach being used in many commercial dairy farms mainly in developed countries to combat this serious problem (Mete *et al*., 2000). There are many types or forms of low cost, high quality plant protein viz, soyflour, soymilk, soy protein concentrate and wheat protein which could be used in the formulation of milk replacers. However, Roy *et al*. (2016) reported that soy protein is widely used in milk replacer formulations because of its good amino acid profile. Soymilk not only provides protein but is also a source of carbohydrate, lipid, vitamins and minerals.

The present study therefore was designed to evaluate the potentials of soymilk as a replacement to cow milk in feeding Friesian x Bunaji Calves.

Materials and Methods

The study was conducted at the National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika-Zaria, Nigeria. Shika is located within the northern Guinea Savanna ecological zone of Nigeria between latitude 10°11'N and llongitude 7°8'E, at an altitude of 650m above sea level (Ovimaps, 2016). The soybean variety used for this study was Samsoy II and was purchased from an open market in Giwa Local Government Area of Kaduna State. The other feed materials *Digitaria smutsii* hay, concentrate diets and cow milk (Friesian x Bunaji milk) were obtained from Dairy Research Programme of NAPRI, Shika-Zaria, Nigeria. The collected soybean was cleaned by winnowing and hand picking stones and debris. The cleaned soybean were soaked in excess water in plastic containers for 72 hours. The water was changed after every 24 hours. After which the soybean was rinsed with clean tap water and sun-dried for 8 days on a stainless tray. The dried soybean was milled into flour and sieved with the use of 0.04 mm sieve. The resultant soyflour was stored in polythene bags and were used to formulate the experimental diets.

Ten (10) litres of Friesian x Bunaji milk from the Dairy Research programme of NAPRI was collected at 08:00 am and used for the morning feeding, while another 10 litres was collected at 04:00 pm and used for the evening feeding, respectively. The experimental diets were prepared immediately after fresh milk collection. Soymilk was prepared in batches according to standard procedure. To formulate one litre of soymilk, 125 g of the 72 hr soaked soyflour was dissolved in 1000 ml of clean tap water (Sarker *et al*., 2015). Thereafter, 6 litres of soymilk was prepared by dissolving 750 g of the 72 hrs soaked soyflour in 6000 ml of clean tap water. The mixture was homogenized by constant stirring to prevent coagulation. The soymilk was added to fresh cow milk in a stainless container at the ratio of 0:1000 mls (which served as the control); 250:750 mls; 500:500 mls and 750:250 mls soymilk:cowmilk respectively before feeding to the calves. The different ratios of the soy:cow milk used are as follows:

Sixteen (16) Friesian x Bunaji calves of mixed sexes (8 males and 8 females) aged between 2 – 3 weeks, with live weight of 34.8±0.7 kg from the Dairy Research Programme of the National Animal Production Research Institute (NAPRI), Ahmadu Bello University (ABU), Shika-Zaria were used for this study. The calves were identified with ear tags, weighed and randomly distributed into four (4) dietary treatments consisting of 4 calves per treatment in a Completely Randomized Design (CRD). The calves were housed in an open-sided, well-ventilated building (calf-pen) with a concrete floor equipped with both feeding and watering troughs. In the morning, each of the experimental animal received one litre of the different ratios of soy:cow milk between 08:00 – 09:00 am, and another one litre was administered in the evening between 04:00 – 05:00 pm. Fresh and clean drinking water was also provided daily *ad libitum*.

Data generated from this study were analyzed using the General Linear Model (GLM) procedure of Statistical Analysis System (SAS, 2002) to see the response of the experimental animals to measured parameters. Significant differences among treatment means were compared using Dunnette's Test in the SAS package.

Table 1: Ingredient composition of concentrate diet fed to Friesian x Bunaji calves

Ingredients	Percentage (%)
Maize	22.00
Maize Offal	22.75
Cotton Seed Cake	52.00
Bone Meal	2.00
Common Salt (NaCl)	1.00
Vitamin-Mineral Premix	0.25
Total	100.00

Results and Discussion

Table 2 shows the results of the average birth weight, pre-weaning growth rate, pre-weaning average daily weight gain and weaning weight of Friesian x Bunaji calves as influenced by different ratios of soy:cow milk. Results showed that calves had significantly ($p<0.05$) different weights at birth. There was also significant ($p<0.05$) difference in pre-weaning growth rate (PWGR), pre-weaning average daily weight gain (PWADWG) and weaning weights (WW) of calves across the treatments. Calves fed diet containing 25:75 ratio of soy:cow milk had higher PWGR (108.75 g), PWADWG (109.41 g) and WW (109.75 kg) followed by those on treatment containing 50:50 ratio of soy:cow milk (105.00 g, 105.73 g and 106.00 kg), respectively. Pre-weaning growth rate of calves in this study was higher than that reported by Otterby *et al.* (1981) when using two kinds of milk replacers, skim milk protein milk replacer and soya protein milk replacer for young calves. The higher PWGR obtained in this study could be attributed to better feed utilization. The higher weaning weight of calves on 25:75 ratio of soy:cow milk implies better feed utilization and transformation into body tissue compared to calves on the other treatments.

Table 2: Pre-weaning growth rate and pre-weaning average daily weight gain of Friesian x Bunaji calves fed different ratios of soy:cow milk.

	Ratios of Soy to Cow Milk (%)				
Parameters	0:100	25:75	50:50	75:25	SEM
BW (kg)	27.75^{ab}	31.00^{a}	24.75^{b}	30.00^{a}	1.25
PWGR[1]	99.50^{ab}	108.75^{a}	105.00^{a}	92.17^{ab}	3.83
PWADWG[1]	100.19^{ab}	109.41^{a}	105.73^{a}	93.17^{ab}	3.83
WW (kg)	100.50^{ab}	109.75^{a}	106.00^{a}	93.50^{ab}	3.83

[ab] means with different superscripts within the same row differed significantly (P <0.05); BW = Birth Weight; WW = Weaning Weight; PWGR = Pre-weaning Growth Rate; PWADWG = Pre-weaning Average Daily Weight Gain; [1] = grams (from birth till weaning); SEM = Standard Error of Mean.

The result of the effect of feeding different ratios of soy:cow milk on thermoregulatory parameters of Friesian x Bunaji calves is presented in Table 3. There was no significant difference (p>0.05) in the rectal temperature (RT) across the treatments. However, heart rate (HR) and respiratory rate (RR) differed significantly (P<0.05) as the levels of soymilk increased in the diet. Heart rate (HR) ranged from 90.00 to 97.43 beats per minute, while respiratory rate (RR) ranged from 40.86 to 43.43 breaths per minute. Animals on 75:25 ratio of soy:cow milk had the highest values of heart rate (97.43 bpm) and respiratory rate (43.43 brpm), respectively. Thermoregulatory are strong verifiable indicators used to identify the response of an animal to heat stress and consequently the level of discomfort or comfort to the animal as a result of feeding (Ganaie *et al.,* 2013). All the thermoregulatory parameters measured in this study were within the normal range for health calves. The higher values of HR obtained might be attributed to high environmental temperatures as reported by Bianca (1976). Similarly, Ganaie *et al.* (2013) stated that high environmental temperature increase heart rate. Heart rate is modulated by autonomic nervous and endocrine system, (in different seasons of the year), it decreases when the temperature is low, increase when temperature is high (Bianca, 1976).

Table 3: Effect of feeding different ratios of soy:cow milk on thermoregulatory parameters of Friesian x Bunaji calves

	Ratios of Soy to Cow Milk (%)					
Parameters	0:100	25:75	50:50	75:25	SEM	Normal Range[1]
RT (°C)	38.44	38.50	38.37	38.44	0.05	38.00 – 39.30
HR (bpm)	95.57[a]	90.00[b]	95.43[ab]	97.43[a]	1.29	48.00 – 84.00
RR (brpm)	42.00[b]	41.86[b]	40.86[c]	43.43[a]	0.49	26.00 – 50.00

[abc] means with different superscripts within the same row differed significantly (P <0.05). RR = Rectal Temperature; °C = Degree centigrade; HR = Heart rate; bpm = beats per minute; RR = Respiratory Rate; brpm = breaths per minute; SEM = Standard Error of Mean. [1]Source: Robertshaw (2004).

Conclusion

This study showed that feeding calves with 25:75 ratio of soy:cow milk is recommended for better weaning weight than feeding cow milk alone.

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